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REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUT. COMMANDER L. M. GARRETT, U. S. N., COMMANDING, AND OF OTHER EXPEDITIONS OF THE "ALBATROSS," 1891-1899.

XXIX.

THE SPONGES.

3. HEXACTINELLIDA.

By ROBERT VON LENDENFELD.

WITH ONE HUNDRED AND NINE PLATES.

TEXT.

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HEXACTINELLIDA.

I. INTRODUCTION.

In this Report the Hexactinellida collected during the Albatross cruises of 1899–1900 and 1904–1905 in the Tropical Pacific under the direction of Alexander Agassiz are described.

Mr. Agassiz's liberality has enabled me to employ methods of research and graphic representation not hitherto used and to describe the material very fully.

II. METHODS.

1. The soft parts.

The deep-sea Hexactinellida which come into the hands of specialists are generally in such a condition that very little can be made out, by the ordinary methods of sectioning and staining, of their very tender soft parts. This is due to their mixing with the deep-sea ooze during the passage of the dredge over the bottom and to the pull and pressure acting on them in the long haul to the surface. After many experiments I finally found the following method best suited to this kind of material: — a piece of the specimen, ½ to 1 cm. in diameter, with intact surface is imbedded in paraffin and cut into *thick* radial sections. These are *not* stuck on the slide but placed free, first in xylol, then in alcohol, where much of the deep-sea ooze, which has got into the sponge during capture, and many of the fragments of spicules splintered in cutting fall out of the section, so that it becomes fairly clean. These loose sections are then passed into absolute alcohol, in which magenta or another aniline dye soluble in alcohol is dissolved. In this solution the sections very rapidly become well stained. They are *not* washed after this, but immediately transferred into xylol, in which the magenta, azur, etc., are insoluble, and then mounted in balsam. By this method the canals and the flagellate chambers can be made out in many a perfectly hopeless looking specimen.

2. The skeleton.

For the study of the arrangement of the spicules, and of the skeleton in general, thick radial sections made in the manner described above, but not stained, gave the best results. Such sections even of hard forms with a continuous skeleton-net, like the Euretidae, can be cut without difficulty.

3. The spicules.

My method of fractional sedimentation with final centrifugation has also been employed in the examination of the Hexactinellida. On account of the great amount of foreign siliceous material (skeletons of Radiolaria, etc.) in many of the specimens these spicule-preparations are, however, often not so clean as one would wish. To obtain clean preparations of the larger spicules I made a heap of spicules of sediment (I) by boiling a piece of the sponge in nitric acid, allowing it to settle a short time and drying in the usual manner. From this I, or rather my wife, who in time grew exceedingly expert, picked out under the microscope the spicules wanted. A fine needle, the point of which was rendered sticky with Schellibaum's mixture of collodion and clove-oil, was used in this work. These spicules were then regularly arranged on a slide, also covered with a thin layer of Schellibaum's mixture. To this they adhere, and can be immersed in balsam and covered with a cover-glass without becoming disarranged.

The preparations of the smaller spicules of sediment (II), etc., and the centrifugated ones were heated till all the chloroform used for dissolving the balsam had evaporated and only the previously boiled balsam, which is quite hard at ordinary temperatures, was left. They were then, whilst cooling, pressed between the leaves of a book. In this way preparations are obtained which are much clearer than unpressed ones, and which can be examined with the highest powers much more conveniently.

4. Graphic representation.

All the figures on the plates in this Report are photographs. These photographs were taken partly with ordinary, and partly with ultraviolet (wave length 280 μ) light; with the same apparatus and in the same way as those illustrating my Report on the Geodidae (Mem. M. C. Z., 1910, **41**, p. 12 ff.) where the photographic methods employed are described. I found it very difficult to obtain good photographs of floricomes and other small microhexaster-forms; chiefly because it is hardly possible to get good clean preparations of intact spicules of this kind, either in balsam (for photography with ordinary light), or in chloral-hydrate glycerine (for photography with ultraviolet light). My hexaster-photographs are consequently not nearly so attractive as the drawings of them in the papers by other authors — but they accurately represent what one actually sees.

To facilitate comparison the figures representing the systematically most important spicules of the same kind in the different species are given in the same magnification throughout. To these commensurate figures others, in other magnifications, are added where necessary. The uniform magnifications selected for the commensurate figures are such that the smallest forms observed come out just large enough to allow their main characters to be distinctly made out. They are: — for the pinules 300; for the microhexactines, the hexasters and their derivates, and the amphidiscs 500. The photographs of parts of the spicules and of whole small spicules showing minute details were all taken with ultraviolet light and are magnified 2000.

5. Measuring.

Every exact description must be based on measured dimensions. The dimensions of organisms and their parts are inconstant and vary in various ways. To obtain dimensional data sufficient for use as premises for a systematic or any other biological conclusion it is therefore necessary to ascertain the range and biometrical character of the variation in the extension in space of the parts. In the case of such organisms as the Hexactinellida the smaller spicules at least should be studied biometrically. They can be most easily and accurately measured and are considered by all authors as the most important part from a systematic (phylogenetic) point of view. It would have been quite impossible, within a reasonable space of time, to take the many thousand measurements necessary for this by means of the methods hitherto employed.

I therefore cast about for a better method and finally worked out a new micromeasuring apparatus, which Mr. Agassiz's liberality enabled me to set up. The plan of this apparatus (Fig. 1) has proved most useful. The greater part of it is also represented on Plate 109. The light of a powerful, self-regulating constant-current arc-light (Fig. 1a) passes a system of lenses and cooler (Fig. 1b) and enters a microscope (Fig. 1c) with the optical axis placed horizontally. A movable mirror 1.5×1.5 m. in size (Fig. 1d) is so placed in front of the microscope that the image produced is reflected on to a vertical glass-plate (Fig. 1e) frosted on the side turned towards the mirror, and measuring 2×2 m. Lamp and microscope are so placed that the latter stands at the side of and close to the frosted glass-plate. The observer sitting in front of the latter can comfortably work both the screws moving the slide to right and left and up and down (Fig. 1g), and that focussing the microscope (Fig. 1h). The horizontal optical axis of the microscope is oblique (not vertical) both to the mirror and the frosted glass. The mirror, however, is placed so that the axis of the cone of light reflected from it abuts vertically on the frosted glass-plate. This arrangement insures the image, thrown on to and visible on the frosted glass, being perfectly true, and not in any way distorted. By means of the screws moving the slide, everything on it can easily be passed in review. When a spicule, or anything else that is to be measured, comes into view, it is focussed and measured.

When working with this apparatus, I placed lamp, microscope, mirror, and frosted glass always in the same position; and every time I commenced I tested the correctness of the position of the parts by projecting and measuring the micrometer-slide. For each combination of objectives and eyepieces used I made a special scale which was drawn on a ribbon of tracing-cloth. These ribbons (tapes) were fixed to canes, like strings to bows (Fig. 2). It is easy with these bow-string tapes to measure rapidly the distance between any two points in a plane vertical to the optical axis of the microscope.

The observer dictates the dimensions thus measured, and anything else notable he may observe. His assistant sits behind him at a table (Fig. 1i) with a shaded (Fig. 1k) light (Fig. 1l). It is possible, if the preparation is a good one, to write down the dimensions at the rate of six to ten per minute.

This method is not only convenient and rapid, but also exceedingly accurate. The measurements taken with it when using high powers are exact to 0.1 μ.

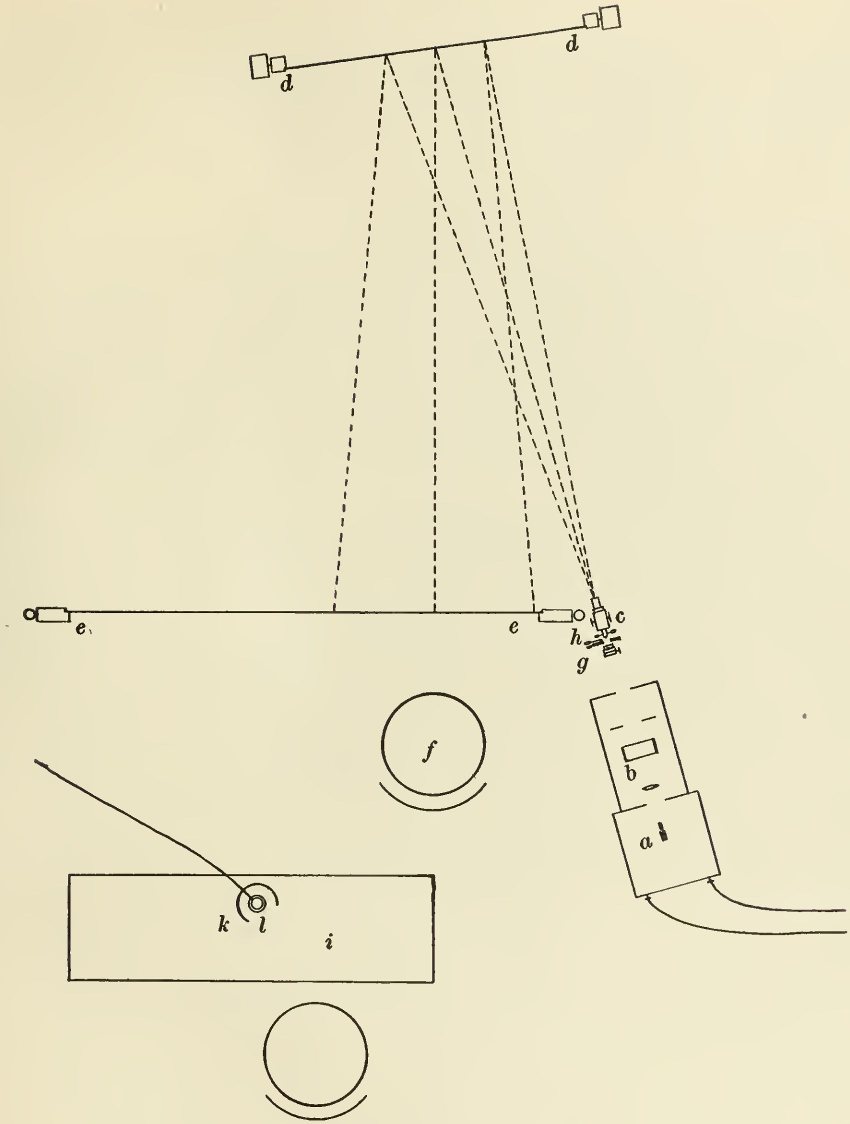

Fig. 1

Fig. 2

Figs. 1, 2.— Projection measuring apparatus. 20 : 1.

The exactness of these measurements is indeed so great, that I detected, in working with this apparatus, certain slight errors in the micrometers employed, which had been obtained from a firm of excellent standing. These errors this firm itself found after having, at my request, reexamined the micrometers.

6. Biometry.

To utilize the measurements taken biometrically, all those of the same dimension in different individuals must be arranged in groups of suitable extent. In each group all the measurements lying between certain limits are placed, and the number of dimensions lying between these limits ascertained. These numbers are then plotted on equidistant ordinates in a graph and the points thus obtained connected by a line. This line is the biometrical frequency-curve of the dimension studied.

In the method generally employed the groups of dimensions represented by the ordinates of the graph are equal in range. That is to say, the mean dimensions of the groups to which the ordinates correspond form an arithmetrical progression like 1, 2, 3, 4, ... n. This method involves a systematic error which makes the resulting biometrical curve wrong and misleading. When a dimension examined varies between limits small in comparison to itself, that error is slight and generally overlooked. When, however, as is the case in the amphidiscs of the Hexactinellida for instance, the dimensions examined vary so much that the largest may be twenty-five times as great as the smallest, the error leads to results so glaringly wrong that it is noticed at once. This error is caused by the *equality* of the extent of the successive groups and by their mean dimensions, which are represented by the ordinates of the graph, forming an *arithmetrical* progression. For it is obvious that a difference, say of 10 μ, in the length of objects only 10–20 μ long must be of far greater biological importance than the same difference of 10 μ in the length of objects 500–510 μ long. To avoid this error I divide the measurements taken into groups of *uniformly increasing* range. The increment selected is such that the extent of each successive group is 10 % greater than the extent of the preceding group, so that the ordinates, which are also placed by me at equal distances in the graph, represent a series of mean-dimensions of groups which form the *geometrical progression* $1.1, 1.1^2, 1.1^3, 1.1^4 \ldots\ldots 1.1^n$.

The biometrical curves obtained in this manner express identically the character of dimensional variation of all the individuals compared, however large or small they may be, and are therefore biometrically much more correct than those obtained by the method generally in use. In this Report such frequency-curves, which are biologically more correct, are extensively made use of.

7. Nomenclature of the spicules.

I use the same names for the spicules as those employed by F. E. Schulze and other authors. The few new names given are explained where they first occur. I find F. E. Schulze's division of the amphidiscs into the three groups macramphidiscs, mesamphidiscs, and micramphidiscs by no means universally applicable and have divided the different kinds of amphidiscs found in each species according to their morphological and biometrical characters, independently of and without regard to the arrangements of them in other species. I have, however, retained Schulze's names, because only a very small fraction indeed of the Amphidiscophora actually growing on the sea-bottom are known, and it would be premature to propose a new general arrangement of these spicules, and to replace Schulze's names by others.

III. DESCRIPTION OF THE SPECIES COLLECTED IN THE PACIFIC OCEAN BY THE ALBATROSS.

HEXACTINELLIDA O. Schmidt.

Siliceous sponges with hexactine (triaxon) spicules, and derivates of such.

The Albatross collection of Pacific hexactinellids comprises, besides a number of small, quite irrecognizable fragments and isolated hyalonematid stalk-spicules, from Stations 3684 (A.A. 17), 3685 (A.A. 25), 3689 (A.A. 134), 4630, 4631, 4649, 4651, 4656, 4685, 4709, 4711, 4721, 4732, 4736, 4742, which are not further referred to in this Report, 124 more or less complete specimens and 130 fragments sufficiently large for study and at least approximate identification.

The examination of this material has corroborated the correctness of F. E. Schulze's[1] division of the order Hexactinellida into the two suborders Hexasterophora and Amphidiscophora.

The collection contains representatives of both suborders.

Hexasterophora F. E. Schulze.

Hexactinellids generally (or always) with hexasters, always without amphidiscs. The spicules are either all free, or some of them are joined by secondarily deposited silica to form a firm supporting skeleton-net.

The collection comprises sixty-seven more or less complete specimens and 124 fragments of Hexasterophora.

The examination of these sponges does not make necessary any alteration in F. E. Schulze's most recent arrangement of the Hexasterophora in ten families;[2] all of them find a place in these families.

[1] *F. E. Schulze.* Revision des systemes der Hyalonematiden. Sitzungsb. Akad. Berlin, 1893, no. 30, p. 541; Amerikanische Hexactinelliden, 1899, p. 93.

[2] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, 4, p. 172.

The collection contains representatives of the following families:— Euplectellidae, Caulophacidae, Rossellidae, Euretidae, Coscinoporidae, and Tretocalycidae.

EUPLECTELLIDAE (Gray) Ijima.

Tubular, cup-shaped or massive Hexasterophora attached by a stalk or a tuft of basal spicules or sedent. Generally with numerous separate oscules. The dermal skeleton is composed of hexactines, the proximal ray of which is the longest. Without hypodermal pentactines.

The collection comprises four more or less complete specimens and six fragments of specimens of Euplectellidae.

Ijima[1] and F. E. Schulze[2] distinguish two subfamilies, Euplectellinae and Corbitellinae. The collection contains representatives of the former.

Euplectellinae Ijima.

Euplectellidae which are attached by a tuft of basal spicules.

The collection comprises four more or less complete specimens and six fragments of Euplectellinae. These belong to the two genera, Holascus and Holascella. The latter is new.

HOLASCUS F. E. Schulze.

Tubular Euplectellidae (Euplectellinae) with terminal sieve-plate, with root-tuft, and without parietal apertures in the body-wall. The chief support of the body-wall is a network composed of large tetractines, pentactines, or hexactines, held together by slender comitals. Oxyhexasters and graphiocomes are always present. Discohexasters and floricomes are absent. Hexactines with equal rays, calicocomes, and sigms occur in some species and are absent in others. The hypodermals are hexactines with short and thick, spiny distal ray, to which slender comital rhabds are attached. The anchoring spicules of the root-tuft are diactine rhabds with oblique backwardly directed spines and a distal tyle, from which anchor teeth-like spines arise. The morphological centre (axial cross) of these spicules is situated a considerable distance above their terminal anchor-tyle.

The collection contains two more or less complete specimens and two fragments of this genus. All belong to the same species, which is new.

[1] *I. Ijima.* Studies on the Hexactinellida. III. Journ. Coll. sci. Tokyo, 1903, **18**, p. 26, 27.
[2] *F. E. Schulze.* *Loc. cit.*, p. 173.

Holascus edwardsii, sp. nov.

Plate 18, figs. 15–26; Plate 19, figs. 1–24; Plate 20, figs. 1–20.

Two somewhat fragmentary specimens and two separate root-tufts of this species were trawled in the Milne Edwards Deep, off the coast of central Peru, at Station 4672, on 21 November, 1904; Palominos Light House, N. E., 163 km. (88 miles); 13° 11.6′ S., 78° 18.3′ W.; depth 5203 m. (2845 f.); they grew on fine, green clay; the bottom-temperature was 35.2°.

Shape and size. One of the two specimens is fairly large, the other small. The large specimen (Plate **20**, fig. 4) appears as a fairly straight, somewhat conic tube about 180 mm. in length. Originally this tube probably had a circular transverse section. Now it is flattened, one side touching the other. The tube is about 90 mm. in circumference at the upper end, and attenuated below to a circumference of about 50 mm. Its upper margin has a lacerated appearance, and is not to be considered as the true termination, but as a line of fracture along which the upper end of the sponge has been torn off. Below, this tube gradually passes into the root-tuft, the upper part of which appears as a compact stalk, circular in transverse section and 15 mm. in diameter. This root-tuft is about 100 mm. long, considerably and uniformly curved, slightly attenuated in the middle, and spread out distally to form a somewhat irregular spicular mass.

The wall of the tube is 4–5 mm. thick. Its outer dermal face (Plate **20**, fig. 4) is very rough and irregular, an appearance probably due, to some extent at least, to the indifferent state of preservation of the sponge. The inner, gastral face (Plate **20**, fig. 3) is perforated by numerous more or less circular apertures. Two kinds of such apertures, large and small ones, can be distinguished. The large apertures are 1.5–2.3 mm. wide in the central part, half way up the tube. Toward both the upper and the lower ends of the tube they become smaller. These apertures are very regularly arranged in one spiral line, or in a succession of ring-shaped transverse rows. Within the spiral (the rings) they are close together, separated by walls of tissue, usually only 0.5–1.5 mm. broad. The spiral turns (rings) themselves are farther apart, separated from each other by zones 3–4.5 mm. broad. The small apertures are mostly circular, 0.3–0.4 mm. in diameter, and scattered in considerable numbers between the large ones.

The small specimen is similar but only 42 mm. long, and also destitute of the upper end. Its tubular part is not collapsed, circular in transverse section, and 6 mm. in diameter. The root-tuft is bent quite round so as to form a semicircle.

The larger of the two separate root-tufts is rectangularly bent near the middle of its length. One limb, which evidently formed the stalk of the sponge, is 60 mm. long, cylindrical, straight, and throughout about 14 mm. thick. The other limb, which formed the root, is 70 mm. long, conic, and attenuated to a fine point. The smaller separate root-tuft is similar but more uniformly curved.

The *colour* of the sponge-body proper, that is the tube, is, in spirit, nearly dark brown. The root-tufts are colourless.

The *skeleton*. A network with rectangular meshes composed of large, stout-rayed pentactines, held together by slender-rayed comitals, forms the main support of the tubular sponge-body. The large pentactines have a short apical and four long lateral rays; two of the latter, the two opposite ones, are usually markedly longer than the other two. These pentactines lie side by side in a single layer in the choanosome of the tube-wall; their apical rays are directed radially outwards; their lateral rays extend paratangentially, the longer ones longitudinally, the shorter ones transversely. The distances between the centres of these pentactines are much smaller than the length of their lateral rays, which consequently cross each other repeatedly. Slender-rayed diactine to hexactine comitals accompany these pentactines in large numbers. As the rays of these spicules closely adhere to the rays of the pentactines, and as different rays of the same comital are often attached to rays of different pentactines, the latter are firmly held together and in position by the former.

Small hexactine megascleres, rhabds, microscleres, and siliceous skeletons of foreign organisms also occur in the choanosome.

The small choanosomal hexactine megascleres appear to be much more abundant in the lower than in the upper parts of the tube-wall. Quite low down, in the region where the tubular body passes into the root-tuft, they form dense masses.

Of choanosomal rhabds other than the diactine comitals of the large pentactines I have observed two kinds, centrotyles and exceedingly slender, thread-like rods. The centrotyles are of varying size, and the large ones usually accompanied by smaller ones arranged round them comital-fashion. The slender thread-like rhabds were found only in the choanosome of the small specimen.

The microscleres are oxyhexasters, hemioxyhexasters, microoxyhexasters, graphiocomes and (?) ring-shaped sigms. Of the three first named, which must be considered as different varieties of the same kind of spicule, the oxyhexasters are by far the most numerous; the hemioxyhexasters are rather, the microoxyhexasters very scarce. The graphiocomes are also rather rare and nearly always destitute of end-rays. The ring-shaped sigms are very numerous, both in the centrifuge spicule-preparations and in the sections, but in spite of this I am not at all sure that they are proper spicules of the sponge. They may, like the masses of other siliceous skeletal structures found in the sponge, be altogether foreign to it.

Below the outer surface of the tube-wall hypodermal hexactines with two radially situated, differentiated rays occur. The distal, differentiated, somewhat protruding ray is short, stout, and spined. It raises the dermal membrane conule-fashion. The four not differentiated (lateral) rays extend paratangentially. The proximal ray is elongated. To the distal rays of these hexactines slender, simple or centrotyle, comital diactines are attached, which, when numerous, form a sort of mantle around it. Below the inner surface similar, hypogastral, hexactines are situated. The distal rays of these spicules are, however, more slender and destitute of comitals.

The root-tuft consists chiefly of very long diactine anchor-spicules. A few spined styles and tylostyles, with the blunt end situated distally, are also found in it; these may, however, be foreign to the sponge.

The *choanosomal centrotyle rhabds* (Plate **19**, figs. 22–24) are 290 μ–1.7 mm. long and, near the middle, 5–47 μ thick. The small ones, under 400 μ in length, are fairly numerous, the larger ones rare. The tyle is usually more (Plate **19**, fig. 23) or less (Plate **19**, fig. 22) toward one end, more rarely situated centrally (Plate **19**, fig. 24). It consists of four ray-rudiments, which are, however, so small in some, particularly the large centrotyle rhabds, that they can hardly be individually distinguished. The tyle measures 14–60 μ in transverse diameter. In the small centrotyle rhabds it is relatively large, the proportion between the tyle-diameter and the thickness of the adjacent parts of the spicule being here 2 : 1 to 3.5 : 1. In the large centrotyle rhabds the tyle is relatively small, this proportion being here 1.27 : 1 to 1.5 : 1. The two rays are conic or cylindric and sharp-pointed or, more frequently, blunt. The largest centrotyle rhabds appear to be quite smooth. The small ones are spiny, particularly near their ends. The degree of spinulation is on the whole in inverse proportion to the length of the rhabd.

The *slender, thread-like rhabds* observed in the small specimen are under 1 μ thick and relatively very long.

The *rhabd comitals of the distal rays of the hypodermal pentactines* are straight or slightly curved, simple or centrotyle, and generally 200–400 μ long and 2–2.5 μ thick.

The rare *styles and tylostyles* of the root-tuft, which, as above stated, may be foreign to the sponge, are covered with spines, and near the distal, rounded end 12–17 μ thick. The distal end itself is either simply rounded off or, more frequently, thickened to a terminal tyle, with a maximum transverse diameter of 32 μ.

The *anchoring spicules* (Plate **20**, figs. 5–20) are anisoactine rhabds. I did not observe any long intact ones. The longest fragments observed were 45 mm. in length. The morphological centre, the position of which is clearly marked by a well-developed axial cross (Plate **20**, figs. 5–8a) is only 137–200 μ distant from the distal end of the spicule. Thus, whilst the proximal ray may attain a length of over 40 mm., the distal ray is usually less than 0.2 mm. long. Proximally the spicule is gradually attenuated to a fine point. Distally it thickens, and it attains its maximum thickness some distance beyond the middle of its length, long before the morphological centre (axial cross) is reached. Beyond, it again becomes thinner, and near the distal end, at the thinnest point between the morphological centre and the terminal anchor, is 7–11 μ thick, about two thirds to three quarters of what it measures in the middle. At the distal end the spicule is thickened to a terminal tyle.

The proximal part of the spicule (Plate **20**, fig. 11) is perfectly smooth. Somewhere about the middle of its oblique length, backwardly directed spines begin to make their appearance; these usually enclose an angle of 20–30° with the axis of the spicule. At first (Plate **20**, fig. 12) these spines are very small and far between. Farther on (Plate **20**, figs. 13, 14) they become larger and more numerous, and they continue to increase in number and size quite up to the morphological centre (axial cross). On the distal ray the spicule has four to seven spines every 100 μ (Plate **20**, figs. 5–10, 15–20). In the middle of the spicule the spines are uniformly scattered and not arranged in groups (Plate **20**, figs. 13, 14). Towards the distal end they tend to form verticillate clusters (Plate **20**, figs. 5–8, 15–20), two of which are particularly pronounced, one situated at the morphological centre (axial cross) (Plate **20**, figs. 5–8a), the other at the end. Together with the terminal tyle this second cluster of spines forms the anchor.

The large spines of the distal part of the spicule are 10–30 μ long and 4–7 μ thick at the base. The terminal ones, which form the anchor-teeth, are similar to the others, but somewhat stouter.

The anchor appears as a conspicuous terminal thickening with an outline closely resembling an inverted gothic arch. From the proximal side of this thickening arise backwardly directed teeth usually six to eight in number. The anchor-teeth of the same anchor being more or less unequal in size, shape, and position, the anchors themselves appear more (Plate **20**, figs. 5, 6, 16, 18) or less (Plate **20**, figs. 7, 8, 19, 20) irregular. The anchor, that is the terminal style together with its teeth, is 45–72 μ long and 32–50 μ broad.

The axial thread of these spicules extends quite to the end of the terminal anchor-tyle. Within this tyle it is thickened in a spindle-shaped manner and here measures 2.5–4 μ in maximum transverse diameter (Plate **20**, figs. 5–10). This terminal thickened part of the axial thread is granular, and irregular in outline. From it arise a number of branchlets, up to 1 μ long, usually very oblique, strongly inclined towards the end of the anchor. According to F. E. Schulze's figures[1] in other species of Holascus the axial thread of the anchoring spicules in the terminal anchor-tyle is not thicker than elsewhere. In describing *H. tenuis* this author, however, says[2] "Der Achsenkanal durchsetzt den Kolben" (that is, the terminal anchor-tyle) "bis dicht an seine untere Spitze und erfährt hier zuweilen eine kleine terminale Verbreiterung oder Zerteilung in ein schmales Büschel mehrerer Endausläufer."

The thickening of the distal end of the spicule and of its axial thread in the anchor-spicules of *Holascus edwardsii* is doubtlessly correlated to the shortening of the distal ray. I think that the influence which prevented the distal ray from obtaining a length commensurate with the length of the proximal ray, also caused the thickening of the ends of the distal ray and its axial thread, and the formation of the oblique branchlets of the terminal swelling of the latter. This influence may be inherent, arising naturally at a certain period of development in the spicule-building cells themselves, or it may be due to the resistance which the distal ray encounters at its tip whilst it is being pushed outward (downward) in consequence of the continued longitudinal growth of the proximal ray. The latter alternative seems *a priori* the more probable, but I am rather inclined to favour the former since young anchoring spicules, the distal ends of which do not protrude over the surface and have not yet reached the deep-sea deposit (ooze) into which they are afterwards driven, already possess a distal anchor-tyle.

The terminal thickening of the axial thread with its branchlets in the anchor-tyle is in many respects similar to certain structures found in the cladomes

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, pl. 16, figs. 11, 13 *H. fibulatus*; Hexactinelliden des Indischen Oceanes. II. Abh. Akad. Berlin, 1895, 1896, taf. 1, fig. 6 *H. robustus*; Ergeb. Deutsch. tiefsee-exped., 1904, **4**, taf. 1, figs. 4, 6 *H. tenuis*.

[2] *F. E. Schulze.* Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 6.

of the anatriaenes of *Thenea valdiviae* [1] and other tetraxonid sponges. In these the branchlets, however, appear to be rudiments of primary axial threads and morphologically equivalent to the axial threads of the rhabdome and the fully developed clades. Here in *Holascus edwardsii* they can only be considered as (secondary) axial thread-branches equivalent to the axial thread-branches in the end-clades of dichotriaenes.

The large *choanosomal pentactines* (Plate **18**, fig. 22a; Plate **20**, figs. 1, 2) have straight or slightly curved conic rays, which are 75–145 μ thick at the base. The lateral (paratangential) rays are long and form the edges of a low quadrangular pyramid, from the apex of which the short apical (distal) ray arises. The lateral rays, which extend longitudinally, are 13–19 μ long, the lateral rays, which extend transversely, 7–11 mm. long. The apical ray has a length of about 1.5 mm. The terminal parts of the rays bear scattered, small, broad, and blunt spines. The other parts of the rays are smooth.

In the distal part of the lateral rays of these pentactines the axial thread is thickened at frequent intervals. These thickenings are, on the whole, conic and consist of verticils of short, rod-like, axial thread-branches diverging only slightly from the axis of the ray, extending backward centripetally and a little outward. The slightly granular substance, of which these rods consist, is apparently the same as the substance composing the axial thread. Sometimes a small cap, with the convex side turned towards the distal end of the ray, is found within the conic rod-verticil, just below its apex. These axially situated caps consist of a substance with a refractive index very different from that of the substance of the axial thread and the silica-layers of the spicule, and are consequently, in spite of their small size, very conspicuous. They look as if they were portions of tissue rich in water, entrapped by the growing spicule (axial thread). The conic verticils of rods (axial thread-branches) and these caps indicate that the growth of the lateral rays of the pentactines is intermittent; the rod-verticils and caps marking the positions of the ray-tips at the times of suspension of longitudinal growth. Each node of the ray between two adjacent thickenings of the axial thread is doubtlessly produced by the uninterrupted work of a spicule-builder or a set of spicule-builders. The secession of work by the cell or cells causes the interruption of growth. After a time the same spicule-builder or same set of spicule-builders or a fresh one or fresh set recommences or commences work, whereupon the growth again goes on.

The *comitals* (Plate **18**, figs. 15, 16, 22b, 23) which hold the large pentactines

[1] *R. v. Lendenfeld.* Die Tetraxonia. Ergeb. Deutsch. tiefsee-exped., 1907, **11**, p. 200 ff.

together are slender-rayed hexactines. The most frequent forms are triactines with a central thickening. Usually the rays are either well-developed and very long, or reduced to mere knobs arising from the centre. Rays intermediate between these extremes (Plate 18, fig. 23) are rare. The rays have a maximum length of 7 mm., are very slender, only 6–14 μ thick, usually nearly cylindrical and terminally rounded, more rarely considerably attenuated towards the end. The central thickening, which is composed of the knob-like rudiments of the aborted rays, is 15–32 μ in diameter.

The *small choanosomal hexactine megascleres* have straight, conic, pointed rays, 0.17–1 mm. long and 12–18 μ thick at the base.

The *hypodermal hexactines* (Plate 18, figs. 19–21, 24–26) have a more or less curved proximal ray, usually 1.2–1.5 mm. long and 5–7 μ thick at the base. The lateral rays are fairly straight, have the same basal thickness, and are usually 180–240 μ long. The distal ray is 180–260 μ long, straight, and 6–13 μ thick at the base. It is more or less club-shaped, thickened above, and abruptly pointed. At the thickest point, which is usually about 50 μ from the end, the distal ray measures 13–23 μ, on an average (of twelve measurements) 18 μ in transverse diameter. The proportion of the basal to the maximum thickness is 1 : 1 to 1 : 3, usually about 1 : 2. The distal ray is covered with spines. These are small and scarce below but become larger and more numerous above, towards the distal end. The spines are broad, conic, and pointed, with a maximum length of 2.5 μ and are directed obliquely upward, towards the end of the ray. On account of their relatively great breadth and their obliquity, they appear as nose-like protuberances of the ray.

The *hypogastral pentactines* (Plate 18, figs. 17, 18) are similar to the hypodermal ones but their distal rays are distally much less thickened. The maximum thickness of their distal rays is only 7–20 μ, on an average (of twelve measurements) 13 μ. The proportion of the basal to the maximum thickness is 1 : 1 to 1 : 2.

The abundant *oxyhexasters*, the rare *hemioxyhexasters*, and the still rarer *microoxyhexasters* (Plate 19, figs. 1, 2) are obviously all different forms of the same kind of spicule. They measure 108–180 μ in total diameter. A difference in the size of forms with simple and with branched rays could not be detected. The main-rays, which are, in the same spicule, equal, and enclose right angles with their neighbours, are 8–12 μ long and 2–4 μ thick. Each one bears from one to four end-rays. The number of end-rays on the six main-rays of the same spicule is usually unequal; but the difference is generally only one, main-ray with only one end-ray being usually associated with bifurcate, bifurcate with trifurcate, and trifurcate with quadrifurcate ones. In the simple rays, that is in those consisting of a main-ray and a single end-ray, the point of demarcation between main- and end-ray is clearly marked by a thickening of the distal end of the former (Plate 19, figs. 4, 5). I consider this thickening a rudiment of the other, reduced, end-rays. The end-rays arise steeply from the main-ray, but immediately curve outward, and are, farther on, usually nearly straight. Occasionally the proximal part of the end-ray, beyond the basal curve, is irregularly bent. The end-rays are conic, gradually attenuated to a fine point, 57–83 μ long and 1.6–2.8 μ thick at the base. The bases of the simple rays have the same thickness as the main-rays. All parts of the spicule are perfectly smooth (Plate 19, fig. 11).

The *graphiocomes* (Plate 19, figs. 12, 13) have main-rays which enclose angles of 90° with their neighbours and are equal in the same spicule. The main-rays are 11–17 μ long and 2.5–3.5 μ thick. The single end-ray brush measured was 15 μ long.

The *ring-shaped sigms* (Plate 19, figs. 14–21), which, as above stated, may be skeletal structures foreign to the sponge, are rods, 1–2 μ, rarely 2.8 μ, thick in the middle, attenuated at both ends to fine points, regularly and uniformly curved so as to form a whole low spiral turn or, more rarely, a part of such a spiral. Lying flat they usually appear as circular rings with an interruption at one point. The rings formed by them are 17–57 μ in diameter. The ends are usually simple and sharp-pointed (Plate 19, fig. 14); rarely they bear on the concave side one or two small, cylindrical, terminally rounded spines (Plate 19, fig. 18). Near the middle of the rod a slight irregularity can usually be made out, but this does not appear to be a thickening which could with any probability be considered as the rudiment of another ray.

Although the upper end is missing in all the specimens and it must therefore be left undecided whether they possessed terminal sieves or not, I think that the want of parietal apertures, the spiculation, and the other characters described above show clearly that they belong to the genus Holascus. From the nine hitherto described species of this genus they differ by possessing ring-shaped sigm microscleres. Since, however, these ring-sigms may not be homologous to the sigms of *H. fibulatus*, but foreign to the sponge, I shall not consider them in the following systematic discussion.

Apart from this, *Holascus edwardsii* differs from five of the nine Holascus species by the absence of calicocomes. Of the remaining four, one, *H. undulatus*, is distinguished from it by the possession of discohexasters; another, *H. stellatus*, by the possession of oxyhexasters (hemioxyhexasters) with strongly curved rays; and a third, *H. fibulatus*, which also has sigm microscleres, by the absence of oxyhexasters. The fourth, *H. obesus*, which appears to differ from *H. edwardsii* only by its thicker body-wall and by having hypodermal hexactines with somewhat longer distal ray, seems to be more closely allied to it. But the material on which F. E. Schulze bases this species was very fragmentary and his description of it is somewhat incomplete. Therefore quite apart from the absence of ring-sigms in *H. obesus* and their presence in *H. edwardsii*, I should hesitate pronouncing these sponges, found respectively off Enderbyland in the Antarctic and off Peru in the Pacific, as specifically identical.

HOLASCELLA, gen. nov.

Tubular Euplectellidae (Euplectellinae) with root-spicule bundles and (probably) without parietal apertures. The body-wall is supported by a network of stout hexactines, pentactines, or tetractines held together by slender comitals. To discohexasters or microdiscohexactines, other hexasters, microhexactine forms, and pentactine and tetractine derivates of these may be added. The hypodermals are hexactines with spiny distal ray. The root-spicules are long, smooth shafts (rhabds or the long radial rays of pentactine anchors, the distal ends of which have been lost) and monactines with oblique, backwardly directed spines and a distal tyle, from which arise similar spines, representing anchor-teeth. The morphological centre (axial cross) of these spicules is situated in the terminal anchor-tyle.

The collection contains two more or less complete specimens and four fragments, which belong to three species, all of which are new.

Holascella taraxacum, sp. nov.

Plate 21, figs. 1–13; Plate 22, figs. 1–41; Plate 23, figs. 1–3.

One specimen, the upper end of which is missing, but which is otherwise fairly complete, and three fragments of this species were trawled in the Eastern Tropical Pacific at Station 4649, on 10 November, 1904; 5° 17′ S., 85° 19.5′ W.; depth 4086 m. (2235 f.); they grew on a bottom of fine, sticky, gray mud; the bottom-temperature was 35.4°.

The specific name refers to the similarity of the abundant discohexasters to the seed-balls of Taraxacum.

Shape and size. The specimen (Plate **21**, fig. 8), which is fairly complete apart from the missing upper end, consists of a nearly straight tube, open at both extremities, from the lower, somewhat attenuated end of which arise three dense bundles of root-tuft spicules. The tube is about 120 mm. long and has a circumference of 70 mm. at the upper end and of 40 mm. at the lower. It is now, although rather rigid, considerably compressed and flattened. In the fresh state it probably had a circular transverse section. The wall of the tube, that is the body proper of the sponge, is, for the most part, 2.5–3.5 mm. thick, and perforated by numerous apertures. These apertures are more or less circular in outline, 0.3–1.5 mm. wide, and quite irregularly distributed. Besides these apertures radial canals of similar width, but covered on the outer side by remnants of tissue, are observed in the tube-wall. For this reason, on account of their quite irregular distribution, and because the open apertures are destitute of a special marginal membrane, and all the larger and most of the smaller ones are traversed by rays of choanosomal spicules, I do not think that they can be considered as true parietal apertures. I believe myself justified in assuming that the tube-wall is, in the living sponge, continuous and destitute of parietal apertures, and that the openings now observed in it are *post mortem* artifacts, produced by the shrinkage and partial maceration of the soft parts, and the loss of extensive tracts of the dermal membrane.

The three root-spicule bundles are very dense, 80–120 mm. long, considerably and uniformly curved, and attenuated distally to quite fine points. Proximally they widen out paratangentially and they pass, by the divergence of the spicules composing them, gradually into the lower end of the tubular body.

Of the three fragments, one is the lower end of a tube similar to the one described above. It is 45 mm. long, circular in transverse section, slightly attenuated below, and open at both ends. Above it has a diameter of 14, below of 12 mm. From its lower end three root-spicule bundles arise. The other two fragments appear to be parts of tubular bodies.

The *colour* of the body proper is, in spirit, dirty brown; the root-spicule bundles are colourless.

Skeleton. The chief support of the body consists of longitudinal and transverse bars, which form a paratangentially extending net with rectangular meshes. This net is composed of the paratangential rays of large stout principal spicules, held together and in position by slender comitals. Most of the principal spicules are hexactines, a few pentactines and tetractines. Each node of the net is occupied by the centre of one of these spicules. The two rays of the large principal hexactines, which extend longitudinally, are considerably longer than the other four. The two rays extending transversely are intermediate in size. The two rays extending radially are the shortest, the proximal one, pointing towards the axis of the tube, being the shorter of the two. The paratangential rays of most of the principal pentactines and tetractines are similarly differentiated. The single radial ray of the pentactines points outward. Most of the comitals are centrotyle rhabds, a few tri-, pent-, or hexactines.

Besides these spicules, there have been found in the body of the sponge hexactines intermediate in size, very long and slender, longitudinally extending rhabds, minute rhabds, micro-tetractines, -pentactines, and -hexactines, oxyhexasters, discohexasters, onychhexasters, (calicocomes), and the central parts (main-ray crosses) of graphiocomes. The oxyhexasters, onychhexasters, graphiocome-centres, and minute rhabds are rare. One or the other of these kinds of spicules may possibly be foreign to the sponge. The other spicule-forms mentioned are abundant and doubtlessly proper to the sponge.

Hypodermal and hypogastral hexactines with two axes (four rays) extending paratangentially and one axis (two rays) extending radially (vertically to the surface) are found below the dermal and the gastral surfaces. The proximal ray of these spicules is elongated, the distal ray spined and more or less thickened. Hexactines of this kind with greatly, and with only slightly, thickened distal ray are indiscriminately mingled both in the outer dermal and the inner gastral face of the tube-wall. The hypodermal and the hypogastral hexactines are very similar. The only difference between them which I could detect is that in some of the hypodermals the distal ray attains a greater length than in any of the hypogastrals, and that in some of the hypogastrals the lateral rays attain a greater length than in any of the hypodermals. It also appears that the distal rays of the hypodermals of the lower part of the sponge are on the whole thicker than those of the upper part.

The root-spicule bundles are composed of numerous large, smooth rhabds, broken off below, and a few spined monactine anchors.

The rays of the *large principal hexactines* (Plate **22**, figs. 5, 6, 9, 10, 36; Plate **23**, fig. 1) are slightly and irregularly curved (Plate **22**, fig. 7) or, more rarely, angularly bent (Plate **22**, fig. 9), blunt, and usually conic. In very long rays (Plate **22**, fig. 7) the thickest point is often some distance from the base, and such rays are somewhat spindle-shaped. Rarely one of the rays is abnormally reduced in length and terminally thickened (Plate **22**, fig. 6), or divided at the end into two branches (Plate 22, fig. 8). The rays are 100–160 μ thick at the base; the longitudinal ones are 6–22.5 long, the transverse ones 2–10, the distal one 1.5–2.5, and the proximal one about 1 mm.

In the proximal part of large rays a homogeneous central part, about 40 μ thick, and a conspicuously stratified superficial part can usually be distinguished. In the axis of the distal part of such large rays structures are observed somewhat similar to those described above in the corresponding spicule-rays of *Holascus edwardsii.* The axial thread is quite thin in the proximal part of the ray; in the distal part it is considerably thickened, and interrupted by caps composed of a substance of different refractive index from the axial thread and the silica-layers surrounding it (Plate 23, fig. 1). These caps are usually 4–6 μ broad and so situated that the convex side lies distally. These caps are irregularly distributed along the axis and are very numerous. Sometimes quite a number of them follow in close succession. From the margin of most of these caps a distinct limit between successive silica-layers arises. These limits extend proximally, are conic in shape, and pass uninterruptedly into the limits between the silica-layers forming the outer, clearly stratified zone of the proximal part of the ray. These limits represent former surfaces of the spicule, whilst the caps mark the positions of the tip of the ray at various times. There can be little doubt that here, as in *Holascus edwardsii*, the growth of these spicules is intermittent, interrupted by periods of rest. Every time the longitudinal growth of the rays recommences after such an interruption a cap is formed.

It has been stated above, that in some of the large principal hexactines one of the rays is reduced in length and terminally thickened. In the centre of the terminal thickening of such shortened rays the central, unstratified zone of the spicule ends in the shape of a slender, pointed cone. The terminal thickening itself is formed exclusively by the clearly stratified superficial zone, each layer of which is here markedly thickened.

The few *large principal pentactines and tetractines* (Plate 22, figs. 7, 8, 11) are similar to the principal hexactines described above. Most of them differ from the latter only by the absence of one (the pentactines) or both (the tetractines) the radial rays. In some of them also the difference of the longitudinally and transversely extending rays is less pronounced than in the principal hexactines.

The axes of the *intermediate hexactines* are not differentiated and, although the rays are in the same spicule often more or less unequal, they are apparently equivalent. The rays are 140–300 μ long, usually cylindrical, 7–12 μ thick, and rounded and often thickened at the end. The tips of the rays are spiny. The other parts of the spicule are smooth.

The *comital rhabds* (Plate 22, figs. 29–36, 38–41) are diactines with a distinct thickening lying more or less centrally. They are 5–15 mm. long and the two developed rays are, at their proximal end, near the centre of the spicule, 11–45 μ thick. They taper distally and measure, at their thinnest point, which is usually situated a short distance from the end, 6–20 μ in transverse diameter. The end itself is usually thickened, more rarely conic and pointed.

The two ends of the same spicule usually differ considerably from each other. The terminal thickening is oval or club-shaped and 20–47 μ in diameter (Plate 22, fig. 38–40). The ends of these spicules are slightly spiny, all the other parts smooth.

The more or less centrally situated tyle consists of four rudimentary rays, the axial threads of which can always be distinguished as an axial cross within it. The degree of reduction of these four rays is subject to considerable variation, and not infrequently the four rudimentary rays of the same spicule are reduced to a very different degree. A series of forms representing different degrees of ray-reduction is reproduced (Plate 22, figs. 29–35).

The *tri-, pent-, and hexactine comitals* are rather rare. The triactine forms are similar to the diactines above described and differ from them only by being smaller and by one of their four reduced rays being much longer than the others. The rays of these spicules are 17–25 μ thick and the longest is 1.5–2.6 mm. long. The pentactines and hexactines have rays 1–2.5 mm. long and 13–20 μ thick.

The *long slender rhabds* are centrotyle and similar to the diactine comitals above described, so that one might consider them as giant forms of these. They attain a length of 36 mm. and a thickness of 27 μ. The central tyle has a maximum thickness of 44 μ. Some of them have a very large terminal tyle, sometimes 70 μ in diameter, at one end. Rays thus terminally greatly thickened are correspondingly reduced in length. The axial cross, which lies in the central thickening, is in some of these spicules very irregular, the axial thread-rudiments composing it enclosing angles very different from 90° with the axis of the two developed rays.

The rare *minute rhabds*, which may perhaps be comitals of the distal ray of the hypodermal hexactines, but which were never seen *in situ* in this position, are about 260 μ long and 1.5 mm. thick.

The proximal and lateral rays of the *hypodermal and hypogastral hexactines* (Plate 22, figs. 1–4, 12–17) are 5–11 μ thick at the base, cylindrical or only slightly attenuated towards the end, and abruptly pointed or blunt. The proximal ray is 0.8–1.8 mm. long, the lateral rays are 0.2–1 mm. The distal ray is 160–500 μ long, at the base 5–18 μ thick, and thickened more or less above. At its thickest point, which lies only a very short distance below the end, the distal ray is 16–60 μ thick. The proximal and the lateral rays are often curved; the distal ray is straight. The proximal and lateral rays are smooth apart from their ends, which are often slightly spined. The basal part of the distal ray is smooth, or only slightly spined; its thickened end is covered with spines, situated very obliquely and directed upwards toward the tip of the ray. These spines are quite numerous and close together, have a maximum length of 5 μ, and are about 4 μ thick. They appear as oval protuberances, the ends of which are drawn out to sharp and slender points. The tip of the ray is free from spines for a distance of about 10 μ. In the distal rays of medium thickness the tip appears as a broad cone, in the very thick ones as a broad round dome. The proximal part of the axial thread of the distal ray is quite thin, its distal part thickened, and about 1.5 μ broad.

I have observed a few spicules in the spicule-preparations which also appear to be hypodermal or hypogastral hexactines, but which differ from the spicules above described by one, two, or even three of their lateral rays being thickened and spined like the distal ray.

The *smooth root-spicules* are all broken off at the lower, distal end. The longest fragments measured were 150–160 mm. long. Proximally these spicules are gradually attenuated to a fine point. Their thickest portion is about 120 mm. from the proximal end; here they are 100–340 μ thick.

The *spined, anchor-like root-spicules* (Plate **22**, figs. 26, 37; Plate **23**, figs. 2, 3) are remarkably scarce. All those seen were broken so that I cannot give their length. To all appearance they are much shorter than the smooth root-spicules. Near their distal end these anchor-spicules are 12–17 μ thick. The end itself is thickened to a terminal tyle, 48–56 μ broad, 54–70 μ long, and in shape like a blunt, inverted cone with convex sides or a rotation-paraboloid. From the shaft of the spicule and from the margin of the upper, basal face of the terminal tyle arise conic, obliquely situated, backwardly directed spines 7–17 μ long. The axial cross (morphological centre) of the spicule lies in the terminal tyle (Plate **23**, figs. 2, 3). These spicules are not, like the similarly shaped anchors of the species of Holascus, diactines, but monactine tylostyles.

Among the *micro-oxyhexactines, -oxypentactines, and -oxytetractines* (*staur-actines*) (Plate **22**, figs. 20–25), the hexactine forms appear to be the most abundant. The rays of these spicules enclose angles of 90° with their neighbours and are equal in most of the hexactines and stauractines. In the pentactines and some of the hexactines (Plate **22**, figs. 20, 21) a differentiation of the three axes is to be noted, two rays of such hexactines lying in one axis, and the ray of the pentactines which has no opposite being longer than the four rays lying in the two other axes. The rays are straight, conic, pointed or blunt, 120–180 μ long and 3–8 μ thick at the base. With the exception of the base and the extreme tip, which are smooth, the rays are covered with spines, 1–1.5 μ long. The distal spines are distinctly recurved (Plate **22**, figs. 18, 19), the proximal ones arise nearly vertically.

The rare *oxyhexasters* (Plate **21**, figs. 1, 2, 9) are about 95 μ in diameter. Their equal and regularly arranged main-rays are straight, fairly smooth, 19 μ long, 4 μ thick at the base, and slightly attenuated towards the distal end. Each main-ray bears a terminal verticil of usually three end-rays, enclosing angles of about 45° with the continuation of the main-ray. The end-rays are perfectly straight, 37 μ long, 2 μ thick at the base, conic, sharp-pointed, and covered with minute spines.

The rare *onychhexasters* (Plate **22**, figs. 27, 28) are 98–105 μ in diameter and have a thickened centre, 4–5 μ in diameter. The main-rays are regularly arranged, in the same spicule fairly equal, straight, on the whole cylindrical, 8–11 μ long and 1.5–2.3 μ thick. They bear from one to four, usually three, end-rays, and sometimes also one or a few irregular knob-like protuberances on their sides. The end-rays are 30–50 μ long and 0.6–1 μ thick at the base. Distally they taper gradually to about 0.3 μ. The end-rays arise nearly vertically from the main-ray and are curved in an S-shaped manner, their proximal part strongly concave towards the continuation of the main-ray, their distal part slightly in the opposite direction. This curvature is different in different end-rays and the degree of divergence of the chords of the end-rays from the continuation of the main-ray is variable. Each end-ray bears several terminal spines. These generally arise at nearly right angles, are curved, concave towards the centre of the spicule, slender, and 2–5 μ long. In view of the shape of the end-rays these onychhexasters might also be termed calicocomes.

Of *graphiocomes* only a few centres (main-ray crosses) have been observed. The main-rays are regularly arranged, equal, 11–13 μ long and 2.5–4 μ thick.

The abundant *discohexasters* (Plate **21**, figs. 3–7, 10–13) are regularly spherical and measure 180–290 μ in total diameter. Their main-rays are regularly arranged, in the same spicule equal, perfectly smooth, about 14 μ long, 3.5–5 μ thick in the middle, and thickened at both ends; proximally to the centre of the spicule, distally to a stout, lens-shaped, transverse disc from the margin and distal face of which the end-rays arise (Plate **21**, fig. 10). The end-rays are so numerous that it is exceedingly difficult to count them. So far as I could make out 23–27 end-rays arise from the terminal disc of each main-ray. The end-rays arising from the central part of the distal face of the terminal main-ray discs are nearly straight throughout, and extend in a radius from the centre of the spicule. The end-rays become longer, more curved and concave toward the continuation of the main-ray axis the farther they are situated from the centre of the disc.

This curvature is restricted to the basal part; the middle- and end-parts are always straight. This increase of length and curvature towards the margin of the disc is such that the tips of all the end-rays are nearly equidistant and lie in the surface of a regular sphere, and that the straight middle- and end-parts of all the end-rays lie in radii from the centre of the spicule. In consequence of this, and because the crowd of end-rays hides the main-rays, the whole spicule appears as a regularly spherical aster composed of numerous straight, concentric, and equidistant radial rays. The end-rays are 80–140 μ long and 2.5–3.5 μ thick at the base. Towards the middle of their length they are attenuated to 1.5–2.5 μ; farther on they again become thicker, and attain a transverse diameter of 3.2–5 μ at their distal end. At the base and just below the tip the end-rays are quite smooth for a short distance. For the remaining greater part of their length they are covered with oblique, backwardly directed and backwardly curved, conic spines, 1–2.5 μ long. From the end arises a terminal verticil of about fifteen recurved spines. The basal parts of these spines are joined to form a disc with strongly convex distal face, from the margin of which their ends protrude freely for a distance of 2–3 μ. The terminal spine-verticils (end-discs) measure 7.5–12 μ in transverse diameter.

The general structure and spiculation of the sponges above described clearly show that they are Euplectellidae, whilst the presence of root-spicule bundles assign them to the Euplectellinae. Since, however, the upper part is not present in any of the specimens, and the state of their preservation is insufficient to determine whether the wall of their tubular body is perforated by parietal apertures or not, it is somewhat difficult to decide in which genus they should be placed. Whether the upper end of the tubular body was open or covered by a sieve-plate of course cannot be decided. About the parietal apertures, however, we may with some confidence say, for the reasons above given, that the holes now observed in the body-wall are *post mortem* artifacts produced by shrinkage and maceration and that the sponge possesses no parietal apertures in the fresh state.

At present three genera, Euplectella, Holascus, and Malacosaccus are distinguished in the Euplectellinae. The certain presence of discohexasters and the probable absence of parietal apertures preclude the sponges described above being placed in Euplectella. From the known species of Malacosaccus, which are soft, flexible, and sac- and cup-shaped, they differ by being hard and brittle narrow tubes. From all the known species of Holascus, except *Holascus undulatus* F. E. Schulze [1] and the species collected by the Challenger and mentioned by F. E. Schulze [2] as Holascus sp., they differ by possessing discohexasters. The spicules of *H. undulatus* described by F. E. Schulze (*loc. cit.*, 1899, p. 17) as discohexasters differ, however, considerably from the true discohexasters found in the sponges described above and have by F. E. Schulze himself lately [3] been declared to be calicocomes, and not discohexasters, so that this species also does not appear to be allied to the sponges above described. Their only closer allies appear to be the species of Holascus referred to and the new Pacific species described as *Holascella ancorata,* and *H. euonyx.*

As they differ from all the hitherto described and named species of Holascus by possessing discohexasters, hemidiscohexasters, or microdiscohexactines, and as the absence or presence of such spicules should be considered as a difference sufficient for generic distinction, I name the new genus Holascella, on account of its similarity to and historic derivation from Holascus.

From Holascus sp. Schulze and the sponge here described as *Holascella ancorata*, *Holascella taraxacum* differs by being destitute of floricomes, and from the latter also and from the sponge here described as *Holascella euonyx* by the absence of discohexactines and hemidiscohexasters with large anchor-like, terminal spine-verticils. From *H. ancorata* and *H. euonyx* it is also distinguished by its principals being mostly hexactines.

Holascella ancorata, sp. nov.

Plate 23, figs. 4–25; Plate 24, figs. 1–9.

One specimen of this species was trawled in the Eastern Tropical Pacific at Station 4649 on 10 November, 1904; 5° 17′ S., 85° 19.5′ W.; depth 4086 m. (2235 f.); it grew on a bottom of sticky, gray mud; the bottom-temperature was 35.4°.

It has discomicroscleres with long, strongly recurved terminal spines not joined at the base to a terminal tyle ("disc"). The end-rays (rays) of

[1] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, p. 15, taf. 3, figs. 1, 2.
[2] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, pl. 15, figs. 14–23.
[3] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 130, 131.

these spicules are exquisitely anchor-shaped in consequence. To this the name refers.

Shape and size. The single specimen (Plate **23**, fig. 9) is a conic tube 40 mm. long. It is circular in transverse section, broken off at both ends, at one end 11 mm. in diameter, at the other 7 mm. Its wall is continuous, not perforated by parietal apertures, and about 2 mm. thick. To the narrower end a root-tuft appears to have been attached.

The colour in spirit is dirty brown.

The *skeleton.* The chief support of the tubular body is a paratangential network of principal spicules held together and in position by slender comitals. The principals have from three to five, rarely six rays. Two opposite rays extend more or less longitudinally. One or both of these longitudinal rays are longer than any of the others. All the rays of the triactines and tetractines and four rays of the pentactines and hexactines lie paratangentially; one ray of the pentactines and two rays of the hexactines extend radially. These radial rays are always shorter than the others. The comitals, which are attached to the rays of these principals, are diactines, triactines, and tetractines. Besides these spicules a few tetractine and a good many hexactine megascleres, with spined rays, much smaller than the principals of the supporting network, occur in the choanosome. Hypodermal and hypogastral hexactines, with the two (opposite) rays of one of the axes differentiated, occur below the dermal and the gastral surface. One of these differentiated rays is elongated, the other thickened and more or less spined. The axis of the two differentiated rays is situated radially; the elongated ray points inwards, the thickened and spined ray outwards. A few spined anchoring spicules have been found in the narrower part of the tube. They are probably root-tuft spicules of the sponge. In addition to the spicules mentioned, rods and tetractines to hexactines with very short, stout rays, probably foreign to the sponge, have been observed in the spicule-preparations. Of microscleres spined microhexactines, floricomes, onycho- and discomicroscleres, and a few main-ray crosses without end-rays have been observed. Among the onycho- and discomicroscleres microhexactines and hemihexasters are much more frequent than true hexasters. Some of the main-ray crosses observed are the central parts of the floricomes; others may be centres of graphiocomes. The discomicroscleres are very numerous and doubtlessly proper to the sponge. All the other microscleres are rather rare and one or the other of them may be foreign to the sponge.

Among the *large triactine to hexactine principal spicules* (Plate **23**, fig. 4;

Plate **24**, figs. 3, 8) the triactines to pentactines are much more numerous than the hexactines. Many of these spicules are very irregular, the rays, also opposite ones, frequently differing very greatly in length, and the longer rays being invariably more or less curved. Most of the triactine principals consist of two opposite longer rays lying in the same axis longitudinally, and one lateral (transverse) shorter ray, more or less vertical to the rhabd formed by the other two. In some of the principal spicules the rays are not only unequal but seem also to be irregular in position, to enclose angles other than 90° with their neighbours. A closer inspection, however, shows that the axial threads of the basal parts of the rays of such spicules are also regularly disposed at right angles (Plate **24**, fig. 8), their apparent irregularity of position being due merely to strong curvatures near their basal part. The rays are smooth and blunt-pointed. The shorter ones are simply conic and gradually attenuated to the end; in the longest ones the thickest point often lies a short distance from the base, so that these rays appear somewhat spindle-shaped. Such rays are at the thickest point about 7% thicker than at the base. The principal spicules are 18–42 mm. long, their longitudinally extending rays measuring 10–21 mm. in length, their transverse paratangential rays 3–15 mm. The rays are 70–160 μ thick at the base. The basal thickness of the rays is, on the whole, proportional to their length.

The rays of these large principals are, like those of the principal spicules of *Holascella taraxacum*, composed of a nearly homogeneous axial and a very clearly stratified superficial zone. In the tetractine (Plate **24**, fig. 8) the axial zone is 18 μ in diameter near the centre of the spicule, whilst the clearly stratified superficial zone has here a thickness of 56 μ. The layers of the latter are very unequal in thickness; distally they terminate in cones, the apices of which lie in the axial thread.

In some of these spicules distinct signs of their having been broken at some time during the period of growth are to be noticed. In the portion of a ray of a principal spicule (Plate **23**, fig. 4) a fracture is visible, which shows that the tip of this spicule-ray was broken off at a point where it was about 25 μ thick, and that the ray continued to grow, not only in thickness but also in length, after this breakage. It is clearly to be seen that a new axial thread, lying *exactly* in continuation of the old broken one, was formed after the fracture. This new axial thread is widened proximally to a cone, which encloses the tip of the old broken axial thread. The new axial thread is a regenerate, the existence of which shows that the elements attached to the tip of a growing spicule-ray are not the only ones that can build up an axial thread.

The *smaller, spined hexactine and tetractine megascleres* (Plate **24**, figs. 1, 2) are 1–4 mm. in maximum diameter. Their rays are unequal, often curved, up to 1.7 mm. long, 12–17 μ thick at the base, and rounded at the end or blunt-pointed. The bases and often also the tips of the rays are smooth, the other parts show sparse, broad, sharp-pointed spines.

The *comital spicules* (Plate **24**, fig. 9) are di- to tetractine. Their rays are straight or irregularly curved, gradually attenuated distally, and terminally rounded. The end-part is usually somewhat thickened and spined. The other parts of the spicule are smooth. The rays attain a very considerable length. Measurements of this dimension cannot, however, be given since all the long rays observed were broken off. The longest intact ones seen were 1.5 mm. long. The rays are 8–28 μ thick at the base and attenuated distally to 5–8 μ. The spined end-part is 7–10 μ thick. In the tetractine and triactine comitals two opposite longitudinal rays lie in a straight line and are longer than the transverse ones (one). In the triactine forms the centre is markedly thickened on the side opposite the single transverse ray (Plate **24**, fig. 9). The diactine forms are centrotyle. The central tyle measures 14–36 μ in diameter. The proportion of the basal thickness of the rays to the transverse diameter of the tyle is 1 : 1.4 to 1 : 3, usually about 1 : 1.6. The two rays of these spicules are usually unequal in length and sometimes one of them is reduced to a mere knob. Such excessive longitudinal reduction is always associated with a considerable thickening. In an extreme form of this kind one ray was observed to be over 2 mm., the other only 44 μ, long. The central tyle measures 40 μ in diameter; the long ray is 16 μ thick and nearly cylindrical. The short ray is 33 μ thick at the base and farther on it is 44 μ thick. This knob-like rudimentary ray is covered with small spines down to within a short distance of its base.

The proximal and lateral rays of the *hypodermal and hypogastral hexactines* (Plate **23**, figs. 12, 13) are 5–9 μ thick at the base. They are cylindrical or slightly attenuated distally, and usually rounded at the end, rarely pointed. Their tips are generally spined, their other parts smooth. The proximal ray is 0.9–1.5 mm. long, the lateral rays 370–450 μ. The distal ray is 220–450 μ long, at the base as thick or somewhat thinner than the other rays, and distally thickened. At its thickest point, which lies near the distal end, it measures 17–40 μ in diameter. The proximal part and the extreme tip are smooth, the other parts of it more or less spined. The spines increase in size and number distally. They arise very obliquely and point towards the tip of the ray. The hypodermals are similar to the hypogastrals. Hexactines with thick strongly spined, and with thin only slightly spined, distal rays occur among both. The distal rays of the hypodermals appear to attain a greater length than the distal rays of the hypogastrals, the former being usually over, the latter under, 400 μ long.

The few *root-tuft anchors* observed are monactines. Their axial cross lies in their terminal anchor-tyle. The shaft is covered with very irregularly distributed, backwardly directed spines 17 μ thick just above the terminal anchor-tyle. The terminal anchor-tyle is similar to that of *Holascella taraxacum.* It is, with the spines, 57–65 μ broad and 74–90 μ long. Its spines, the anchor-teeth, are very irregular.

The *microoxyhexactines* (Plate **23**, fig. 8) measure 112–195 μ in total diameter. Their rays are regularly arranged, in the same spicule fairly equal, straight, conic, pointed, 55–105 μ long and 3–5 μ thick at the base. Their length is not in proportion to their basal thickness, the shorter rays of smaller microoxyhexactines being often thicker than the longer rays of larger ones. The rays are rather sparsely spined. The spines are sharp, not over 1 μ long, and directed obliquely backwards.

The *onychomicroscleres* (Plate **23**, figs. 10b, 11, 14b, 15, 16) measure 65–90 μ in total diameter, and have one to three end-rays. Many are microonychhexasters with only one end-ray on all the main-rays. Others are hemionychhexasters, with one end-ray on some, and two or, rarely, three end-rays on the other main-rays. A few are true onychhexasters with two to three end-rays on each main-ray. The main-rays are regularly arranged and, in the same spicule, fairly equal. They are cylindrical, smooth, about 5 μ long and 1.5–2 μ thick. The end-rays are straight or only slightly curved, 28–50 μ long, conic, at the base about 1 μ thick, and at the end 0.5–0.8 μ. They bear exceedingly minute spines along their length, and at their end there are several, usually three or four, large, more or less vertical spines. These terminal spines are not over 7 μ long, very slender, and curved, either simply, concave to the centre of the spicule, or in an S-shaped manner. When two or three end-rays arise from a main-ray, they enclose angles of 30° to 40° with its continuation; when there is only one end-ray it lies in the continuation of the main-ray, and usually passes into it so gradually that main- and end-ray together appear as a simple, conic hexactine ray. Sometimes a slight irregular thickening or change of direction indicates the point where the main-ray passes into the end-ray. Such simple rays are 33–35 μ long.

The *discomicroscleres* (Plate **23**, figs. 5–7, 10a, 14a, 17–25) measure 130–220 μ in total diameter. They generally have only one, sometimes two, very rarely three end-rays. Most of them are microdiscohexactines with one end-ray on each main-ray; some hemidiscohexactines with one end-ray on some main-rays and with two end-rays on others. A few are true discohexasters with two end-rays on all or with two end-rays on some and three end-rays on the other main-rays. The main-rays are regularly arranged and, in the same spicule, fairly equal. They are smooth, about 5 μ long and 2.5–3.7 μ thick. The end-rays are straight or slightly irregularly curved, 50–110 μ long, thinnest some distance below the distal extremity, and thickened at both ends. The proximal end is 2–3 μ thick, the thinnest point 0.7–1.5 μ, and the distal end 2.6–4 μ. The end-rays bear very minute spines on their sides and a verticil of large, anchor-teeth like, strongly recurved spines at their end. These terminal spines are conic, 8–10 μ long and 1.2–1.6 μ thick at the base. They are not joined at the base to a terminal tyle or disc, and together form an exquisite anchor, 9–12 μ broad and about as high. When two or three end-rays arise from a main-ray, they are usually arranged somewhat irregularly and enclose angles of 20°–45° with the continuation of the main-ray. When, as is the rule, there is only a single end-ray, it lies in the continuation of the main-ray, and usually passes into it so gradually that main- and end-ray together appear as a simple hexactine ray. Such simple rays are 65–115 μ long.

Axial threads are found only in the main-rays. They appear as thin, fairly straight rods, are about 5 μ long, and terminate abruptly at the point where the main-ray divides into the two or three end-rays (Plate **23**, fig. 7, right), or passes into the single end-ray (Plate **23**, figs. 6, 7, left, upper and lower). The simple rays with only one end-ray consequently possess an axial thread only in their basal (main-ray) part.

The few main-ray crosses observed, which may be centres of *graphiocomes*, consist of regularly arranged, equal, straight main-rays 10 μ long and 3.5 μ thick, from the ends of which large numbers of end-rays arise.

The *floricomes* (Plate **24**, figs. 4–7) measure 48–60 μ in total diameter. Their main-rays are regularly arranged, in the same spicule equal, cylindrical, straight, 6–7 μ long, and about 1.5 μ thick. Each main-ray bears a verticil of about twelve end-rays. All the end-rays arise at exactly the same level, 1–1.5 μ below the distal end of the main-ray, which protrudes for that distance in the shape of a rounded knob beyond the ring-shaped line of their insertion. The end-rays of the same verticil are exactly equal in size, shape, and position, relative to the main-ray from which they arise. They are, measured along their chord, 20–23 μ long and strongly curved in an S-shaped manner. Their basal part is directed outwards and slightly backwards, their central part upwards and slightly outwards, and their distal part again outwards and slightly backwards. They are exceedingly thin at the base, but thicken distally and attain, a short distance from the end, a maximum transverse diameter of about 1.3 μ. The end-rays are smooth on the inner side, that is the side turned towards the continuation of the main-ray. On the opposite, outer side their thicker distal part bears fairly large spines.

As far as the fragmentary condition of the specimen allows one to judge, the only species more closely allied to it is the specimen referred to by F. E. Schulze[1] as Holascus sp. and those described in this paper as *Holascella taraxacum* and *H. euonyx.* It is very clearly distinguished from Holascus sp. Schulze and *Holascella taraxacum* by the terminal spines of its discomicroscleres. In the sponges described above these are long, slender, strongly recurved, and isolated quite down to the base. In *Holascella taraxacum* they are certainly, and, to judge by the figures, in Holascus sp. Schulze most probably, short, divergent, and basally joined to form terminal tyles ("end-discs"). From the former *H. ancorata* also differs by the principals, which are in the sponge above described chiefly tri- and tetractines, in *H. taraxacum* chiefly hexactines; by the discomicroscleres, which have few end-rays in the former and very numerous end-rays in the latter; and by the floricomes which are present in the former and appear to be absent in the latter. There can, therefore, be no doubt that *H. ancorata* is specifically distinct from *H. taraxacum.* Whether it is also distinct from Holascus sp. Schulze, of which no adequate description exists, is not so easy to say, the figures of this sponge given make it highly probable, however, that it belongs to a different species.

It appears to be more closely related to these species than to the sponge here described as *Holascella euonyx.* From this it differs by the superficial hexactines, the distal rays of which are much thicker and more club-shaped in *H. ancorata* than in *H. euonyx;* by the discohexactines and hemidiscohexasters, the rays (end-rays) of which are more spiny and bear much smaller terminal anchor-teeth in the former than in the latter; by the onychhexactines and hemionychhexasters, which have much shorter terminal spines in the former than in the latter, and by the presence of floricomes in the former and their absence in the latter.

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 86, 87, pl. 15, figs. 14–23.

Holascella euonyx, sp. nov.

Plate 24, figs. 10–17; Plate 25, figs. 1–24.

A fragment of this species was trawled nearly under the equator in the Eastern Pacific at Station 4742, on 15 February, 1905; in 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); it grew on very light, fine, Globigerina ooze; the bottom-temperature was 34.3°.

It is characterized by possessing hemionychhexasters and onychhexactines with very long terminal spines (end-claws). To this the name refers.

Shape and size. The single fragment (Plate **25**, fig. 17) is a very slightly cylindrically curved plate which may have formed part of a wide tube. It is 51 mm. long, 15 mm. broad, and about 1.5 mm. thick.

The *colour* in spirit is brown.

The internal *skeleton* is composed of parallel bundles of spicule-rays, and of loose spicules. Near the surface special superficial (dermal, gastral) hexactines occur. The bundles are composed of stout principals, for the most part tetractine, and slender comitals likewise chiefly tetractine. The loose parenchymal spicules consist of numerous large and a few small simple hexactines; a few hemionychhexasters; numerous onychhexactines; numerous small discohexasters with many end-rays; very few large hemidiscohexasters with few end-rays; and numerous large discohexactines. The special superficial hexactines have a differentiated distal ray.

Besides these spicules numerous small hexactines with curved rays, a few pinules, and a good many large amphidiscs have been observed both in the sections and the spicule-preparations. These spicules are in all probability foreign.

The distal ray of the *superficial* (dermal, gastral) *hexactines* (Plate **25**, figs. 14, 15, 21–24) is fairly straight, 235–270 μ long and about 6–10 μ thick at the base. Towards the distal end it is thickened more or less, the end itself being abruptly pointed. At its thickest point, which lies a short distance below the end, the distal ray measures 9–16 μ in transverse diameter. The basal part of the ray is smooth, the distal part covered with stout, very oblique spines 1–2 μ long. These spines are somewhat curved, concave to the axis of the ray, and point towards its distal end. These distal rays consequently somewhat resemble wheat-ears. The axial thread extends quite to the tip of the ray, its end is not covered with silica (Plate **25**, figs. 22, 24). The proximal and the lateral rays are curved, cylindroconic or conic, at the base about as thick as the basal part of the distal ray, smooth in their proximal part, and covered with minute oblique spines, inclined towards the end, in their distal part. The lateral rays are 215–420 μ long and often thickened at the end. The proximal ray attains a length of 400–530 μ. The fragmentary state of the specimen renders it impossible to determine which of the superficial hexactines observed are dermal and which gastral.

The *tetractine principal spicules* (Plate 25, fig. 16) have two long rays extending longitudinally and two shorter transverse rays. The four rays do not lie in one plane. The rays are 80–140 μ and more thick at the base. About their length I cannot be definite, since the larger spicules of this kind were invariably broken. The longest longitudinal ray-fragment observed was 19 mm. long.

The *tetractine comital spicules* (Plate 25, fig. 18) are similar to the principal ones, but have rays usually only 9–17 μ thick.

The *large loose hexactines* (Plate 25, figs. 19, 20) have straight or curved, equal or unequal rays, which arise from a distinct central thickening, 38–50 μ in diameter. The rays are 0.3–1.7 mm. long, at the base 10–35 μ thick, usually 10–15 μ, and smooth or, more frequently, covered with sparse fairly stout, low spines.

The *small hexactines* measure 120–150 μ in diameter, and have straight, conic rays, 6–7 μ thick at the base, and densely covered with rather large spines.

The *onychhexactines* and *hemionychhexasters* (Plate 24, figs. 13, 14; Plate 25, figs. 1, 6–9, 13b) are both derivates of onychhexasters, and there is no difference between them, except that in the former (Plate 25, figs. 7, 9) all the main-rays bear only one end-ray, while in the latter (Plate 25, fig. 8) one or two of the main-rays bear two end-rays. When, as is the rule, only one end-ray is present, this either extends exactly in the continuation of the main-ray (Plate 25, fig. 9), or there is a slight, abrupt curvature at the point where the main-ray passes into the single end-ray (the upper ray, Plate 25, figs. 7, 8). In any case the main- and the single end-ray together form a ray, simple in outer appearance. That these apparently simple rays are in truth composed of a main-ray and a (single) end-ray is, however, clearly shown by the axial thread, which is only 7–8 μ long, and present in the basal (main-ray) part of the ray only. These onychhexactines and hemionychhexasters measure 53–95 μ in total diameter. Their simple rays are 25–45 μ long. The main-rays which bear two end-rays are, like the axial threads of the simple rays, 7–8 μ long. The simple rays are 2–3 μ thick at the base and taper distally to 1–1.5 μ. They are either smooth throughout, or slightly roughened by exceedingly minute spines in their basal and middle-parts. Each ray (end-ray) bears at its end a verticil of four or, more rarely, three large curved, conic spines, 7–15 μ long. The basal part of these spines is directed outward, slightly upward, and usually encloses an angle of 105°–102° with the ray. Their ends are bent downwards, towards the centre of the spicule. These spines are regularly arranged and, when four in number, form a regular cross.

The *small discohexasters* (Plate **24**, figs. 10–12, 13b, 14b, 15–17; Plate **25**, fig. 13a) measure 38–44 μ in total diameter. They have a centrum 3.3–4 μ in diameter, from which six equal and regularly arranged main-rays arise. The main-rays are cylindrical, 6.5–9 μ long, 1–1.4 μ thick, and simply rounded off at the end. About 1 μ below the end each main-ray bears a high frill, which appears as a round, subterminal, transverse disc 5–7 μ in diameter. From the margin and the upper distal face of this disc very numerous diverging end-rays arise, which together form a short and broad bunch, at the distal end 19–25 μ in diameter. The individual end-rays are, at the base, curved, concave to the continuation of the main-ray axis, and in their distal and middle-parts straight. They are 13 μ long, throughout about 0.2 μ thick, covered with exceedingly minute, recurved spines along their length, and crowned at the end with a verticil of similar but larger spines. These terminal spines together form a kind of end-disc, generally a little less than 1 μ in transverse diameter.

The *large hemidiscohexasters and discohexactines* are very similar and differ from each other only in that one of the main-rays bears two end-rays (Plate **25**, figs. 2–5, 10, 11) in the former, whilst all six main-rays bear only one end-ray in the latter. The large discohexactines measure 173–232 μ in total diameter, usually 194–215 μ. Their six simple rays are fairly equal and regularly arranged, straight or slightly and uniformly curved, and sometimes just perceptibly abruptly bent at the point where the short basal part, which is the main-ray, passes into the long distal part, which is the single end-ray. The short basal (main-ray) part of the ray contains an axial thread 6–7 μ long; 6–7 μ is accordingly the length of the main-ray. The long distal (end-ray) part is destitute of an axial thread. The rays of the large discohexactines are 95–110 μ long and thickened at both ends. They measure at the base 4.5–6 μ, at the thinnest point, which lies somewhere near the middle of their length, 2.4–5 μ, and at the distal end 5–6.5 μ in transverse diameter. Along their length these rays are either quite smooth or bear a few minute, recurved spines. The end is crowned by a terminal verticil of usually five or six recurved spines, 7–12 μ long, and 1.8–4 μ thick at the base. These spines are conic, uniformly recurved and rather sharply pointed; together they form an exquisite anchor 15–22 μ broad and 10–16 μ high.

The nearest ally to this sponge appears to be *Holascella ancorata*. From this it is distinguished by its superficial hexactines having more slender distal rays, by its discohexactines having smoother rays and larger terminal anchor-teeth, by the terminal spines of its onychhexactines and hemionychhexasters being much longer, and by possessing no floricomes. On account of its general similarity to *Holascella ancorata* I assign it to the genus Holascella. It must, however, be borne in mind that the fragmentary condition of the specimen precludes the possibility of saying with certainty whether it really belongs to this genus, for if the sponge of which it formed part should have been destitute of a root-tuft, which is quite possible, it would have to be placed in Corbitella or another genus of the Corbitellinae. In this respect it is noteworthy that its discohexactines are rather similar to the discohexactines of *Corbitella* (*Eudictyon*) *elegans* Marshall.[1]

CAULOPHACIDAE F. E. Schulze.

Wineglass- or mushroom-shaped Hexasterophora with a firm stalk; solitary or forming branched colonies. With dermal pinules and large hypodermal pentactines.

The collection comprises thirty more or less complete specimens and eighty-three fragments of specimens of this family. The position of three of the latter is doubtful. The others belong to the three genera Caulophacus, Caulophacella, and Calycosilva; the last two of these are new.

CAULOPHACUS F. E. Schulze.

Mushroom-shaped Caulophacidae with hollow stalk, discohexasters, and microdiscohexactines.

There are twenty-eight more or less complete specimens and forty-nine fragments and stalks of Caulophacus, all of which belong to the same species.

[1] *W. Marshall.* Untersuchungen über Hexactinelliden. Zeitschr. wiss. Zool. Suppl., 1875, **25**, p. 211, 212, taf. 16, figs. 66 a–l. *I. Ijima.* Studies on the Hexactinellida. II. Journ. Coll. sci. Tokyo, 1902, **17**, p. 11–16, pl. figs. 13–15.

Caulophacus schulzei Wilson.

Plate 7, figs. 20–31; Plate 8, figs. 1–29; Plate 9, figs. 1–33; Plate 10, figs. 1–29; Plate 11, figs. 1–17.

Mem. M. C. Z., 1904, **30**, p. 43; Plate 4, figs. 1, 3, 5–10; Plate 5, figs. 1–6, 8–10.

All the specimens referred to this species were trawled at Station 4651 off northern Peru on 11 November, 1904; 5° 41.7′ S. 82° 59.7′ W.; depth 4063 m. (2222 f.); they grew on sticky, fine, gray sand; the bottom-temperature was 35.4°.

Apart from peculiarities due to differences of age and preservation, all these sponges are fairly identical. The nearly complete specimens are mushroom-shaped, composed of a discoid body and a stalk attached to the lower face of the disc. The fragments appear to be parts of similar sponges. Six specimens have been selected for detailed study, and to these all the figures on the plates refer. These specimens are marked A–F. A, B, and C are small specimens with discs 27–31 mm. in diameter. D, E, and F are large specimens. D had a disc 60 mm. in diameter. E was probably still larger, but is too fragmentary for exact measurement. F is a detached stalk which appears to have belonged to a specimen with a disc also about 60 mm. in diameter.

Shape and size. In the smallest nearly complete specimen, the disc-shaped body is oval in outline, 19 mm. long, 16 mm. broad, and 2.5 mm. thick in the middle. Towards the margin it thins out. The central part of the upper, gastral face is flat, its marginal part slightly convex. The stalk is eccentric, oblique, 2 mm thick close to its point of insertion to the sponge-body (disc), and attenuated below. In seven of the nearly complete specimens the disc is fairly flat, circular to oval in outline, 24–35 mm. in maximum diameter, and 5–7 mm. thick in the middle. One of these small specimens is represented on Plate **9**, fig. 30. In these specimens the central part of the upper, gastral face is flat, slightly concave or slightly convex, the marginal part usually distinctly convex. The proximal end of the stalk is 2–5 mm. thick. The eccentricity of its point of insertion varies considerably and is in one of the specimens so great that its distance from the farthest point of the margin is thrice that of its distance from the nearest. In one small specimen (Plate **9**, fig. 29) the disc is a little over 30 mm. in diameter, 7 mm. thick in the middle, and folded in above. The upper, gastral face is, apart from the remarkable infolding, nearly flat in the middle and strongly convex towards the margin. The lower, dermal face is convex in the middle and flat near the margin. The margin itself is very clearly defined and sharp (Plate **8**, figs. 28b, 29b). The stalk is, close to its point of insertion, 4.5 mm. thick; 8 mm. lower, where it is broken off, it is only 2.2 mm. thick.

The remaining nineteen specimens, one of which is represented on Plate **9**, fig. 28, are larger. Their irregularly oval discs are 40–64 mm. long, 34–54 mm. broad, and 7–12 mm. thick in the middle. The more or less eccentric and oblique stalk is, near its point of insertion, 2.5–7.5 mm. thick and quite rapidly attenuated below. The disc is flat, slightly convex or concave. The greater part or the whole of the marginal portion of the upper face is convex, so that the margin appears slightly bent down.

The stalk is not intact in any of the specimens, but there are among the fragments three rather long stalks with intact lower (distal) end. These are 30–40 mm. long, curved, particularly near the base, and 2 mm. thick (at the lower end) to 3.3 mm. (at the upper end). One of these stalks (Plate **9**, fig. 28) appears to have been torn off the larger specimen. In the photograph this stalk is artificially attached to it.

The specimens examined by Wilson (*loc. cit.*, p. 43, Plate **4**, fig. 3) were similarly composed of a calyculate, flat, or somewhat convex disc-shaped body, 22–50 mm. in diameter, and a stalk invariably broken.

The *colour* of all the specimens in spirit is brownish gray.

General structure. Remnants of a superficial membrane supported by the lateral pinule-rays can be made out both on the dermal and the gastral faces of the sponge. This membrane lies on both sides, 70–100 μ above the level occupied by the lateral rays of the hypodermal and hypogastral pentactines. In the intervening space shreds of tissue are observed, indicating that in life this zone was occupied by a network of trabeculae. Below the level marked by the lateral pentactine rays subdermal and subgastral cavities occur, which lead into canals extending more or less transversely, often through the greater part of the thickness of the whole disc (Plate **8**, figs. 28, 29; Plate **9**, fig. 32). The entrances to these canals are clearly visible, both on the dermal and the gastral face of the disc-like body. Where the superficial membrane is still present, they are covered by it; where this membrane has been lost, as is the case on nearly the whole of the surface in most of the specimens, they are freely exposed. The apertures of the dermal face resemble in shape and arrangement those of the gastral face, but are on the whole somewhat larger. The largest are always formed on the central part of the disc. Towards the margin they become smaller. Their distance from each other is in proportion to their size; the marginal ones lie much closer together than the central ones. The largest central apertures are 0.8–4 mm. wide, their width being, on the whole, in proportion to the size of the specimen. Apertures over 3 mm. in diameter have been observed only in specimens with discs more than 50 mm. long. Apart from this it is also to be noticed that the smaller these apertures are, the better the specimen is preserved. Their great width in indifferently preserved specimens is probably due to extreme *post mortem* shrinkage of the soft parts.

The canals into which these apertures lead are 0.2–1.5 mm. wide in the best preserved specimens (Plate **8**, figs. 28, 29). In specimens not so well-preserved the largest attain, probably in consequence of excessive shrinkage of the soft parts, a width of 3 mm. (Plate **9**, figs. 32, 33).

The spaces between these canals are occupied by a dense, readily stained tissue in which are observed traces of oval cavities 120–140 μ long and 70–90 μ broad, which may be remnants of the walls of the flagellate chambers.

The stalk is hollow (Plate **9**, figs. 27, 33a). I failed to find any open communication between the cavity of the stalk and the wide canals of the body proper.

The stalk is supported by a tubular network (Plate **9**, fig. 27; Plate **10**, figs. 8, 13, 14) composed of many longitudinal and a few transverse rhabds and other megascleres, joined by apposed silica, which solders these spicules together where they come in contact, and which forms short rods connecting adjacent spicules. It is to be noted also that pinules are embodied in this network (Plate **10**, fig. 8a). The longitudinal rhabds, of which this skeleton-net is chiefly composed, are in the outer part of the tube situated longitudinally. Towards its inner surface their position becomes on the whole more oblique, and here transverse rhabds also occur. The (mostly longitudinal) beams of the network are usually 20–60 μ thick, their (mostly transverse) secondary connections usually 4–12 μ. Above, where the stalk passes into the body of the sponge, the longitudinal rhabds of its skeleton become free.

The megascleres of the body are chiefly pinules, hypodermal and hypogastral pentactines, hexactines, and rhabds. Besides these a few large, not hypodermal or hypogastral, pentactine hexactine-derivates have been observed. The hexactines and pentactine hexactine-derivates are scattered throughout the choanosome. Some of the rhabds are isolated, most of them form bundles, which traverse the interior obliquely and extend paratangentially some distance below the surface. Hypodermal and hypogastral pentactines, with paratangential lateral rays and an apical ray directed radially inward, are noticed under the dermal and gastral surface. The whole of the surface is occupied by pinules, the lateral rays of which extend paratangentially in the superficial membrane. The gastral pinules and the dermal pinules of the body and the stalk are quite similar. Nearly all the pinules are regularly hexactine. There are numerous forms of microscleres. These can be classified in two groups not connected by transitions. The first group comprises hexasters, hemihexasters, and hexactines, the rays (end-rays) of which are, when young, smooth, and sharp-pointed, when adult covered with numerous large lateral spines and crowded with a verticil of terminal spines. The young forms of this group appear as oxy-, the adult forms as disco-hexasters, -hemihexasters and -hexactines. The second group comprises discohexasters with generally smooth main-rays, from the ends of which arise regular verticils or bunches of slender end-rays. The end-rays are densely covered with small lateral spines, and crowned with a verticil of terminal spines. The spicules of this group appear to replace, in this and other species of Caulophacus, the plumicomes of Sympagella and Calycosilva. For this reason and because they differ very considerably from the discohexasters of the other group of microscleres I think it better not to describe them as discohexasters, as previous authors have done, but to give them another name, discocomes.

The discohexasters, etc., occupy the choanosome in dense masses. One of the rays of those situated in the walls of the large choanosomal canals is usually directed canalwards and protrudes into the canal-lumen. The walls of these canals therefore appear somewhat spiny and the spicules rendering them so might be considered, to a certain extent, as canalaria.

The discocomes are met with chiefly in the subdermal and the subgastral region, and here occasionally form clusters in which large and small ones are irregularly intermingled.

The *rhabds of the stalk* (Plate 10, figs. 11, 12) are 14–28 μ thick near the end. The end itself is more or less thickened. This terminal thickening is greater in the stout, than in the slender rhabds. When great it gives to the rhabd-termini the appearance of oval tyles. The thickened end-part (tyle) measures 18–38 μ in transverse diameter, and is 4–12 μ thicker than the adjacent parts of the spicule. This more or less thickened end-part is densely covered with small spines; the remainder of the spicule is smooth. The terminal region occupied by the spines is 44–60 μ long.

The *rhabds of the body proper* (Plate 10, figs. 1–7, 9, 10) are more or less, sometimes very considerably curved, slightly attenuated toward the rounded, usually somewhat anisoactine ends, centrotyle, and everywhere smooth, except at the ends. The end-parts are covered with small spines, and sometimes slightly thickened. These rhabds are 1.2–4.3 mm. long, measured along the chord connecting their ends, and 7–26 μ thick near the middle. The central tyle measures 11–32 μ in transverse diameter and is 2–9 μ, on an average about 4.4 μ, thicker than the adjacent parts of the spicule. In the central tyle a transverse cross is observed, composed of four rudimentary axial threads, about 1 μ long. At the ends, these rhabds are 0–4 μ thinner than near the centre. Their aniso-actinity is not great, the difference in the thickness of the two ends usually not exceeding 2–3 μ. The terminal spiny regions are 20–45 μ long. The spines in them stand close together, attain a length of about 1 μ, and arise vertically. They are either straight or slightly curved backwards, towards the middle of the rhabd, at the end.

In comparing the measurements of the rhabds of the body of the small specimen (with a disc about 30 mm. in diameter) with those of the rhabds of the large specimen D (with a disc about 60 mm. in diameter), I found no perceptible difference in their length, but a well-pronounced difference in their thickness, the body-rhabds of the 30 mm.-specimen B being 10–21 μ thick and having central tyles 15–26 μ in diameter; those of the 60 mm.-specimen D being 10–26 μ thick and having central tyles 16–32 μ in diameter.

Wilson (*loc. cit.*, p. 45) states that in the specimens examined by him the rhabds were 1–4 mm. long, usually 1.5–2.5 mm.; 8–12 μ thick, exceptionally 24 μ; and "subterminally roughened with microtubercles." To me the sub-terminal protuberances appear as sharp-pointed spines and I should not call them "microtubercles."

The *hexactine megascleres of the choanosome* (Plate 7, figs. 20–31) measure 1.2–3.2 mm. in total diameter. The rays of the same hexactine are fairly equal in thickness but differ more or less, often very considerably, in length. In many hexactines the longest ray is two to three times as long as the shortest. The rays are 250 μ–1.4 mm. long, conic, blunt, 25–74 μ thick at the base, and 7–18 μ just below the end. They are more or less, often considerably, curved, rarely angularly bent (Plate 7, fig. 28). The long rays are invariably smooth and attenuated toward the end. The rays reduced in length are either conic, pointed, and spiny (Plate 7, fig. 21) or, more rarely, cylindrical, terminally thickened, and smooth (Plate 7, fig. 29).

In the shortened conic and spined rays there is a correlation between the number and size of the spines on the one hand, and the degree of longitudinal reduction of the ray on the other, the development of the spines being in proportion to the degree of reduction. Here, as in the similar case of *Calycosilva cantharellus*, this correlation between spine-development and reduction in length is probably due to the potential energy of the silicoblasts building the short rays being partly diverted from their normal use of forming long rays and converted into the work of producing spines. The longitudinal reduction of the rare, smooth, terminally thickened, shortened rays is obviously of a different nature, the potential energy of the silicoblasts being in this case diverted in another direction. The difference of these two kinds of reduction is probably attributable to a difference in the cause of the reduction.

There is no perceptible difference in the dimensions of the hexactine choanosomal megascleres of the small (B, 30 mm.-disc) and large (D, 60 mm.-disc) specimen.

Wilson (*loc. cit.*, p. 44) found the hexactine rays 0.7–1.2 mm. long, and 28–48 μ thick at the base. He occasionally observed hexactines with spines on all rays, but does not mention the forms with spines on the reduced ray only. In his figure (*loc. cit.*, Plate 5, fig. 10) all the hexactines are drawn with stout, straight, and equal rays. My photographs (Plate 7, figs. 20–31) show that in the material examined by me their appearance is different. Since, however, the figure (Plate 5, fig. 10) of Wilson is a general view of a section, I believe myself justified in assuming that this difference is not real but merely due to the hexactines in the figure cited having been drawn schematically.

The rare *pentactine hexactine derivates* (Plate 8, figs. 23, 24) are, apart from the suppression of one of the rays, similar to the hexactines. Some of them bear spines on all the rays. These pentactines are 1.1–3.1 mm. in diameter. The longest of their usually unequal rays, which may be the unpaired apical one or another, is 0.8–1.6 mm. long, their shortest ray 0.4–1.4 mm. The rays are 30–55 μ thick at the base.

The *hypodermal and hypogastral pentactines* (Plate 8, figs. 1–7, 12–22, 25–27) are very similar. Their lateral rays are either all properly developed and fairly equal (Plate 8, figs. 19–21, 25–27), or one, two, or three of them are more or less reduced in length, shorter than the others (other), and also, if more than one, unequal in length among themselves (Plate 8, figs. 12–14, 18, 22). The properly developed lateral rays are straight or slightly curved, conic, and very blunt. Their proximal part is either smooth or it bears a larger or smaller number of spines. Farther on, and up to a short distance from the end, they are nearly always smooth. The end itself is either also smooth or densely covered with small spines. The proximal spines extend, when present, from over a quarter to nearly a half of the length of the ray. They are low, broad, pointed, and conic. In regard to their number the lateral rays, even of the same spicule, are very unequal (Plate 8, figs. 13–15). Sometimes there are a good many, sometimes but a few, occasionally only one, and not infrequently none at all. When the spines are numerous a spiral arrangement of them can occasionally be made out quite distinctly (Plate 8, figs. 13, 15).

When the lateral rays are markedly reduced in length, their ends are usually thickened (Plate 8, figs. 12, 14, 18, 22). The terminal thickening is either spiny (Plate 8, fig. 14) or smooth (Plate 8, fig. 12).

The lateral rays are 250 μ–1.1 mm. long, and 25–65 μ thick at the base. The properly developed long ones taper gradually to the rounded end which is 5–12 μ thick. The ends of the longitudinally reduced and terminally thickened lateral rays measure 15–25 μ in transverse diameter. In some specimens, as for instance in the small one with 30 mm.-disc, the lateral rays of the hypodermal pentactines are slightly shorter than those of the hypogastrals, those of the former sometimes measuring in this specimen 0.9 mm. in length, those of the latter 1 mm. In the other specimens, as for instance in the large one D with 60 mm.-disc, the lateral rays of the hypodermal pentactines are considerably longer than those of the hypogastrals, those of the former measuring in this specimen up to 1 mm., those of the latter only up to 670 μ in length.

The proximal ray is straight or slightly, often irregularly, curved, and tapers gradually to the blunt or rounded end. The basal part of the proximal ray is smooth for a short distance, then follows a region which usually bears broad and low, conic spines. The number of these spines is variable. Sometimes (Plate 8, figs. 7, 16, 17) there are a good many, sometimes only few (Plate 8, figs. 1, 5), and sometimes none at all (Plate 8, fig. 6). When these spines are numerous, the portion of the proximal ray bearing them is usually more or less thickened. The distal and the middle-part of the ray are generally smooth.

The proximal ray is 600 μ–1.1 mm. long, and 30–55 μ thick at the base. The maximum thickness of the spiny part is 1–4, rarely as much as 7 μ greater than the thickness of the base of the ray.

The difference in the length of the proximal ray of the hypodermal and hypogastral pentactines is similar to, but not so great as, the difference in the length of their lateral rays. In the small 30 mm.-disc specimen B the proximal ray of the hypodermals is not over 0.95 mm. long, that of the hypogastrals not over 1.1 mm. In the larger 60 mm.-disc specimen D the proximal ray of the hypodermals is not over 1.1 mm. long, that of the hypogastrals not over 0.96 mm.

Also in the specimens examined by Wilson (*loc. cit.*, p. 46) the hypodermal and the hypogastral pentactines were very similar. Wilson (*loc. cit.*, p. 46, 47) remarks that there is no trace of a (sixth) distal ray. In the pentactines of the specimens examined by me, such a trace occurs as a short continuation of the axial thread of the proximal ray beyond the centrum. The measurements given by Wilson (*loc. cit.*, p. 47) are: — lateral rays 0.4–0.75 mm. by 36–48 μ, proximal ray 0.78–1 mm. by 50–60 μ. In his drawing (*loc. cit.*, Plate 4, fig. 9) of a pentactine the spines are much smaller than in the pentactines examined by me with distinctly spined proximal ray (Plate 8, figs. 5, 7, 16, 17).

The *pinules* (Plate 11, figs. 1–16, 17a) are nearly always regularly hexactine. Only exceptionally a pinule with a rudimentary proximal ray or some other abnormity is met with. Apart from certain differences in their dimensions, which will be dealt with below, the dermal pinules of the upper part of the stalk, the dermal pinules of the body, and the gastral pinules are identical. The lower parts of the stalks at my disposal are denuded of their pinules, so that I am unable to say what these may be like. Probably they are similar to those of the upper part of the stalk, but smaller.

The distal pinule-ray is straight, 140–390 μ long, and 8–23 μ thick at the base. Above the ray thickens, and it attains its maximum transverse diameter a little below the middle of its length, where it is usually a third to twice as thick as at the base. In four pinules measured, the thickness of the distal ray was:—

at the base	14,	at the thickest point	25 μ
" " "	16,	" " " "	28 μ
" " "	18,	" " " "	28 μ
" " "	20,	" " " "	35 μ

Beyond the thickest place it is attenuated, at first slowly, then rapidly, to a rather sharp point. It consequently appears spindle-shaped. It is covered throughout with sharp-pointed, conic spines. The proximal spines are very small. Farther up they become larger and they increase in size to the middle of the ray, where they measure 18–22 μ by 5–8 μ. From here onwards they again become smaller, but only very slightly, the uppermost spines still being quite large. The proximal spines arise vertically, those farther up obliquely, and the nearer we approach the middle of the ray the more inclined towards its tip do their basal parts become. The small proximal spines are straight, those farther up slightly curved towards the tip of the ray. The maximum thickness of the distal ray, together with its spines, is 25–70 μ.

The proximal ray is, when normally developed, straight, 70–145 μ long, 8–17 μ thick at the base, and attenuated towards the blunt end, at first gradually, then abruptly. Its distal part bears numerous fairly large spines, its proximal part fewer and smaller ones. Sometimes this part of the ray is nearly smooth. Exceptionally the proximal ray is reduced or hypertrophied. When reduced it is 7–40 μ long, more or less cylindrical, as thick throughout as the normal proximal ray at its base, and terminally rounded. A hypertrophic proximal ray observed (Plate 11, fig. 13) was 150 μ long, considerably thickened in the middle, attenuated to a rather sharp point, and densely covered with large spines. It measured at the base 16 μ and at its thickest point 25 μ in transverse diameter. Another still more hypertrophic one in all respects resembled the (opposite) distal ray.

The lateral rays are similar to the proximal ray, but more frequently smooth in their basal part. They are 80–157 μ long, and 8–18 μ thick at the base.

The lateral rays of the same spicule are usually fairly equal. But in one quite abnormal pinule which I found in the large specimen D they were very unequal. In this remarkable spicule two adjacent lateral rays were hypertrophic, covered with long spines, and similar to the distal ray of an ordinary pinule, whilst the other two laterals were normal and the spinulation of the distal ray so much reduced that it resembled the (normal) proximal ray.

I measured a good many pinules of four different specimens (B, C, D, and E). The results of these measurements are tabulated on p. 57. Specimen E, which was taken for detailed study because it appeared to be a part of a specimen larger than any of the nearly complete ones, was too fragmentary to allow of a distinction between its dermal and gastral faces. The dermal and gastral pinules of this specimen are therefore not distinguished in the table.

From this table the following conclusion concerning the differences in the dimensions of the pinules can be drawn. There is, in specimens of similar dimensions (B and C), a not inconsiderable variation in the dimensions of the pinules, particularly the length of the distal ray. In the large specimen D all the rays of the body-pinules attain a greater thickness and the proximal and lateral rays also a greater length than the corresponding rays of the corresponding pinules (dermal and gastral) of the small specimens B and C. The rays of the dermal pinules are thicker at the base than the corresponding rays of the gastral pinules of the same specimen. This applies also to the maximum thickness of the distal ray with its spines in specimens C and D, but not in B. The distal rays of the gastral pinules attain a considerably greater length than the corresponding rays of the dermal pinules of the same specimen. The other rays are in some specimens longer in the dermal, in others longer in the gastral

PINULES.

				Distal apical ray			Proximal apical ray		Lateral rays	
				Length	Thickness at base	Maximum thickness with spines	Length	Thickness at base	Length	Thickness at base
Specimen B (30 mm.-disc)	dermal body		limits μ	215–340	10–19	25–40	100–120	10–12	90–140	10–14
			average of the largest three μ	289	16	37	112	12	128	13
	gastral		limits μ	240–390	10–15	26–45	90–110	8–13	115–125	10–11
			average of the largest three μ	337	13	38	103	10	120	11
Specimen C (30 mm.-disc)	dermal body		limits μ	190–228	10–16	32–40	95	13	125	12
			average of the largest three μ	216	13	38	95	13	125	12
	gastral		limits μ	280–300	8–12	28–32	90–100			
			average of the largest three μ	298	12	32	100			
Specimen D (60 mm.-disc)	dermal	upper part of [illegible] stalk	limits μ	140–230	8–17	30–50	70–105		80–120	
			average of the largest three μ	217	12	45	97		110	
		body	limits μ	210–310	11–21	30–68	75–124	10–17	90–170	9–15
			average of the largest three μ	287	21	65	115	15	150	14
	gastral		limits μ	215–365	13–19	37–57	80–145	8–15	100–165	9–15
			average of the largest three μ	332	18	56	127	14	138	13
Specimen E (disc probably over 60 mm.); body			limits μ	190–385	10–23	32–70	90–133	8–17	90–157	8–18

pinules. The dermal pinules of the upper part of the stalk are in all dimensions smaller than the dermal pinules of the body of the same specimen. This difference is greatest in respect to the basal thickness of the distal ray.

In the specimens examined by Wilson (*loc. cit.*, p. 45) the proximal and lateral pinule-rays measure about 100 by 8–10 μ. These rays, particularly the laterals, are, according to this, considerably smaller in Wilson's specimens than in those examined by me. The distal pinule-ray is, according to Wilson (*loc. cit.*, p. 45), covered with narrow scales not over 16–20 μ long. His measurements agree with mine, but it does not seem correct to call these structures scales. As my photographs (Plate **11**, figs. 15, 16) show, they are ordinary conic spines with a fairly circular transverse section. Wilson (*loc. cit.*, p. 46) gives sets of measurements of the distal pinule-rays of two specimens, one in which they are slender and one in which they are stout. The distal ray of the dermal pinules is (together with its spines) in the first 240–320 μ by 36–40 μ, in the second 210–240 μ by 44–56 μ; the distal ray of the gastral pinules in the first is 260–360 μ by 32–36 μ, in the second 280–320 μ by 36–40 μ.

The *oxyhexasters*, *hemioxyhexasters*, and small *oxyhexactines*, found in small numbers in several specimens, I at first took for skeletal elements *sui generis*. A careful search, however, revealed the presence of a few spicules connecting them with the discohexasters, hemidiscohexasters, and discohexactines, and the examination of these transitional forms made it clear that these oxyhexasters, etc., are young forms of the discohexasters, etc.

The young oxyhexaster-like etc. of discohexasters etc. (Plate **9**, figs. 14–16) measure 60–190 μ in total diameter, and have six rays. These are 2–4 μ thick at the base, conic, sharp-pointed, perfectly smooth, and either simple or provided with one or two, rarely three, branch-rays. The spicules of this kind with all six rays simple, which appear as small oxyhexactines, are very rare; in the majority one or more (Plate **9**, figs. 14, 15) or, less frequently, all rays (Plate **9**, fig. 16) bear branches. The simple rays are straight. Those bearing branches diverge a little above the branching point slightly in a direction opposite to that in which the branch lies, but are straight apart from this divergence. The branches arise at a distance of 12–20 μ from the centrum of the spicule, steeply, sometimes nearly vertically, from the rays, but very soon curve sharply outward and then again become fairly straight, remaining so to the end. Like the main-rays themselves, these branches (branch-rays) are conic, sharp-pointed, and perfectly smooth. When a ray bears more branches than one, they usually arise at the same point and diverge in different directions. Exceptionally I have seen two branches arising at different points and extending in nearly the same direction.

Wilson (*loc. cit.*) does not mention such spicules as occurring in the specimens examined by him.

In the rare *transitional* (*adolescent*) *forms* described above, connecting the oxyhexasters, etc., with the fully developed discohexasters, etc., the rays and branches are quite smooth along their length but crowned at the end by small verticils of recurved spines. By an increase in the thickness of all parts, by a growth of the terminal spines, and by the addition of lateral spines along the length of the rays and branches, these adolescent forms become adult discohexasters, etc.

The adult *discohexasters*, *hemidiscohexasters*, and *discohexactines* (Plate 8, figs. 10, 11; Plate 9, figs. 1–7, 9–13, 17–26; Plate 10, figs. 27a, 28a, 29a) have, including the branches, six to seventeen rays and measure 139–264 μ in total diameter. In the large specimens D and E these spicules attain a larger size (diameter of largest 264 and 260 μ respectively) than in the smaller specimens B and C, where the largest measured were only 240 μ in diameter. The basal thickness of the rays is 6–15 μ. The total diameter, and to a certain extent also the basal thickness, of the rays are, as the subjoined table shows, in inverse proportion to the number of rays (branches).

DISCOHEXASTERS, HEMIDISCOHEXASTERS, AND DISCOHEXACTINES.[1]

Number of rays and branches	Diameter of the spicules		Basal thickness of the rays μ
	limits μ	average of the largest three μ	
6	170–264	254	7–15
7–8	170–250	245	7–15
9–12	140–230	238	7–15
13–17	139–195	161	6–8

In the large specimens D and E the discohexactines with six simple unbranched rays are the most frequent. In the small specimens B and C on the other hand the majority of these spicules are hemidiscohexasters and discohexasters with branches on one to all six rays.

[1] This table is based on the measurements of the discohexasters, etc., of all the specimens examined.

Except in the vicinity of the branching points, the main- and branch-rays are fairly straight. All the rays, both main and branch, are conic and gradually attenuated to the end, which is 2–4 μ thick. The simple stem-like basal part of the branch-bearing rays is smooth. Apart from this the rays and branches are entirely covered with stout, pointed, and strongly recurved spines 2–4 μ long. These spines are quite uniformly scattered along the length of the rays (branches) and congregated at their ends, where they form terminal verticils or bunches 7–10.5 μ in transverse diameter. Particularly when viewed with lower powers the terminal spine-verticils more or less resemble convex discs with deeply serrated margin. The lateral spines decrease in size toward the distal ends of the rays (branches). The most distally situated spines, which form the terminal verticil or bunch, are much larger than the adjacent lateral ones, about as large as the basal lateral ones. Exceptionally one single hypertrophic terminal hook-like spine replaces the verticil or bunch.

The distance of the branching point of the rays from the centrum of the spicule, that is the length of the simple stem of the branch-bearing rays, is 15–22 μ. These stems are very short accordingly, compared to the size of the whole spicule. Generally there is only one branch on a ray, but two or three are also frequently met with. More than three are rare. The largest number of branches on one ray observed was six. When there are more branch-rays than one, they arise either at the same or at different levels. When the number of branch-rays is great the latter is the rule. In most cases the main-ray is clearly distinguished from the branch-ray or branch-rays by its slighter divergence from the continuation of the axis of the stem, and by its greater length (Plate 9, fig. 21). Sometimes, however, there is no such distinction, the distal part of the main-ray being as long and diverging as much as the branch, and the stem appearing to divide into equal branches (Plate 9, fig. 18). The angle between the distal part of the main-ray and the branches is variable, most frequently about 45°.

Wilson (*loc. cit.*, p. 48) states that in the specimens examined by him the rays of the discohexactines were 80–110 μ long and 8 μ thick at the base, their terminal spine-verticils or branches being 10–12 μ in diameter and appearing as watch-glass shaped end-discs. To me these groups of spines, which are correctly represented in Wilson's figures (*loc. cit.*, Plate 5, figs. 4, 5, 9), do not appear as watch-glass shaped end-discs.

The *discocomes* (Plate 10, figs. 15–26, 27b, 28b, 29b) normally consist of six main-rays joined at right angles, each of which bears a terminal verticil or bunch of end-rays. One discocome I saw had seven main-rays. The discocomes measure 44–312 μ in total diameter. The main-rays and end-ray verticils or bunches of the same spicule are equal. Exceptionally (Plate 10, fig. 17) one or two end-rays arise from a main-ray below the terminal verticil or bunch. In one discocome one of the main-rays bore a stout branch, which was crowned, like a main-ray, by a bunch of end-rays. In respect to these irregularities the rays of the same spicule are unequal. The main-rays are straight, 20–65 μ long, cylindrical, and 1.5–7 μ thick. At their distal end they are abruptly thickened to an inverted cone or convex disc, 7–16 μ in diameter, from the distal face of which the end-rays arise. The main-rays are generally perfectly smooth, exceptionally they bear a few rather large spines. The axial thread of the main-ray ends abruptly in the terminal thickening and does not give off branches for the end-rays; the latter appear to be destitute of axial threads. The number of end-rays on each main-ray is from six to eighteen or more. When their number is great, it is exceedingly difficult to count them. When few in number they form a verticil, when more numerous, a bunch or brush, in which they are fairly equidistant. The terminal verticils or bunches formed by the end-rays appear as inverted cones with apical angles of 25–100°. The individual end-rays are straight or curved in an S-shaped manner with outwardly directed distal end. Measured along their chord they are 18–103 μ long. They are 2–3 μ thick at the base and taper gradually to 1–1.5 μ at the distal end. They are densely covered with lateral spines all along their length, and crowned by a verticil of terminal spines at the end (Plate 10, figs. 20, 21, 26). The largest spines are the terminal ones. The verticil formed by them somewhat resembles a convex end-disc with serrated margin and has in transverse diameter a maximum of 4.5 μ. The lateral spines usually decrease in size very considerably towards the proximal end of the end-ray, but in some of these spicules the proximal end-ray spines are quite large (Plate 10, figs. 15, 16). All the spines arise obliquely, their basal parts being inclined towards the centre of the spicule; their ends are bent down in the same direction. They, therefore, appear strongly recurved (Plate 10, figs. 15, 16). All the spines on the end-rays of the large discocomes and the distal spines on the end-rays of all but the very smallest discocomes are clearly visible. The spines on the proximal parts of the end-rays of the smaller discocomes and all the spines of the smallest are, however, too minute to be clearly discernible as such; the presence of these spines is indicated only by the rough appearance of the end-rays.

The individual discocomes differ very considerably in size. A cursory examination shows that the relative dimensions of the main- and end-rays, and the number, position, arrangement, and shape of the latter are not the same in the large and small discocomes. To obtain an insight into the correlation of the various peculiarities of the discocomes of different size, I measured thirty-three of these spicules all from the same large specimen (E). The smallest of which all the dimensions were taken was 70 μ in diameter, the largest 312. Discocomes less than 70 μ in diameter are rare, the smallest observed was 44 μ, and these small ones are probably only young forms. As I was unable to take with sufficient exactitude all the measurements required of these small discocomes I have not taken them into consideration in the correlations of the several characteristics. The difference of the diameters of the smallest (70 μ) and the largest (312 μ) completely measured discocome is 242 μ. This 242 μ represents the range of variation in size (diameter) of the thirty-three discocomes studied. The fourth part of it was taken, 242 : 4 = 60.5, and thus the variation-range itself divided into four equal parts, each extending over 60.5 μ of diameter-variation. To the first of these four parts belong all the discocomes 70–130.5 μ in diameter, to the second all 130.5–191 μ, to the third all 191–251.5 μ, and to the fourth all 251.5–312 μ. The discocomes belonging to the same quarter of the diameter-variation range were considered as forming a group and their measurements combined. The subjoined table (p. 63), gives the measurements of the four groups of differently sized discocomes.

The table indicates that the small discocomes (of group I) are more numerous than the larger, and that among the latter those of group III (191–251.5 μ in diameter) are scarcer than those of groups II and IV. It further shows that the relative length of the main-rays is in inverse proportion and the relative length of the end-rays is in true proportion (total diameter) of the spicule, that is, the larger the discocome the relatively longer the main-rays and the relatively shorter the end-rays.

The number of end-rays on each main-ray and the degree of their divergence (the width of the apical angle of the bunch or verticil formed by them) are in inverse proportion to the size of the spicule; largest in the smallest (group I) and smallest in the largest (group IV). Besides these differences of the relative dimensions of the parts of larger and smaller discocomes, also differences in the shape and arrangement of the end-rays are to be noticed. In the small discocomes (Plate **10**, figs. 17, 18, 24, 25) the end-rays are more or less curved in an S-shaped manner, in the large discocomes (Plate **10**, figs. 19–21) they are straight. In the small discocomes, where they are more numerous, the end-rays form brush-like bunches, whilst in the large discocomes, where they are fewer in number, they are arranged in a simple verticil. The terminal thickening of

DISCOCOMES.

Dimensional groups (diameter)			I (70–131.5)	II (131.5–191)	III (191–251.5)	IV (251.5–312)
Number of discocomes of each group measured			15	7	3	8
Diameter	limits μ		70–130	136–186	200–250	270–312
	average μ		97.1	162.3	225.4	296.5
Length of main-rays	limits μ		20–35	30–50	45–65	44–65
	average μ		27.1	40	54.4	54.9
	average percent of total diameter		27.9	24.6	24.1	18.4
End-rays	number on each main-ray	limits	9–18 and more	6–11 and more	8	6–9
		average μ	about 16	8.5	8	8
	length	limits μ	18–35	25–48	55–60	70–103
		average μ	20.7	41.2	58.3	93.8
		average percent of total diameter	22.1	25.4	25.9	31.6
Apical angle of terminal bunch or verticil of end-ray	limits		40–100	28–60	30–35	25–35
	average		65	38	33	29

the main-rays, from which the bunches or verticils of end-rays arise, is very different in discocomes of different size (Plate **10**, figs. 17–25); long and conical in the large ones (Plate **10**, figs. 19–21), and short and more disc-shaped in the small ones (Plate **10**, figs. 22–25).

In consequence of all these differences the large discocomes differ from the small ones very considerably in appearance; they nevertheless represent a fairly continuous series of forms.

Some of the small discocomes here considered, like those less than 70 μ in diameter, may be young forms of the large ones. Most of them, however, can not be considered as such, since their end-ray bunches could not be converted into end-ray verticils like those of the large discocomes by means of the apposition of silica-layers and since no silico-clastic process is known to occur in sponges, which would make possible a conversion (development) of the end-ray bunches of the small discocomes into the end-ray verticils of the large ones.

Wilson (*loc. cit.*, p. 48, 49) is inclined to consider the large and the small discocomes as distinct forms, although he has himself observed transitions between them. The discocomes observed by him had main-rays 16–50 μ long, and on each main-ray five to twenty or thirty end-rays 16–100 μ long.

Wilson (*loc. cit.*, p. 43) examined fourteen specimens from Albatross Stations 3382 and 3399. Both lie off Panama, 3382 6° 21′ N., 80° 41′ W., 3399 1° 7′ N., 81° 4′ W. The depth at these Stations, 3279 m. (1793 f.), 3182 m. (1740 f.), is considerably less than at Station 4651 (2222 f.) where my specimens were obtained.

There can be no doubt that the specimens described above belong to *Caulophacus schulzei* Wilson. Their similarity among themselves, and to those examined by Wilson, is indeed remarkably great. This great similarity makes it probable, first, that this species is very constant in character, and, secondly, that the conditions of life are very similar at the three Stations 3382, 3399, and 4651.

CAULOPHACELLA, gen. nov.

Caulophacidae with oxyhexasters, without any other kind of microsclere.

The collection contains one fragmentary specimen of this genus, which belongs to a new species.

Caulophacella tenuis, sp. nov.

Plate 12, figs. 1–19.

One fragmentary specimen of this sponge was trawled in the Eastern Tropical Pacific, southwest of the Garrett Ridge, at Station 4732, on 21 January, 1905; 16° 32.5′ S. 119° 59′ W.; depth 3679 m. (2012 f.); it grew on a bottom of Globigerina ooze; the bottom-temperature was 34.8°.

The specimen is a thin lamella. To this the specific name refers.

The only specimen in the collection is a fragment, measuring 15 by 8 mm., of a flat lamella, about 1 mm. thick.

The *colour* in spirit is nearly dark brown.

General structure of the skeleton. Both faces of the lamella are covered with pinules occupying the usual position. The pinules on one side are much larger than those on the other. The face covered with the larger pinules I consider the dermal, the opposite face the gastral. Pentactines, with paratangentially extending lateral rays, and an apical ray directed radially inwards, occur under both surfaces. The pentactines underneath the face with the larger pinules are much larger than those underneath the opposite face. The former are considered as hypodermal, the latter as hypogastral. Numerous slender and some large rhabds, a few large hexactines, and dense masses of oxyhexasters and hemioxyhexasters occur in the interior (Plate 12, fig. 13). The oxyhexasters are much more numerous than the hemioxyhexasters.

Small hexactines with rays strongly curved at the end; large sword-shaped hexactines with stout and spiny sword-handle ray; middle sized hexactines with cylindrical, terminally rounded, strongly curved rays; and a few other forms have also been observed in the spicule-preparations. I consider these spicules as foreign to the sponge.

The *rhabds* are 3–17 mm. long, 10–34 μ thick, rarely 50 μ, and quite sharply pointed.

The rare *large hexactines* have straight, conic rays, 0.5–1 mm. long and 20–45 μ thick at the base. The rays are smooth for the greater part of their length, their tips only being covered with small tubercles.

The *hypodermal and hypogastral pentactines* differ only in regard to their size. Their lateral rays are straight, conic, and rather sharply pointed. Those of the former are 500–1100 μ long and 14–32 μ thick at the base; the corresponding measurements of the latter are 110–330 μ and 7–14 μ.

The *dermal and gastral pinules* (Plate 12, figs. 1–8, 14, 15, 19) also differ only in size. In both the distal ray is straight, stout at the base, and only slightly thickened above. Sparse, small spines arise from its basal part. Towards the end the spines become more crowded and larger, the largest attaining a length of 7 μ in the dermal pinules and a length of 5 μ in the gastral. These spines are sharp-pointed, directed obliquely upward towards the tip of the ray, and also curved in this direction. Their basal part is inclined at an angle of about 60° to the ray; farther on they bend, usually somewhat abruptly, towards the ray; so that the angle between their end-part and the ray is 45° or less. Usually the spines of the same region are fairly uniform. Sometimes, however, adjacent spines differ considerably in position. Occasionally I have observed pinules in which the distal spines all tended to one side as if bent by a lateral current. As a rule (Plate **12**, figs. 1–4, 7, 8) their curvature is simple, the spines extending in planes which pass through the axis of the ray. In a few cases, however, the spines (Plate **12**, figs. 5, 6) are curved doubly, and spirally twisted round the ray.

The lateral rays are conic, straight or slightly curved, and rather uniformly and densely covered with small spines. The proximal ray is rudimentary, very considerably shortened, cylindrical, terminally rounded, and also covered with small spines, some of which arise from its apex. The dimensions of the dermal and gastral pinules are tabulated below.

PINULES.

		Dermal pinules	Gastral pinules
Distal ray	length μ	270–373	115–180
	thickness at base μ	6–13	5–7
	maximum transverse diameter (with the spines) above μ	14–22	8–15
Proximal ray	length μ	5–16	5–10
	thickness μ	6–13	5–7
Lateral rays	length μ	120–232	85–130
	thickness at base μ	5–12	5–6

The *oxyhexasters and hemioxyhexasters* (Plate **12**, figs. 9–13, 16–18) measure 100–125 μ in total diameter, rarely 137 μ. The main-rays are in the same spicule equal, and regularly arranged, each one enclosing right angles with its four neighbours. They are straight, cylindrical, 8–11 μ long, and 2.7–5 μ thick, rarely as much as 6 μ. Each main-ray bears from one to three end-rays. The number of end-rays is by no means always the same on the six main-rays of the same spicule. Most frequently oxyhexasters are observed with three end-rays on some main-rays and two end-rays on the others, and with two or three end-rays on all the main-rays. More rarely one or two main-rays bear only one end-ray, which is either clearly distinguished as such or gradually passes into the main-ray. These spicules, which appear as hemioxyhexasters, are, apart from their hemioxyhexastrose character, identical with the oxyhexasters in structure. The basal part of the end-rays is usually directed obliquely outward and encloses an angle of 40°–45° with the continuation of the main-ray. A short distance from their origin the end-rays are curved rather abruptly toward the continuation of the main-ray, whereupon they straighten out, their middle- and end-parts being straight, or only slightly curved. The end-rays are 42–56 μ long, and 1.5–3 μ thick at the base. They are conic and taper very uniformly to an extremely fine point. The main-rays are smooth, the end-rays covered with rather numerous slender, oblique, backwardly directed spines, which attain a length of 0.3–0.5 μ.

The dermal and the gastral pinules and the spiculation generally indicate that the thin lamellar fragment above described formed part of a caulophacid sponge. It differs, however, from all the known forms of the Caulophacidae which comprise Caulophacus F. E. Schulze, Sympagella O. Schmitt, Aulascus F. E. Schulze (identical, according to Ijima, with Sympagella), and Calycosilva Lendenfeld (comprising part of F. E. Schulze's Calycosoma). The absence of discohexasters, hemidiscohexasters, and discohexactines makes it impossible to place it in the genus Caulophacus, the absence of plumicomes excludes it from Sympagella, Aulascus, and Calycosilva. The new genus is named Caulophacella on account of its similarity to Caulophacus.

CALYCOSILVA, gen. nov.

Stalked, calyculate or mushroom-shaped Caulophacidae. The choanosomal megascleres are rhabds and hexactines. Hypodermal pentactines are always present. Hypogastral pentactines are present or absent. The surface is covered with hexactine pinules which are similar on the dermal and gastral side of the body. The proximal ray of some of the pinules may be reduced. The microscleres are onychhexasters and plumicomes to which oxyhexasters and helonychhexasters may be added. Without discohexasters and discohexactine microscleres.

The collection contains one complete specimen and thirty-one fragments referred to this genus, all of which belong to a new species.

Calycosilva cantharellus, sp. nov.

helix, var. nov.

Plate 1, figs. 1–8, 20–24; Plate 2, figs. 3, 7–13, 15; Plate 3, figs. 1–5, 8–30; Plate 4, figs. 23, 24; Plate 5, figs. 1, 2, 4, 5, 7–9, 11–15, 18–20; Plate 6, figs. 5–21, 24–34; Plate 7, figs. 1–10, 12–14, 16, 17.

simplex, var. nov.

Plate 1, figs. 9–19, 25–29; Plate 2, figs. 1, 2, 4–6, 14, 16; Plate 3, figs. 6, 7; Plate 4, figs. 21, 22; Plate 5, figs. 3, 6, 10, 16, 17; Plate 6, figs. 1–4, 22, 23; Plate 7, figs. 11, 15, 18.

megonychia, var. nov.

Plate 4, figs. 1–20; Plate 5, fig. 21; Plate 7, fig. 19.

All the specimens of this species were trawled at Station 4651 off northern Peru, on 11 November, 1904; 5°41.7′ S., 82°59.7′ W.; depth 4063 m. (2222 f.); they grew on sticky, fine, gray mud; the bottom-temperature was 35.4°.

The complete specimen shows that the sponge is, in outer appearance, similar to the mushrooms of the genus Cantharellus, and to this the specific name refers. It possesses spirally twisted onychhexasters, which I name helonychhexasters. Such spicules have not been found in any of the other (more or less fragmentary) specimens. In some of the latter the average and the maximum size of the onychhexasters is considerably greater than in the others. On account of this and other differences between them I distinguish three varieties within this species:— var. *helix*, with helonychhexasters (the complete specimen); var. *megonychia*, without helonychhexasters, with larger onychhexasters (six fragmentary specimens); and var. *simplex*, without helonychhexasters, with smaller onychhexasters (twenty-five more or less fragmentary specimens). Twenty-four of the specimens of var. *simplex* are identical and obviously parts of the body proper of the sponge. These are designated *C. c.* var. *simplex* (A). One corresponds to the basal part and the stalk of the complete specimen. This is designated *C. c.* var. *simplex* (B).

Shape and size. The complete specimen of *C. c.* var. *helix* (Plate 6, fig. 18) appears as a horizontally expanded plate, from near the centre of the lower side of which a slender stalk arises. The stalk is 52 mm. long, nearly circular in transverse section, and at the lower end, where it was attached to the sea-bottom, 4 mm. thick. It gradually thickens above and measures at its upper end, where it gradually passes into the body proper of the sponge, 7 mm. in transverse diameter. Its lower portion is markedly bent and has the appearance of having first grown somewhat obliquely and later vertically. The plate, which is to be considered as the body proper of the sponge, is irregularly oval in outline and measures 68 by 92 mm. Its central part, to which the stalk is attached, is 6 mm. thick. Towards the margin it thins out. The plate is somewhat bent in an undulating manner and at one place strongly curved inwards. In the figure

(Plate 6, fig. 18) this involuted portion of the body, which extends quite to the centre, lies in front.

The lower side of the plate-like body is the dermal, the upper, the gastral. They are identical in structure and both formed by a transparent membrane destitute of larger apertures. The entrances to the large afferent and efferent choanosomal canals are seen through this membrane. In some places where the superficial membrane has been lost these canal-entrances are bare.

The six specimens of *C. c.* var. *megonychia* are fragmentary plate-like parts of the body proper of the sponge. Parts of some of these attain a thickness of 8 mm., and these thin out to a rather fine margin at one side. The largest of these fragments is 49 mm. long and 35 mm. broad.

The twenty-four fragmentary specimens of *C. c.* var. *simplex* (A) are parts of plates with a maximum length and breadth of 50 mm., and are at their thickest point 4–6 mm. thick. One of these fragments formed a central part of a sponge; to this the upper part of a stalk is attached. The surface has the same character as in *C. c.* var. *helix,* the only difference being that much more of the superficial membrane has been lost and that some slender spicules protrude from it to distances of 10 mm. or more. I am inclined to consider these hair-like spicules as foreign.

The single specimen of *C. c.* var. *simplex* (B) (Plate 5, fig. 10) has the shape of a pipe. It is traversed by the fragment of a large foreign spicule, probably a root-tuft spicule of a hyalonematid. This foreign spicule, which forms the base of attachment is — for a length of 39 mm. — coated by a thin layer of the sponge. Thus a cylinder 39 mm. long and 2–3 mm. thick, appearing as the stem of the pipe, is formed. This stem is to be considered as the stalk of the sponge. From one end of this stalk, which probably lay horizontally on the sea-bottom, a structure 9 mm. thick and 15 mm. long, resembling the bowl of the pipe, arises at an angle of about 106°. This part of the specimen is to be considered as the upper end of the stalk and part of the body proper of the sponge.

Colour. All the specimens are grayish brown. *C. c.* var. *helix* has a more grayish colour, *C. c.* var. *megonychia* and *simplex* are more brownish. The specimens of *C. c.* var. *megonychia* are rather darker than the others.

General structure. A fine superficial membrane uniformly covers the dermal surface of the stalk and the dermal and gastral surfaces of the body proper. This membrane is supported by the paratangential rays of the pinules and perforated by pores which lead into a superficial cavity, 60–90 μ high (radial dimensions), and traversed by numerous fine trabeculae. This cavity is limited distally by the superficial membrane containing the paratangential pinule-rays, proximally by another perforated membrane or, to speak more correctly, a network of paratangential trabeculae, containing the paratangential rays of the (hypodermal and hypogastral) pentactines. The subdermal (Plate 5, figs. 1, 4f) and subgastral (Plate 5, figs. 1, 4b) cavities extend below this membrane or network. These are identical in shape, 300–600 μ high (radial dimensions), and traversed by radial columns connecting their roof with their floor. Each of these columns consists of a proximal ray of a (hypodermal or hypogastral) pentactine, enveloped in a mantle of soft tissue. In the formation of many of them also the distal end of a transverse choanosomal rhabd takes part. The columns are on an average 250 μ apart, and usually 30–40 μ thick. Numerous fine, thread-like trabeculae arise from the columns and join to form close reticulations which surround them like trellis-work. Above and below these reticulations are very extensive, and join to form continuous networks extending along the roof and floor of the cavity. In the middle they appear to be less extensive. In the sections large empty spaces are observed between the trellis of trabeculae surrounding the columns in this region. I think it quite likely that in life these cavities are also traversed by trabeculae, and am inclined to ascribe their emptiness in the sections (Plate 5, figs. 1, 4) to the trabeculae having here been torn and lost through shrinkage when the sponge was captured and preserved.

The floor of the subdermal and subgastral cavities is traversed by bundles of rhabds (Plate 5, figs. 1, 4c, f) and perforated by numerous apertures. These are more or less circular, both on the dermal and the gastral side, and in the best preserved specimens (parts) are sometimes 1.5 mm. wide. In specimens (parts) not so well-preserved and more strongly shrunken some of them attain a diameter of 3 mm. (Plate 4, fig. 20). On the gastral side their distance from each other nearly equals their diameter, on the dermal side they are farther apart. The apertures on the lower, dermal side lead into the afferent, those on the upper, gastral side into the efferent canals. The afferent and efferent canals are, in well-preserved parts of the plate-like body proper of the sponge, 0.75–1.5 mm. wide, and extend in a direction more or less vertical to the surface (Plate 5, figs. 1, 4, 16). Their length is on the whole proportional to their width. The widest reach to within a short distance of the floor of the (subdermal or subgastral) cavities on the opposite side. The stalk is hollow, with an eccentric, not axial cavity, and walls, which in the middle of the stalk of the specimen of *C. c.* var. *helix* are 2.5 mm. thick on one side and 0.7 mm. on the other. Vertical, apparently efferent canals of considerable width (Plate 5, fig. 16) leading up to the central part of the gastral face of the sponge are observed where the stalk is attached to the body proper.

Some canals are traversed by thread-like or membraneous trabeculae, others appear to be destitute of such. It is difficult to say whether the latter are empty in the living sponge, or whether they have lost their trabeculae after capture. I think, however, that the latter assumption is more likely to be correct than the former.

The trabeculae traversing the cavity of the stalk are distinctly membraneous, and stouter and more distant than the ones spread out in the canals of the body proper of the sponge.

The flagellate chambers (Plate 2, fig. 7a) form a continuous layer intervening between the afferent and efferent canals. They are more or less oval, wide-mouthed sacs and measure 70–100 μ in transverse diameter. Their length varies considerably, from 120 to 220 μ.

More or less spherical bodies 2–5 μ in diameter are met in various parts of the sponge. These lie either singly or in groups, and stain strongly with aniline-blue and magenta. The largest of the groups formed by them attain a maximum diameter of 36 μ, and are composed of forty or more such bodies. Some of them, particularly the larger single ones, are enclosed in spherical envelopes, about 9 μ in diameter, which are often very distinct and appear as cell-walls. The space between the highly stained body and the envelope is occupied by a colourless (unstained) and transparent substance. The highly stained body is not always stained uniformly throughout. One can often distinguish within it a not so strongly stained ground-substance, and a very strongly stained, irregularly branched, apparently chromidial mass. On a few of the envelopes enclosing these bodies was observed a circle, 2 μ in diameter; this appeared as the margin of a round aperture, perhaps covered by an operculum. In one of these the stained body did not lie altogether within the envelope but had partly emerged from it through this aperture and filled it up like a plug.

The spicules taking part in the formation of the *skeleton* are: — large, stout-rayed hexactines; derivates of these hexactines with less than six rays, mostly diactines (in *C. c.* var. *simplex* only); ordinary rhabds; slender, rectangularly bent diactines (in *C. c.* var. *helix* only); large, slender-rayed triactines (in *C. c.* var. *megonychia* only); pentactines; hexactine pinules with a fully developed or a reduced proximal ray; a few microhexactines (in *C. c.* vars. *simplex* and *helix* only); a series of forms of regular onychhexasters; a few irregular onychhexasters; onychhexaster-derivate oxyhexasters (in *C. c.* vars. *helix* and *megonychia* only);

helonychhexasters (in *C. c.* var. *helix* only); and plumicomes (exceedingly scarce in *C. c.* var. *megonychia*).

In the body proper of the sponge all the spicules are isolated and free. In the stalk the ordinary choanosomal rhabds are joined to form a dictyonal network to which also a few hexactines may be attached.

In *C. c.* var. *simplex* (B) the skeleton-net of the stalk (Plate 5, figs. 3b, 10) closely surrounds the hyalonematid root-tuft spicule (Plate 5, figs. 3, 10a) which forms the base of attachment. The thinner distal end of this envelope, which corresponds to the lower end of the stalk, consists of a network with beams 12–35 μ thick, and irregularly triangular or polygonal meshes, on an average about 100 μ wide. In this network main longitudinal and secondary transverse beams cannot be distinguished. Farther on, towards the upper end of the stalk, the network becomes more regular and more and more distinctly composed of longitudinal main beams (15–65 μ thick, usually 20–45 μ), joined by short, transverse connections to a ladder-like structure. In consequence of the main beams not being quite parallel, and the transverse beams very irregularly distributed, the meshes of this part of the network are very unequal in size, 5–50 μ and more broad, 30–200 μ and more long. However different their size may be, in shape and position these meshes are very much alike, always elongated, oval, or rectangular with strongly rounded corners, and arranged with their long axis extending longitudinally. In some parts of this network the beams are smooth, in others covered by small, low, sharp spines. At the upper end of the stalk the transverse connections become less numerous and the network dissolves itself into a sheaf of longitudinal rhabds.

Ends of the rhabds taking part in the formation of the net in many places freely protrude from it. These free rhabd-termini, which are rather scarce below, but become quite frequent above, are blunt-pointed or rounded, and just below the end, for a distance of 50–70 μ, densely covered with fairly large spines. In the blunt-pointed ones the end itself is free from spines. In the terminally rounded ones the spines cover the end also. The spined part below the end, particularly in the blunt-pointed forms, is considerably thickened, club-shaped, and measures 15–28 μ in transverse diameter.

The skeleton-net in the stalk of *C. c.* var. *helix* (Plate 5, figs. 5, 7) is similar, but smooth and still more ladder-like. Its beams are 10–53 μ, usually 20–40 μ, the free ends of the rhabds taking part in its formation, 15–30 μ thick. At the upper end of the stalk the transverse beams become scarcer and the characteristically tubular network dissolves itself into a hollow sheaf of isolated longitudinal rhabds. On reaching the body proper of the sponge this hollow sheaf of rhabds opens out in a calyculate manner and divides into numerous rhabd-bundles (Plate 5, figs. 1e, 4e, 16), which extend in the floor of the subdermal cavities paratangentially and more or less radially towards the margin of the plate-like sponge-body. Occasionally anastomosing they here form a kind of loose paratangential network with radially elongated meshes.

On the gastral side, in the floor of the subgastral cavity, a similar network of preponderantly radially extending rhabd-bundles (Plate 5, figs. 1c, 4c) is observed.

Besides these paratangential rhabd-bundles in the floors of the subdermal and subgastral cavities numerous isolated rhabds and loose bundles of them, situated obliquely or transversely (Plate 5, figs. 1d, 4d), are found in the choanosome. The ends of many of the transverse rhabds adhere to proximal rays of hypodermal and hypogastral pentactines. In the centre of the sponge-plate, near its junction to the stalk, some oblique rhabds, similar to these but very much larger, have been observed (Plate 5, fig. 16).

At the point of junction of the stalk to the body proper of the sponge some long and slender diactines with actines enclosing an angle of about 90° (orthomonaenes) have been observed in *C. c.* var. *helix.*

The hexactines lie scattered rather irregularly in the choanosome. The thickness of their rays and the size of their spines are subject to considerable variations. The shortest rayed and most strongly spined are found in the centre of the body at its junction with the stalk. Towards the margin of the sponge-plate the rays of the hexactines become more slender and less spiny.

Tetractine and triactine hexactine-derivates have been found in small numbers, chiefly in *C. c.* var. *megonychia.* The diactine hexactine-derivates are not numerous, and have been observed only in *C. c.* var. *simplex* in the region of the junction of the stalk to the body proper of the sponge.

The gastral and dermal surfaces of the body proper and the surface of the stalk are uniformly covered by a dense pinule-fur (Plate 2, figs. 1a, 8a, 13a; Plate 4, figs. 21–24; Plate 5, figs. 1a, g, 4a, g, 11a, g, 16a, g). The two kinds of pinules, with long, well-developed, and pointed proximal ray, and with short, rudimentary, rounded proximal ray, which are not, or hardly at all, connected by intermediate forms, are quite indiscriminately scattered, and although the former are relatively more numerous on the body and the latter predominate on the stalk, both kinds appear everywhere to be intermingled. Apart from the dermal pinules of the body being on the whole slightly larger and having slightly larger distal rays than the gastrals, there seems to be no difference between them (Plate 4, figs. 21–24; Plate 5, figs. 1, 4). The pinules of the stalk are considerably smaller than those of the body proper.

The crosses formed by the four lateral rays of the pinules lie paratangentially in the superficial membrane (Plate 2, figs. 8a, 13a). Their centres are about as far apart as their rays are long. In some places they are arranged regularly, two rays of any two adjacent ones lying parallel and close together (part of the lower half of Plate 2, fig. 13). In other places their arrangement is not so regular. The (smaller) pinules of the stalk are much closer together than the (larger) pinules of the body.

The apical distal ray is much longer in the larger pinules of the body than in the smaller pinules of the stalk and, as stated above, on the whole in the dermal body-pinules slightly longer than in the gastrals. But also apart from this, the distal pinule-ray is very variable in length, and we find everywhere pinules with long and with short apical distal ray intermixed indiscriminately. This renders the fur formed by these pinule-rays very shaggy (Plate 4, figs. 21–24).

In the outermost region, which is occupied by the superficial cavities and, as above stated, is 60–90 μ thick, no skeletal elements other than proximal pinule-rays are met with.

A membrane or network extends parallel to the surface below this region and separates it from the subdermal and subgastral cavities, forming the roof of the latter. The centres and the paratangentially extending lateral rays of the (hypodermal and hypogastral) pentactines are situated in this membrane. The apical rays of these spicules are situated radially and directed inward. The crosses formed by the lateral rays of the pentactines are for the most part regularly arranged. The distances between the centres of adjacent pentactines are in the same region fairly equidistant and a little shorter than the length of their lateral rays. Two lateral rays of adjacent pentactines are parallel and lie close together (Plate 2, fig. 13b). The hypodermal and hypogastral pentactines of the body are quite similar and nearly equal in size; the hypodermal pentactines of the stalk are considerably smaller. The body-pentactines are accordingly also farther apart than the stalk-pentactines. The distances between the centres of these spicules being shorter than the length of their lateral rays, the tips of the lateral rays of each pentactine extend beyond the centres of the four adjacent ones. This renders the quadratic reticulations formed by the lateral pentactine rays quite firm. In some places small (probably young) pentactines have been observed. The lateral rays of these spicules extend paratangentially like those of the larger ones, but are, apart from this, more or less irregularly disposed and lie anyhow in the meshes of the quadratic network formed by the lateral rays of the large pentactines.

In most of the pentactines the apical ray is well-developed, longer than the lateral rays; in some it is reduced and considerably shorter than the laterals. The pentactines with short apical ray appear to be scattered indiscriminately among the pentactines with long apical ray.

Most of the apical (proximal) rays of the pentactines penetrate and extend beyond the paratangential membranes or networks forming the floors of the subdermal and subgastral cavities. The end-part of many transverse rhabds are parallel to and in close contact with proximal pentactine rays (Plate 2, fig. 12b).

The microhexactines are very rare and have been found only in the regions of the subdermal and subgastral cavities.

The regular onychhexasters are abundant in the choanosome and in the floors of the subdermal and subgastral cavities (Plate 2, fig. 3; Plate 5, fig. 1). Some also occur in the proximal parts of the columns and threads which traverse these cavities. They are not confined to the body proper of the sponge and also occur in the stalk. These onychhexasters form a series, one end of which is represented by onychhexasters with short and stout end-rays, the other by onychhexasters with long and slender end-rays. The former are found in the proximal parts of the subdermal and subgastral regions of *C. c.* vars. *simplex* and *helix*, but appear to be absent in *C. c.* var. *megonychia*. The latter are, in all varieties, plentiful in the interior. Intermediate forms are met with wherever onychhexasters occur.

The oxyhexasters occur in small numbers in the choanosome of *C. c.* var. *helix* and somewhat more frequently in *C. c.* var. *megonychia*.

The helonychhexasters, which occur only in *C. c.* var. *helix*, are met with in fairly large numbers in the floors of the subdermal and subgastral cavities and are also found in the proximal parts of the columns and threads traversing these cavities. These spicules are not uniformly distributed throughout this region, but in some parts of it are much more numerous than in others.

The plumicomes are confined to the columns and threads which traverse the subdermal and subgastral cavities and are more numerous in their distal than in their proximal parts. Their paratangential distribution is fairly uniform. They are quite abundant in *C. c.* vars. *simplex* and *helix*, but very rare in *C. c.* var. *megonychia*.

The ordinary *rhabds* (Plate 1, figs. 1–4; Plate 2, figs. 1b, 12b; Plate 5, figs. 1, 2, 4, 8, 9, 11–16) are more or less, sometimes very considerably curved, usually in a somewhat wavy manner. They attain a length of 2.2–9.1 mm. and a thickness of 5–80 μ. The ordinary stout rhabds, which are found in small numbers in the region of the junction of the stalk to the body proper, are in *C. c.* var. *helix* 45–55 μ thick, in *C. c.* var. *simplex* 55–80 μ. The ordinary slender rhabds, which form the paratangential bundles in the floors of the subdermal and subgastral cavities and which traverse the choanosome obliquely and transversely in large numbers, are 2.2–6.2 mm. long and 5–23 μ thick near the middle. They are in *C. c.* vars. *megonychia* and *simplex* on the whole somewhat thicker than in *C. c.* var. *helix*. Forms intermediate between the stout rhabds mentioned above and these slender ones occur, but they are rare. The longest rhabd observed, which measured 9.1 mm. in length, belongs to these intermediate forms.

In these rhabds a longitudinal main axial thread is observed, which terminates just below the two ends in the adult spicules, but opens out freely, with a funnel-shaped widening, in some at least of the young. Besides this there are two short rudimentary axial threads, forming a cross. The two rudimentary axial threads are usually 1.5–4 μ long. Very distinct rounded protuberances arise over most of the slender rhabds (Plate 1, figs. 3, 4; Plate 5, fig. 9). These protuberances are generally very low, lower than broad, and in that case the spicule appears as a centrotyle. Exceptionally they attain a greater length, and in that case the spicule appears as a tri- to hexactine, with two long rays, and from one to four perfectly smooth, terminally rounded, cylindrical, rudimentary rays. The longest rudimentary ray of this kind observed measured 38 μ in length. In some of the slender rhabds the central tyle is so small as to be hardly or not at all discernible (Plate 5, fig. 8). Hardly or not at all centrotyle rhabds are much more frequent among the thicker than among the slender rhabds and most of the thickest are not centrotyle at all. Twenty slender rhabds of *C. c.* var. *helix* which I measured were 7–20 μ thick in the middle, close to the central tyle, which measures 10–23 μ in diameter. In these spicules the central tyle was 1–7 μ thicker than the adjacent parts of the spicule. This difference is correlated to the thickness of the spicule only in so far as it is on the whole somewhat smaller in the thicker than in the thinner rhabds.

Most of the ordinary rhabds are more or less anisoactine amphistrongyles or very blunt amphioxes (Plate 5, figs. 2, 12, 13). Their ends are usually about a third to a half as thick as their central part. Sometimes a slight spindle-shaped thickening is observed just below the end. Occasionally (Plate 5, figs. 14, 15) one end is considerably thickened to a more or less spherical tyle, 24–50 μ in transverse diameter. Only a few rhabds are smooth throughout. In most a spined zone, 10–90 μ in extent, is observed at, or just below, the ends. In the terminally thickened tyle-ends, this spined zone is short and situated terminally, the spines being sometimes restricted to a small patch on the apex of the terminal tyle. Also in the cylindrical strongyle rhabd-termini the spines often extend quite to the end. In the tapering rhabd-termini, which are usually slightly thickened in a spindle-shaped manner just below the end, the extreme tip is usually quite smooth. In such rhabd-termini the smooth terminal zone is sometimes 27 μ long, the spined zone appearing as a belt below the end. The spines are conic, simple, 1.5–4.5 μ long, and crowded quite closely in the spined zones.

Abnormal rhabds are rare. In one there were two distinct centres, 5 μ apart, each with a cross of rudimentary transverse axial threads and a tyle. In another, one end was abruptly bent. Several show short rudimentary branch-rays, each with an axial thread, at one end.

Some rhabds are corroded and have partly lost one or more of the superficial silica-layers composing them. In one, which had lost a part of its outermost layer, a perfectly regular spiral split, forming six close turns, traversed the part of its still remaining portion bordering on the line along which the rest had broken away.

The *rectangularly bent diactines* (Plate 5, fig. 20) have been found only in *C. c.* var. *helix*, and here also they are very rare. The two actines are straight or slightly bent, perfectly smooth, 1.3–2.3 mm. and more long and 32–35 μ thick at the base. The angle enclosed by them is 89–99°.

The *large slender-rayed triactines* (Plate 5, fig. 21) have been found only in *C. c.* var. *megonychia*, and here also they are very rare. Their rays are smooth and at the base about 24 μ thick. Two lie in a straight line, from which the third arises vertically.

The *hexactines* (Plate 1, figs. 14–24; Plate 2, figs. 4, 6, 9, 11, 14–16) of the two varieties are similar in shape and size. They measure 0.9–3.4 mm. in total diameter. Their rays are 0.16–2.2 mm. long, straight or slightly curved, very rarely angularly bent, and, on the whole, conic. At their base the rays are 18–67 μ thick and, for a distance of 40–160 μ, smooth. Farther on they are covered with spines for a distance of 140–450 μ. In this spined region the rays are thicker than at their base, and attain a thickness of 22–75 μ. In the rays reduced in length the spiny region extends quite to the end. In the normal long rays a distal part of considerable length, which is either smooth throughout or provided only with a few small spines close to the end, follows the spiny region. This distal part of the ray is conic and tapers gradually to a rounded end, 5–17 μ thick. This has been observed only rarely in the hexactines of *C. c.* var. *megonychia*. One of the rays is thickened at the end, the terminal tyle attaining a transverse diameter of 35 μ.

In some hexactines the rays are nearly equal in length. In most an often very considerable difference in length of the individual rays is to be noticed. This irregularity is usually due to one ray (Plate 1, figs. 16, 17, 22) or two rays (Plate 1, figs. 14, 15) being more or less reduced in length. In the slender-rayed hexactines, which are probably young forms, the rays thus shortened are similar to the long ones. In the stout-rayed hexactines, which are certainly full-grown forms, this difference in ray-length is associated with and obviously correlated to a difference in the arrangement and shape of the spines, which renders the appearance of the shortened rays often very different from that of the long ones.

The spines of the spiny regions of the long, not reduced, hexactine rays (Plate 1, figs. 14–18; Plate 2, figs. 4, 6, 11, 16) are conic, not very sharp-pointed, and 5–35 μ long. They arise quite or nearly vertically and are not very close together, on an average about 50 μ apart. In some cases they seemed to be arranged spirally, but I could not verify this and was indeed unable to prove the existence of any kind of regularity in their arrangement. The spines of the short, reduced, hexactine rays (Plate 1, figs. 14, 15, 16; Plate 2, figs. 2, 14) are much closer together, often in contact with each other at the base, and occasionally branched. The branched spines (Plate 2, figs. 2, 14) consist of cylindroconic stems, the ends of which are split up into from two to four stout, conic, obliquely diverging, secondary spines. These spines somewhat resemble the protruding rays of the sterrasters of the Geodidae.

The silicoblasts building the rays of the hexactines possess, when they start work, a certain amount of potential energy, E. This is expended in building the ray and in forming the spines. The production of the former requires the work W_1, the production of the spines the work W_2. When their task is done the whole of E will have been converted into work, W, and this W will be equal to $W_1 + W_2$. Under normal conditions there is a certain proportion between W_1 and W_2. When, however, a spicule or some other obstacle prevents the silicoblasts from producing a ray of the normal size, less than the usual proportion of W is expended on W_1 so that, W being $= W_1 + W_2$, more remains for W_2. This leads to the hyperdevelopment of the spines actually observed on the shortened rays.

The ray being much shorter and the spines more numerous and on the whole larger, there is no room on the ray for the development of a spineless distal part, and there is not even on the whole ray space sufficient for the spines to be placed at so great a distance from each other as in the spined regions of the normally developed long ones. It seems very probable that this crowding may lead to a partial concrescence of two or more adjacent spines and thus to the formation of the apparently branched structures above referred to, which I am inclined to consider as more or less coalesced groups of as many spines as they bear terminal spinelets.

Of *hexactine-derivates with less than six rays* pentactine, tetractine, and triactine forms have been observed in all varieties, diactine ones, however, only in *C. c.* var. *simplex*. Several pentactine to triactine forms have been observed, in *C. c.* var. *megonychia*. In the two other varieties they are exceedingly rare. Apart from the smaller number of their rays, they do not differ from the hexactines above described. The diactine forms are much more frequent than those in *C. c.* var. *simplex*.

The *diactine hexactine-derivates* (Plate 1, figs. 25–29; Plate 2, fig. 5), which I have found only in *C. c.* var. *simplex*, appear as straight, or slightly curved, or angularly bent, blunt, usually isoactine amphioxes. They are 2.6–3.3 mm. long and 40–90 μ thick in the middle, where a slight thickening is sometimes discernible. Some taper from here uniformly towards both ends, in others each actine is thickened some distance from the centre. The transverse diameter of these thickened parts is in such spicules 10–15 μ greater than that of the centre. These hexactine-derivate amphioxes bear spines, the size, number, and arrangement of which are subject to considerable variation. A part of the spicule, situated at or near the middle of its length, is always free from spines (Plate 1, figs. 25–29). Farther on the two actines bear spines, which are either sparsely and irregularly scattered (Plate 1, figs. 25–27) or restricted to distinct belts, one on each actine, within which the spines stand rather close together (Plate 1, figs. 28, 29; Plate 2, fig. 5). In shape and size the spines of these amphioxes resemble the spines of the hexactines above described. A few of the spines are branched (bifurcate).

The *pentactines* have very much the same shape and size in the three varieties, and there seems to be hardly any difference between the hypodermal and the hypogastral pentactines of the body. The pentactines of the stalk are smaller and have a relatively shorter apical (proximal) ray.

The four lateral rays of the hypodermal (Plate 6, figs. 1–8) and hypogastral (Plate 1, figs. 5–13) *pentactines of the body proper* are 250–770 μ long, usually

300–700 μ, 16–47 μ thick, usually 19–32 μ at the base, and on the whole conic. They taper gradually to the rounded end, which is 1–11 μ thick, usually 2–4 μ. In two belt-like regions, one a short distance from the base and the other a short distance from the end, each lateral ray usually bears small, low spines, the spines of the proximal belt being larger and more numerous than those of the distal belt. The base, the middle, and the end of the lateral ray are usually smooth.

The angles between the lateral rays are always nearly 90°. In this respect the crosses formed by them are regular. The length of the lateral rays of the same spicule is, however, by no means the same. In this respect the crosses are irregular. Among all the many pentactines I measured I found not one with equally long lateral rays. The difference in the length of the longest and shortest lateral ray of the same spicule amounts to 20–320 μ.

The apical (proximal) ray is similar to the lateral rays in shape, but very variable in length, 0.15–1.37 mm. long, and at its base usually somewhat thicker than the lateral rays. In most of the pentactines the proximal ray is well-developed and longer, in some reduced, as long as or shorter than the lateral rays. Some of these reduced proximal rays are truncate at the end as much as 15 μ thick. A correlation between this occasionally occurring reduction of the proximal ray and the development of the lateral rays does not seem to exist. The influences (obstacles) which prevent the silicoblasts building the former from properly executing their task of producing a proximal ray of normal length, do not appear to affect in any way those building the latter.

A crowding of the spines is observed in the reduced apicals of the pentactines similar to that in the reduced hexactine rays, described above; it is not, however, so marked. The cause of this crowding is doubtless in both the same.

The lateral rays of the hypodermal *pentactines of the stalk* (Plate 6, figs. 9–12, 13a) are 230–520 μ long and at the base 17–42 μ thick, usually 18–32 μ. They are conic, have blunt ends, and are either quite smooth or provided only with very small spines. The crosses formed by them are, like those of the pentactines of the body, regular in respect to the angles between the rays, which are always about 90°, but irregular in respect to their length, which always differs more or less. The difference between the length of the longest and shortest lateral ray of the same spicule is in these pentactines 10–80 μ. The apical (proximal) ray is similar to the laterals in shape and usually about as long or only a little longer.

As mentioned above there are two kinds of *pinules;* pinules with properly developed proximal and apical rays, and pinules with such rays rudimentary and not at all, or but slightly, connected by intermediate forms. Both kinds occur both on the body and on the stalk. The dermal and gastral pinules of the body are very similar, and both differ from the pinules of the stalk. The pinules with rudimentary proximal ray do not differ from those in which this ray is properly developed in other respects. I shall, therefore, describe the pinules in two groups: — the dermal and gastral body-pinules with long and short proximal ray, and the dermal stalk-pinules with long and short proximal ray.

The four lateral rays of the (dermal and gastral) *pinules of the body* (Plate **2**, fig. 13; Plate **4**, figs. 21–24; Plate **6**, figs. 14–17, 19–25; Plate **7**, figs. 6–19) have in all three varieties the same shape and size. They are 50–144 μ long, enclose right angles, and form crosses 120–280 μ in diameter (Plate **2**, fig. 13a; Plate **6**, fig. 23; Plate **7**, figs. 16–18). The lateral rays of the same pinule are not equally long, but their differences in length are usually not great, the longest lateral ray being only 2–20 μ, rarely as much as 45 μ, longer than the shortest. The lateral rays are straight, 4–10 μ thick at the base, nearly always conic, and pointed at the end. Pinules with one or more lateral rays reduced in length and terminally rounded (Plate **7**, fig. 8), or very thick at the base and abruptly attenuated to a thin conic end-part, are exceedingly rare. The lateral rays bear vertically arising spines, which are very small and close together near the end but more distant and larger (1.5–3 μ long) in the middle and proximal parts of the ray. These spines are remarkably slender, even the longest is not much over 1 μ thick at the base.

The apical proximal ray is, when properly developed (Plate **6**, figs. 19–22, 25; Plate **7**, figs. 6, 7, 9, 10, 19), similar to the lateral rays in shape, spinulation, and size. When reduced (Plate **6**, fig. 24; Plate **7**, figs. 12–15) it is as thick, but in *C. c.* vars. *simplex* and *helix* is only 5–10 μ, in *C. c.* var. *megonychia* 5–20 μ long, and terminally rounded. On such proximal rays the spines are generally as far apart as on the long ones, and not crowded. One or two spines often arise from the rounded end of the ray.

The apical distal ray of the body-pinules is longest in *C. c.* var. *helix*, shorter in *C. c.* var. *simplex*, and still shorter in *C. c.* var. *megonychia*. It is in the dermal body-pinules of all varieties longer than in their gastral ones, being

in the dermal body-pinules of *C. c.* var.	*helix*	130–385 μ
“ “ “ “ “ “ “ “ “	*simplex*	100–290 μ
“ “ “ “ “ “ “ “ “	*megonychia*	100–180 μ
“ “ gastral “ “ “ “ “ “	*helix*	120–270 μ
“ “ “ “ “ “ “ “ “	*simplex*	100–240 μ
“ “ “ “ “ “ “ “ “	*megonychia*	100–195 μ long.

This ray in all varieties is at its base 5–13 μ thick, usually a little thicker than the other rays. It thickens above and attains its maximum thickness about a quarter of its length from the centrum of the spicule. From its thickest point it tapers gradually towards the stout, blunt-pointed, distal end (Plate 6, figs. 14–17). It bears numerous spines. These have the ordinary conic shape and are not at all broadened and flattened like scales. The spines arising from the basal part of the ray are vertical, quite distant, short, and straight (Plate 6, figs. 21, 22, 24; Plate 7, figs. 6, 8–10). Farther up they become more numerous, longer, and more inclined toward the ray, their ends pointing obliquely upward. This oblique direction is attained partly by the spines of this region arising obliquely, partly by their being more or less abruptly bent in their basal portion. About two thirds or three quarters of the way up the ray these spines attain their maximum size. They are in this region about 15 μ long, 1.5–2 μ thick at the base, and arise at an angle of about 70° from the ray. They are bent abruptly upwards 1–2 μ from their base, the axis (chord) of their conic, slightly and somewhat irregularly curved end-part enclosing an angle of about 23–30° with the axis of the ray. Towards the end of the ray the spines gradually become smaller, those arising nearest its freely protruding tip being only 5 μ long, or still shorter. The distal pinule-ray, together with its spines, resembles the tail of a mammal or wheat-ear more than the cone of a fir-tree. Its maximum breadth is 15–32 μ. In respect to this dimension there is no perceptible difference between the dermal and gastral body-pinules and the body-pinules of the three varieties.

The (dermal) *pinules of the stalk* (Plate 6, figs. 26–34) have the same structure as the body-pinules but differ from them in their dimensions and the prevalence of forms with reduced proximal ray. Their lateral rays are only 54–100 μ long and the crosses formed by them 115–196 μ in diameter. Their proximal ray is, when properly developed, 50–90 μ long, when reduced, 4–10 μ. These rays are 3–7 μ thick at the base. The distal ray is 55–115 μ long, and 6–10 μ thick at the base. The maximum breadth of this ray, with its spines, is 13–30 μ. On the whole these pinules decrease in size from the upper to the lower end of the stalk.

I have above drawn attention to the fact that there are no, or hardly any, intermediate forms connecting the pinules with reduced proximal ray with those in which this ray is properly developed. In fact I have not observed a single body-pinule with a proximal ray 21–59 μ long, the nearest approach to an intermediate form being the pinule (Plate 7, fig. 8) in which the proximal ray is, although 60 μ long, nearly cylindrical and terminally rounded.

This absence of intermediate forms, and the fact that the spines are no closer together on the reduced than on the long proximal rays, show that the reduction of the short ones cannot be due merely to obstacles which impeded their longitudinal growth. It is, therefore, probable that we have here to deal with two distinct kinds of pinules, one with long, and one with short proximal ray, even though the pinules with short proximals are locally aggregated only in so far as they are relatively much more numerous on the stalk than on the body.

The *scarce microhexactines* (Plate **3**, fig. 1), which have been found only in *C. c.* vars. *simplex* and *helix*, measure 16–19 μ in total diameter, and consist of six equal, cylindrical, terminally rounded rays, (without centrum) 6–8 μ long, and 3–8 μ thick, which enclose right angles. The rays bear numerous larger or smaller spines on their sides and on their ends.

At first I took these spicules for central remnants of hexasters which had lost their end-rays, like those described by F. E. Schulze [1] and Ijima [2] in other Hexactinellida. But since I found no indication of these spicules having once possessed end-rays, I think this view hardly tenable.

Of *hexasters* two main groups can be distinguished:— one represented by the regular onychhexasters, the onychhexaster-derivate oxyhexasters, their regular onychhexasters, and the helonychhexasters; the other by the plumicomes.

The *regular onychhexasters* (Plate **2**, fig. 3a; Plate **3**, figs. 21–30; Plate **4**, figs. 1–19) form a series commencing with small ones with stout end-rays and recurved terminal spines, and ending with large ones with slender end-rays and terminal spines directed obliquely outward. In *C. c.* vars. *helix* and *simplex* the whole of this series of onychhexasters is met with; in *C. c.* var. *megonychia* I have observed the large forms with slender end-rays only. The onychhexasters of *C. c.* var. *helix* are 39–88 μ in total diameter, those of *C. c.* var. *simplex* 48–106 μ, and those of *C. c.* var. *megonychia* 80–130 μ. They consist of a centrum, 5–6 μ in diameter, from which arise the six concentric and equal main-rays, the axes of which enclose angles of 90°, with trumpet-shaped, proximal extensions. The main-rays are smooth, 2–4 μ thick, (without the centrum) 1.5–6 μ long, and thickened in a trumpet-shaped manner and divided into from two to five end-rays at the distal end. The end-rays of the same spicule are fairly equal in shape

[1] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, p. 31, taf. 5, fig. 8.

[2] *I. Ijima.* Studies on the Hexactinellida. I. Journ. Coll. sci. Tokyo, 1901, **15**, p. 198, 292, pl. 4, fig. 20.

and size; the number of them on each of the six main-rays is, however, by no means always the same. The end-rays are 1.5–2 μ thick at the base, and arise steeply, sometimes at nearly right angles, from the main-rays. Farther on they curve inward, towards the continuation of the axis of the main-ray to which they belong. Distally this curvature rapidly decreases and the end-part is for a smaller or greater, usually a very considerable length, either quite straight or only slightly curved, or irregularly bent like an oak-branch and knotty in appearance. Onychhexasters with end-rays thus bent have been chiefly found in *C. c.* var. *megonychia* (Plate **4**, figs. 2–4, 14, 17). In all regular onychhexasters, whether large or small, the centrum, the main-rays, and the proximal parts of the end-rays are nearly identical in shape and have the dimensions given above; the great differences in these hexasters observed are entirely due to differences in the degree of longitudinal development of the distal straight end-parts of the end-rays. In the smallest onychhexasters observed (Plate **3**, fig. 21) this distal straight part is quite insignificant and hardly distinguishable. The larger the onychhexaster is, the longer and the more conspicuous does this part of the end-ray become (Plate **3**, figs. 22–27; Plate **4**, figs. 2–7). The end-rays are cylindroconic, attenuated distally. This attenuation is slight and very much the same in all end-rays, however long they may be. The consequence of this is that the thickness of their distal ends is in inverse proportion to the length of the end-rays; greatest in the shortest, and smallest in the longest. In the small onychhexasters, 39–45 μ in diameter, of *C. c.* var. *helix*, the end-rays are 15–18 μ long and 1–1.8 μ thick at the end; in the largest onychhexasters, 80–88 μ in diameter, of the same variety the end-rays are 34–41 μ long and only 0.8–1 μ thick at the end. In the larger onychhexasters of *C. c.* vars. *simplex* and *megonychia* the same inverse relation between the length and terminal thickness of the end-rays is observed. The angles between the chords of end-rays arising opposite each other from the same main-ray are correlated and in inverse proportion to the size of the spicule and the length of the end-rays. In the small onychhexasters, 39–45 μ in diameter, of *C. c.* var. *helix*, these angles are 70°–90°; in the large ones, 80–88 μ in diameter, of the same variety 59°–77°.

The end-rays bear numerous small recurved spines along their length (Plate **3**, fig. 28; Plate **4**, figs. 9, 10, 16) and one to five large spines at the end. The former are largest and most conspicuous in the smallest onychhexasters (Plate **3**, fig. 22); in the large onychhexasters they are smaller. Their size is, on the whole, in inverse proportion to the length of the end-rays and the size of the whole spicule. In the smallest onychhexasters the terminal spines are 2–3 μ

long and generally strongly recurved, so that these end-rays become anchor-like. With the increase in size of the onychhexaster (length of the end-rays) the terminal spines become longer. In the largest onychhexasters they are 2–8 μ long. At the same time they change their shape and their position relative to the end-ray from which they arise, generally being the more directed outward the longer the end-ray is. In the medium-sized onychhexasters (Plate 3, figs. 24, 25, 28–30) they are usually more or less vertical to the end-ray, their end being slightly bent inward (Plate 3, figs. 28, 30) or outward (Plate 3, fig. 29). In the large onychhexasters (Plate 3, figs. 26, 27; Plate 4, figs. 2–4, 13–19) they are generally directed obliquely outward. This clearly pronounced correlation between the length of the end-rays and the position of the terminal spines is very remarkable.

The *oxyhexasters* (Plate 3, figs. 4, 5; Plate 4, fig. 1) are not numerous and have been found only in *C. c.* vars. *helix* and *megonychia*. They measure in the former 90–94 μ in total diameter, in the latter 100–133 μ. From a centrum 5–7 μ in diameter arise four smooth main-rays, 2–6 μ long, 2–2.5 μ thick in the middle, and thickened at each end. The main-rays of the same spicule are equal and their axes enclose angles of 90°. Each main-ray bears two to four end-rays, 40–60 μ long and 1.5–2 μ thick at the base. The end-rays arise steeply from the main-rays. Their proximal end is curved inwards, towards the continuation of the axis of the main-ray to which they belong. Their distal and middle-parts are nearly straight. The chords of opposite end-rays of the same main-ray enclose angles of about 70°. The end-rays bear along their length a few very small spines, are conic, and taper gradually to a fine point.

This description shows that these oxyhexasters are very similar to the largest onychhexasters and distinguished from them only by the tips of their end-rays being destitute of terminal spines. In some hexasters (Plate 4, fig. 1), similar in every other respect to the oxyhexasters above described, a slight angular bend is to be noticed 4–8 μ below the tip in one or more of the end-rays. In others again (Plate 4, figs. 16–18) this angular bend is more pronounced, the bent end-part diverging strongly from the continuation of the middle-part of the end-ray. In others again only some of the end-rays are simply pointed, the others bearing terminal spines, similar to those of the large onychhexasters.

From these observations I conclude that the oxyhexasters above described are to be considered as onychhexaster-derivates. I think their appropriate place is in a continuation of the onychhexaster-series beyond the end represented by the large ones with long end-rays and outward-directed terminal spines.

It seems very probable that they have been produced by a further development of the onychhexasters in the direction of small forms with recurved terminal spines, or large forms with upward directed terminal spines. I think that the forms described above, in which the end-rays appear to be angularly bent near the end, have been developed out of large onychhexasters by a reduction of the number of the terminal spines to one, and by a further increase of the angle at which this single remaining spine arises from the end-ray. The bent terminal part which appears as the distal end of the ray is, according to this, not a part of the end-ray at all, but a terminal spine. When, by a further development in this direction and a further increase of the angle between the terminal spine and the end-ray, this angle becomes 180°, an apparently true oxyhexaster is the result.

That the oxyhexasters are to be considered as such ultra-end forms of the onychhexaster series is corroborated by the fact that they are larger than the largest regular onychhexasters found in the same variety.

In the not spirally twisted *irregular onychhexasters* (Plate 3, figs. 2, 3, 6, 7), which are very rare, the end-rays only or both the end- and the main-rays may be irregular. The onychhexaster (Plate 3, figs. 6, 7) is an example of the former case. In this spicule, which was found in *C. c.* var. *simplex*, the main-rays are regularly disposed, equal, abnormally stout, 7 μ long, and 5 μ thick. Each main-ray bears only one or two somewhat irregularly curved end-rays, which are also abnormally stout, being 2–3 μ thick at the base. The terminal spines are 3 μ long and recurved. The whole spicule measures 74 μ in maximum diameter. The onychhexaster (Plate 3, figs. 2, 3) is an example of the latter case. In this spicule, which was found in *C. c.* var. *helix*, two opposite main-rays, lying in a line, are considerably longer than the other four, and the end-rays are not, as is invariably the case in the regular onychhexasters, arranged in a verticillate manner at the end of each main-ray, but arise from them at various points. The main-rays are 4 μ thick, the end-rays basally 2 μ. The terminal spines are irregularly disposed, and 3–5 μ long. The whole spicule is 89 μ long and 64 μ broad. I consider these rare, not spirally twisted, irregular spicules as mere pathological abnormities.

The *helonychhexasters* are onychhexasters in which most end-rays or all of them are spirally twisted. To this spiral twisting the name I have given these spicules refers. The helonychhexasters are quite abundant in *C. c.* var. *helix*, but absent in the other two varieties.

The *helonychhexasters* of *C. c.* var. *helix* (Plate 2, fig. 3b; Plate 3, figs. 8–20) have a centrum 4–6 μ in diameter, from which six main-rays arise. These are very similar to the main-rays of the regular onychhexasters, enclose right angles with their neighbours, are smooth, 2–4 μ thick, and (without the centrum) 2–5 μ long. Forms with long and slender end-rays and outward directed terminal spines, forms with short end-rays and recurved terminal spines, and intermediate forms, corresponding to the different forms of the regular onychhexasters described above, are met with also among the helonychhexasters.

The twisted end-rays of the same spicule are always curved in the same direction and describe evolvent (spiral) curves extending in planes parallel to each other and vertical to one of the three axes of the spicule. The two (opposite) main-rays of the spicule representing this axis, lie in the axis, the four others in a plane parallel to the spirals accordingly. Each main-ray bears from one to four end-rays. When only one end-ray is present the main-ray usually passes into it gradually. The end-rays 10–35 μ long arising from the main-rays, which lie in the axis of the spiral, often do not participate in the general twisting and are usually either irregularly curved throughout, or curved only basally and nearly straight distally, like the end-rays of the regular onychhexasters. The end-rays arising from the four main-rays parallel to the plane of the spiral twist are generally all affected by the torsion. At the base, where they are most strongly curved, their radius of curvature is about 7 μ. Farther on their curvature, being a spiral or evolvent one, decreases. Still farther, at a smaller or greater distance from the distal end, the curvature is usually reversed, the terminal part of the end-ray being fairly straight and arising radially or obliquely from the convoluted central mass of the spicule. Depending, as it does, on the variable position of the point of recurvature, the length of this end-part is very variable.

The transverse diameters parallel to the plane of spiral twist, which pass through the centrum of the spicule, represent the breadth of the spicule, while the diameter along the axis of torsion can be considered as its length. Taking breadth and length in this sense, we find that the spicule is 33–58 μ long, whilst its central convoluted mass measures 15–22 μ, and the whole spicule 16–67 μ in breadth. Numerous small, recurved spines, uniformly scattered along the length of the ray, and two to five larger terminal spines 1.7–4 μ long originate from the end-rays arising from the main-rays lying in the torsion-axis and also from those of the others in which the straight end-part attains a greater length. Accordingly the spinulation of these end-rays is very similar to that of the end-rays of the regular onychhexasters. The spinulation of the end-rays spirally twisted for a greater part of their length is much more irregular. Here the spines scattered along the length of the end-ray are not uniformly distributed and often restricted to its outer, convex side; they are also unequal in size, some of them attaining a very considerable length. Such end-rays usually have only one terminal spine, sometimes 6.5 μ in length, which is directed obliquely outward. The angle between this terminal spine and the adjoining part of the end-ray usually is rather obtuse and not infrequently becomes 180°. In this case the terminal spine appears as the tip of the end-ray, and the end-ray itself becomes simple, as in the oxyhexasters above described.

Intermediate forms with somewhat curved but not properly spirally twisted end-rays, connecting the helonychhexasters with the regular onychhexasters, have occasionally been found, but they are exceedingly rare.

Spicules twisted spirally like the helonychhexasters of *C. c.* var. *helix* have repeatedly been noticed in Hexactinellida.

Oxyhexasters and oxyhexaster-derivates with a reduced number of spirally twisted rays have been found by F. E. Schulze in *Holascus stellatus*,[1] *Holascus ridleyi*,[2] and *Rhabdocalyptus mollis*[3] and by Ijima in the last named species,[4] in *Hyalascus giganteus*[5] and in *Staurocalyptus pleorhaphides*.[6]

Discohexasters with the verticils of end-rays twisted spirally round the continuations of the axis of the main-rays from which they arise, have been found by F. E. Schulze in *Hertwigia falcifera*,[7] *Rhabdopectella tintinnus*,[8] and *Saccocalyx pedunculata*[9].

Clavules with branch-rays twisted spirally round the shaft have been found by F. E. Schulze in *Farrea convolvulus*[10] and by Wilson in *Farrea occa claviformis*[11].

The spirally twisted oxyhexasters of *Holascus stellatus*, *Holascus ridleyi*, *Rhabdocalyptus mollis*, *Hyalascus giganteus*, and *Staurocalyptus pleorhaphides* are similar to ordinary, not twisted oxyhexasters occurring in the same sponge and more or less connected with them by intermediate forms. The same applies

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 86, pl. 14, figs. 10–12.
[2] *F. E. Schulze.* *Loc. cit.*, p. 90, pl. 17, fig. 7.
[3] *F. E. Schulze.* *Loc. cit.*, p. 157, pl. 64, figs. 10, 11.
[4] *I. Ijima.* Studies on the Hexactinellida. IV. Journ. Coll. sci. Tokyo, 1904, **18**, p. 266, pl. 20, fig. 9.
[5] *I. Ijima.* *Loc. cit.*, p. 106, pl. 8, fig. 16
[6] *I. Ijima.* *Loc. cit.*, p. 229, pl. 16, fig. 8.
[7] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, p. 23, taf. 3, fig. 8.
[8] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 108, pl. 12, fig. 8.
[9] *F. E. Schulze.* Hexactinelliden des Indischen Oceanes. II. Abh. Akad. Berlin, 1895, 1896, p. 55, taf. 5, figs. 4, 9, 10.
[10] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, p. 72, taf. 16, figs. 1, 2.
[11] *H. V. Wilson.* Mem. M. C. Z., 1904, **30**, p. 59, pl. 7, fig. 3.

to the clavules with twisted branch-rays of *Farrea occa claviformis* and the helonychhexasters above described. The discohexasters with spirally twisted end-ray verticils of *Hertwigia falcifera*, *Rhabdopectella tintinnus*, and *Saccocalyx pedunculata* and the clavules with similarly twisted branch-rays of *Farrea convolvulus* on the other hand do not appear to be associated with regular, not twisted spicules of the same kind.

In studying the question how these spirally twisted spicules have been produced I gained the impression that the parts of the living mass[1] which built them must have changed their relative positions in a torsional manner during the growth of those rays or portions of rays which are spirally twisted in the full-grown spicule. In the case of the oxyhexasters, helonychhexasters, and clavules with spirally twisted branch-rays there is only one torsion-axis corresponding to one of the axes of the spicule, and in these the torsion seems to have affected the whole living mass uniformly. In the case of the discohexasters there are six torsion-axes of this kind, corresponding to the axes of the six main-rays, and six different torsional systems in the living mass.

In speaking of the spirally twisted oxyhexasters of *Rhabdocalyptus mollis* which were found in some, but not in all specimens, Ijima[2] says: "I am therefore disposed to consider them as of inconstant occurrence in the species. Possibly they are produced only under certain abnormal conditions." Also in *Calycosilva cantharellus* they have been found in one specimen only. Since, however, this was obtained together with the others destitute of these spicules in the same locality, at a considerable depth, where doubtless the environment was very monotonous, it is hardly to be supposed that the external influences acting on it could have been in any way different from the influences acting on the others. A spiral twisting of some of the spicules is, as the above statement shows, if not a frequent, still a widespread occurrence in hexactinellids. It seems therefore improbable that the spiral twist is produced through the influence of abnormal conditions, and to be considered as an abnormity. Neither can it be ascribed to obstacles preventing the (twisted) rays from growing in the usual direction, because, in the first place, there are no such obstacles, and because, in the second place, their presence could not affect all the actually twisted rays of a spicule in the same way and induce them to curve round spirally in the same direction.

[1] I use the expression "living mass," because I do not know whether these spicules are built by distinct cells, and if so, by how many, or by syncitia, and if so, how many nuclei or chromidia or other centres of vital action, these syncitia contain.

[2] *I. Ijima.* Studies on the Hexactinellida. IV. Journ. Coll. sci. Tokyo, 1904, **18**, p. 266, 267.

In view of these circumstances I consider these spirally twisted skeletal elements as spicules *sui generis*, and the difference between them and the similar, not spirally twisted spicules, as similar in nature to the difference between the simply curved and spirally twisted horns of closely allied forms of Bovidae.

The *plumicomes* (Plate 2, fig. 12c; Plate 7, figs. 1–5) are quite abundant in *C. c.* vars. *simplex* and *helix*, but exceedingly rare in *C. c.* var. *megonychia*. Those of *C. c.* var. *helix* are 47–55, those of *C. c.* var. *simplex* 50–69 μ in diameter. Those of *C. c.* var. *megonychia* seem smaller than those of the two other varieties. Measurements I cannot give, because I saw only few and these were broken. Four equal main-rays, which enclose angles of 90° with their neighbours, arise from a slight central thickening about 2.5 μ in diameter. These main-rays are straight, cylindrical, smooth, 9–12 μ long, 0.9–1.6 μ thick, and simply rounded at the end. Some distance below the end each main-ray is thickened to a spherical or oval tyle, 2–3 μ in diameter. The distal part of the main-ray, lying beyond this tyle, is 2–4 μ long. A considerable number, twenty or more, branch-rays arise from the tyle of each main-ray. Their points of origin are fairly equidistant, but irregularly scattered over the surface of the tyle. The end-rays are very thin and strongly curved in an S-shaped manner. They terminate with fine points. A few small spines are occasionally observed on the concave side of their distal part. The end-rays are equal and regularly arranged so as to diverge above in a plumose manner.

I think there can be no doubt about the close relationship of the sponges above described. All the specimens were found at the same station; the fragments appear to be parts of sponges similar in shape to the complete specimen; no difference could be detected in their soft parts; and the shape and arrangement of most of their spicules are the same in all. Still there are differences in the spiculation of the thirty-two specimens, according to which they fall into three groups. The chief differences between these groups, which I describe as distinct varieties, are tabulated on p. 91.

The nearest allies of the sponges described above as *Calycosilva cantharellus* are the species assigned by previous authors to the genera Sympagella, Calycosoma, and Aulascus: — *Sympagella nux* O. Schmidt 1870 (F. E. Schulze 1887, 1897, 1899, 1900; Topsent 1904); *Aulascus johnstoni* F. E. Schulze 1887 (F. E. Schulze 1897); *Calycosoma validum* F. E. Schulze 1899; *Sympagella anomala* I. Ijima 1903; and *Calycosoma gracile* F. E. Schulze 1903. All these, with the single exception of *Aulascus johnstoni* F. E. Schulze differ from *Calycosilva cantharellus* by being destitute of hypogastral pentactines. *Aulascus johnstoni*

		C. c. var. helix	C. c. var. simplex	C. c. var. megonychia
Rectangularly bent diactine megascleres		present	absent	absent
Large, slender-rayed triactines with two rays in a straight line and the third arising vertically from this		absent	absent	present
Amphiox, diactine hexactine-derivates		absent	present	absent
Body-pinules	dermal	distal ray 120–270 μ long	distal ray 100–240 μ long	distal ray 100–180 μ long
	gastral	distal ray 120–270 μ long	distal ray 100–240 μ long	distal ray 100–195 μ long
Onychhexasters		39–88 μ in diameter	48–106 μ in diameter	80–130 μ in diameter
Oxyhexasters		present	absent	present
Helonychhexasters		present	absent	absent

F. E. Schulze differs from it by its shape and by some of its spicules. In *Aulascus johnstoni* all the pinules have a properly developed proximal ray, and discohexasters and discohexaster-derivate discohexactines occur. In *Calycosilva cantharellus* many pinules have a reduced proximal ray, and discohexasters and discohexactines are absent. Also the plumicomes are somewhat different. Among the above mentioned related forms without pentactine hypogastralia, *Calycosoma gracile* F. E. Schulze, which is not very different in shape and has very similar onychhexasters and plumicomes, appears to be most closely allied to *Calycosilva cantharellus*. The differences between the latter and the most similar of the allied forms (*Aulascus johnstoni* and *Calycosoma gracile*), let alone the others, are so considerable as to necessitate the establishment of a new species for its reception.

Whilst I experienced no difficulty in coming to this decision about the establishment of a new species, I found it exceedingly difficult to decide whether this new species should be assigned to one of the three genera mentioned, and if so, to which one. Ijima [1] attaches little systematic importance to the presence or absence of hypogastral pentactines and accordingly proposes to unite the

[1] *I. Ijima.* Studies on the Hexactinellida. III. Journ. Coll. sci. Tokyo, 1903, **18**, p. 96.

species referred by F. E. Schulze to the two genera Sympagella, without, and Aulascus, with hypogastral pentactines in one genus, which should, since this has priority, be named Sympagella. According to the diagnosis of this genus given by Ijima the species belonging to it possess discohexasters. Since discohexasters are entirely absent in *Calycosilva cantharellus,* we cannot, if we accept Ijima's classification place this sponge in this genus or in Aulascus, united with it by him. If we follow Ijima's example of not considering the presence or absence of hypogastral pentactines of systematic importance sufficient for generic distinction, we must place the sponges above described in the same genus as *Calycosoma gracile* F. E. Schulze. According to Ijima[1] the Caulophacidae are distinguished from the Rossellidae *i. a.* by the former possessing and the latter being destitute of true pinules with a well-distinguished distal ray. If this be accepted the two species (*validum* and *gracile*) placed by F. E. Schulze in Calycosoma must be generically separated, because only one (*C. validum*) has no true pinules and can be retained in the Rossellidae, where F. E. Schulze[2] although doubtful about it himself, places Calycosoma; whilst the other (*C. gracile*) possesses pinules with well-distinguished distal ray and must be assigned to the Caulophacidae. The first described of these two species is the rossellid *Calycosoma validum.* This must therefore be considered as the type species of the genus and for this the generic name Calycosoma must be retained. The other species, *Calycosoma gracile,* with which the sponges described above might be generically united, has, according to this, to be excluded from Calycosoma, and a new generic name has to be found for it.

Under these circumstances I establish a new genus for the sponges described above, in which also *Calycosoma gracile* F. E. Schulze 1903 might be placed. The name Calycosilva denotes its origin from Calycosoma on the one hand, and on the other indicates that the sponges are covered by a forest of pinules with well-distinguished distal ray.

Doubtful Caulophacid.

Plate 32, figs. 10–12.

The collection contains three fragments of skeleton-nets collected with the tangles at Station 3689 (A. A. 134) on 28 October, 1899; 18° 06′ S., 142° 24′ W.; depth 1476 m. (807 f.); they grew on a bottom of fine coral-sand and manganese nodules; the bottom-temperature was 37.6°.

[1] *I. Ijima.* Studies on the Hexactinellida. III. Journ. Coll. sci. Tokyo, 1903, **18**, p. 79, 80, 112, 114.
[2] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 174, 176.

The largest fragment (Plate 32, fig. 10) is apparently part of a stalk. It is 99 mm. long., 12 mm. thick at the base, and 17 mm. at the upper end. At the thinner, probably the lower, end it is solid for a distance of 18 mm.; farther on it is tubular. The tube thus formed widens above in a calyculate manner and has a wall about 3 mm. thick. The two other fragments which are 57 mm. and 49 mm. long respectively are curved lamellae, also about 3 mm. thick. They apparently formed parts of lamellar, calyculate sponges.

The *skeleton-net* (Plate 32, figs. 11, 12) consists of main-beams 100–300 μ thick, which extend obliquely longitudinally or, more rarely, transversely. These main-beams form more or less distinct bundles, within which they lie quite close together and connected by numerous short, somewhat thinner, transverse beams. The bundles are on an average about 0.6 mm. thick and form a network with elongated spindle-shaped meshes, usually 0.4–0.6 mm. broad and 1–3 mm. long. The individual beams are either smooth or bear a few scattered, low, blunt spines. Here and there the spines are more crowded.

In some respects these specimens resemble the skeleton-nets of the stalk and the lower parts of the body of caulophacid hexactinellids, and they may have formed parts of such.

ROSSELLIDAE (F. E. Schulze) Ijima.

Hexasterophora with special diactine to hexactine dermal, and pentactine hypodermal spicules, which latter sometimes project a considerable distance beyond the surface, their lateral rays then forming a veil covering the sponge.

The collection contains twenty-two more or less complete specimens and twelve fragments of this family.

F. E. Schulze [1] distinguishes three subfamilies in this family, all of which are represented in the collection.

Rossellinae F. E. Schulze.

Rossellidae without discoctasters and plumicomes.

The collection contains twenty more or less complete specimens and twelve fragments of specimens belonging to this subfamily. All are referred to the new subspecies *Bathydorus laevis spinosissimus*.

[1] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, 4, p. 176.

BATHYDORUS F. E. Schulze.

Thin-walled, sac-shaped, calyculate or lamellar Rossellidae (Rossellinae) with oxyhexasters and sometimes also hemioxyhexasters but no other microscleres in the choanosome. With hypodermal pentactines. The dermal spicules are usually chiefly tetractines (stauractines), but forms with fewer (one to three) or more numerous (five or six) rays may also occur, the forms with fewer rays sometimes predominating. The gastral spicules are hexactines, the distal ray of which may be differentiated so as to render these spicules somewhat pinule-like.

Bathydorus laevis F. E. Schulze.

F. E. Schulze, Abh. Akad. Berlin, 1895, 1896, p. 57, taf. 6, figs. 1–10. F. E. Schulze, Sitzungsb. Akad. Berlin, 1897, p. 535. I. Ijima, Annot. zool. Jap., 1898, **2**, p. 47. F. E. Schulze, Indian Triaxonia, 1902, p. 78, pl. 14, figs. 1–10. H. V. Wilson, Mem. M. C. Z., 1904, **30**, p. 51, pl. 5, figs. 11–13; pl. 6, figs. 1, 2.

Bathydorus laevis spinosissimus, subsp. nov.

Plate 14, figs. 1–32; Plate 15, figs. 1–22; Plate 16, figs. 1–24.

All the specimens of this subspecies were trawled off northern Peru, Station 4651, on 11 November, 1904; 5° 41.7′ S., 82° 59.7′ W.; depth 4063 m. (2222 f.); they grew on sticky, fine, gray sand; the bottom-temperature was 35.4°. Three specimens distinguished as A, B, and C were examined in detail.

These sponges are related to *Bathydorus laevis* F. E. Schulze (*loc. cit.*, 1896, p. 57). Within this species Wilson (*loc. cit.*, p. 51) has distinguished the subspecies *spinosus*, which differs from the typical *B. laevis* by its spicules, particularly its dermals, which are much more spiny. In the specimens here described the dermals are still more spiny, and the pentactines, which are smooth in *B. laevis spinosus*, are also usually covered with spines. The name of this new subspecies refers to this further development of the spinulation.

Shape and size. The best preserved specimens, one of which C (Plate **14**, fig. 13), show calyces with rather broad bottom and a thin undulating wall. The margin, which is much torn, appears to have been lobose in the living sponge. In the calyculate specimens the two halves of the calyx-wall are quite flattened and pressed against each other. In the fresh state these calyxes were, no doubt, open. The other, fragmentary specimens are lamellae, which appear to have formed part of calyxes similar to those described above. The walls of the calyculate specimens are mostly 1–2 mm. thick, and thin out towards the margin. The fragmentary lamellae are 1–2.5 mm. thick. The largest calyculate specimen (C) is 39 mm. high and of varying breadth, 7 mm. below, 45 mm. above. This specimen has a slender protuberance 11 mm. long and 2.5 mm. thick, which arises from the outer (lower) convex side of the broad rounded bottom of the calyx. Another calyculate specimen is more slender, 28 mm. high, 8 mm. broad below increasing to 25 mm. above. The lamellar fragments measure 25–56 mm. in maximum diameter.

Pores, mostly 200–400 μ in diameter, on both sides of the calyx-walls are observed. These are now open. In the living sponge they were probably covered by (dermal and gastral) sieves. From the inner and the outer surface large and small prostal spicules protrude. Most of these, particularly the larger ones, are very slanting and enclose small angles with the surface. Pores are observed also on the surface of the fragmentary lamellae, but these no doubt in consequence of *post mortem* shrinkage and maceration are much wider than in the better preserved calyculate specimens and have a maximum diameter of 1.5 mm. These fragmentary, lamellar specimens show but little of the protruding prostal spicules.

The *colour* in spirit is light dirty brown with a greenish tinge.

General structure. The superficial pores above referred to lead into canals, in specimen A 300–400 μ wide, which traverse nearly the entire thickness of the lamella in a somewhat oblique direction (Plate **14**, figs. 14, 15). Indications of flagellate chambers can be made out in parts of the sections of this specimen. It seems that they are small, spherical or slightly oval, and 70–120 μ in diameter.

The *skeleton* of the interior consists chiefly of rhabds and oxyhexasters. The former are exceedingly variable in size and extend paratangentially and obliquely. The proximal parts of the prostals, which are imbedded in the choanosome, also take part in the formation of its skeleton. Beneath the dermal and the gastral membranes paratangentially situated rhabds form loose reticulations. Fairly numerous hypodermal pentactines with rather long lateral rays arranged in the usual manner are observed below the dermal membrane. Hypogastral pentactines appear to be absent. The dermal membrane is occupied by dense masses of spicules, the rays of which are on an average about twice as long as the distance between their centres. These spicules are mostly regular tetractine stauractines, but similar spicules with one or two shortened or entirely suppressed rays (irregular stauractines, triactines, and diactines) occur. Similar spicules with five or six rays (pentactines and hexactines) also occur in the dermal membrane. The gastral membrane is occupied by more slender-rayed pinule-like hexactines, generally with one more or less differentiated, outwardly directed ray. These gastral spicules do not lie quite so close together as the dermals. The prostals which protrude from both surfaces are large and small rhabds.

Besides the spicules described above, which I have observed *in situ* in the sections, some other forms, which I am inclined to consider as proper spicules of the sponge, also occur in the spicule-preparations. These are: — hemioxyhexasters; angularly bent diactine megascleres; hexactine megascleres with fairly equal rays; hexactine megascleres, with one ray much longer than the other four; and pentactine megascleres, with relatively short lateral rays. The hemioxyhexasters, which are similar to the oxyhexasters, doubtlessly form part of the skeleton of the interior. The angularly bent diactines, and the hexactines with rays fairly equally long, may also take part in the formation of the interior skeleton. According to Schulze [1] such hexactines occur in the choanosome of the type of *Bathydorus laevis.* About the hexactines with one long ray and the pentactines with long proximal ray I have my doubts. Wilson [2] says that hexactines with one elongated ray, 10 mm. long, occur in *Bathydorus laevis spinosus* and that these spicules are here so situated that their elongated ray protrudes freely beyond the surface, prostal-fashion. The hexactines with one elongated ray observed by me were much smaller and made rather the impression of being derivates of hypodermal pentactines, with a short apical distal ray. The pentactines with short lateral rays are probably also hypodermal.

The *rhabds* (Plate **14**, figs. 1–10) vary exceedingly in size, and a continuous series of intermediate forms connects the smallest with the largest. They are 1–21 mm. long, and 5–105 μ thick at the thickest point. The small rhabds are distinctly centrotyle (Plate **14**, figs. 5, 6), many of the large ones without a central tyle. The four rudimentary rays which compose the tyle are often very clearly distinguished, particularly in the small rhabds. Not infrequently they are unequal in length, in which case the tyle formed by them appears eccentric (Plate **14**, fig. 5). The tyle may measure 22 μ more in transverse diameter than the adjacent parts of the spicule. This difference is not only relatively but also absolutely greater in the small and slender than in the large and stout rhabds. Differences of over 11 μ in thickness of tyle and adjacent parts of the spicule were only observed in rhabds less than 20 μ thick.

The end-parts of the rhabds are conic (Plate **14**, fig. 7), cylindroconic (Plate **14**, figs. 7, 9), or cylindrical (Plate **14**, figs. 1, 3, 10), and terminally

[1] *F. E. Schulze.* Hexactinelliden des Indischen Oceans, II. Abh. Akad. Berlin, 1895, 1896, p. 58, taf. 6, fig. 2; Indian Triaxonia, 1902, p. 79, pl. 14, fig. 2.

[2] *H. V. Wilson.* Mem. M. C. Z., 1904, **30**, p. 52.

rounded or, rarely, sharp-pointed (Plate **14**, fig. 2), or first thickened and then attenuated to a blunt point (Plate **14**, fig. 4). The ends of the normal rhabds, with rays not differing very much in length, are 3–45 μ thick, which is a sixth to three quarters, sometimes nearly quite as thick as their middle-part. The small rhabds are on the whole less attenuated towards their ends than the large ones.

The two rays composing the rhabds usually differ more or less in respect to the shape and thickness of their ends, and also in respect to their length. One end is often much more blunt than the other, and the difference in the thickness of the two ends is sometimes so great that one end is more than twice as stout as the other. The difference of the two rays in length is usually inconsiderable; occasionally, however, one ray is reduced very considerably in length, and then this difference is great. In four rhabds of this kind one (the normal ray) measured over 2 mm. long, the other (the reduced ray) only 100–290 μ. These greatly shortened rays are terminally thickened either gradually or abruptly, in which latter case their end appears as a terminal tyle, the transverse diameter of which may be nearly twice as great as that of the base.

In some of the large rhabds, particularly the large prostals, one or more thickenings are observed some distance below the end (Plate **14**, figs. 7–9). Occasionally such thickenings also occur near the centre of the spicule.

The end-parts of all the small and most of the large rhabds for a distance of about 80–100 μ are covered with vertically arising spines 1–2 μ high (Plate **14**, figs. 1–4, 8–10). Some of the largest rhabds appear to have smooth end-parts (Plate **14**, fig. 7). Apart from their end-parts the rhabds are perfectly smooth. On the end-parts of some rhabds the spines are more numerous than on the end-parts of others. Also in this respect the two rays of the same rhabd often differ. The ends of the rays reduced in length are always densely spined.

Two kinds of *angularly bent diactines* (Plate **16**, fig. 19) can be distinguished, one with an obtuse angle between the two rhabd-rays, the other with an angle of 90° or less. The former are similar to the rhabds described above, from which they differ by the angle between the rays being only about 120° instead of 180°. I consider these diactines as derivates of the ordinary rhabds. In the latter the angle between the two rays is usually 75°–90°. The rays of these spicules are 0.3–1.5 mm. long, 7–20 μ thick at the base, straight, and rather unequal in length. At the point of junction of the two rays the spicule is thickened to a conspicuous tyle. I have not observed any angularly bent diactines with angles of 90°–120° which might be considered as transitions between the two kinds of these spicules observed, and I am not sure whether the forms with angles of 90° or less are to be considered as rhabd-derivates like those with obtuse angles.

In all these diactines the two rays are of equal thickness at the base. I found, however, also an angularly bent diactine with an angle of 73°, in which one ray, 460 μ long and 7 μ thick at the base, was curved concave towards the other, the other being straight, 850 μ long and 23 μ thick at the base.

The *pentactines and apparently pentactine-derivate hexactines.* Among the pentactines two groups can be distinguished, one with relatively long, and the other with relatively short lateral rays. The hexactines appear to be derivates of pentactines belonging to the first group.

The *pentactines with relatively long lateral rays* (Plate **16**, figs. 4–8, 16, 17, 20–24). The proximal ray is 0.5–1.5 mm. long, usually straight, conic, and 20–38 μ thick at the base, and gradually attenuated to the blunt end, which measures 4–8 μ in transverse diameter (Plate **16**, figs. 4–6, 8). Rarely the proximal ray is either curved, or nearly cylindrical, rounded, and slightly thickened at the end (Plate **16**, fig. 7). The lateral rays are generally straight, conic, and blunt, those of the same spicule being usually not very different in length (Plate **16**, fig. 4). Sometimes, however, one of the lateral rays is either slightly curved (Plate **16**, fig. 16) or greatly reduced in length, cylindrical, and terminally rounded (Plate **16**, fig. 17). The longest lateral ray of the pentactine is 270–750 μ long, the shortest 60–700 μ. The lateral rays are usually about 2 μ thinner at the base than the proximal ray of the same spicule. Their ends are 2.5–15 μ thick. The lateral rays enclose angles of 76°–97°, usually considerably less than 90°, with the proximal ray.

In many of these pentactines all the rays are rather densely covered with spines throughout their whole length (Plate **16**, figs. 15, 20–23). These spines are conic, sharp-pointed, about 1 μ high and, on an average, 4 μ apart. Towards the ends of the rays the spines usually become smaller and less numerous. The ends themselves, however, generally bear considerably larger spines, which either pass gradually into the smaller ones, or are separated from them by a distinct limit, situated a short distance from the end of the ray. In some pentactines the spiculation is not so great, portions of the rays appearing quite smooth. In a few hardly any spines, or no spines at all, could be detected.

When these spicules are slightly heated, the superficial silica-layers partly split off and it is then clearly to be seen (Plate **16**, figs. 20, 21) that the limits between the outermost and the next silica-layers are perfectly smooth. From this it follows that the spines are not formed until after the spicule has attained its full size. The partly and wholly smooth pentactines, above referred to, should, I think, therefore be considered as not completely developed, adolescent spicules, in which the spines are not yet, or as yet only partly, formed.

The rays of the rare *apparently pentactine-derivative hexactines* (Plate **16**, fig. 3) are 12–25 μ thick at the base. One of them is elongated and 570 μ–2 mm. long. This ray corresponds with and is similar to the proximal ray of the pentactines above described. The four rays vertical to this elongated ray are, in the same spicule, more or less unequal in length, the longest being 160–500 μ long, the shortest 135–225 μ. They correspond with and are similar to the lateral rays of the pentactines. The sixth ray, which lies in the continuation of the axis of the elongated one, is straight, conic, blunt, and 88–420 μ long.

The *pentactines with relatively short lateral rays* (Plate **16**, figs. 1, 2) have an apical (probably proximal) ray 780 μ–2.7 mm. long and 13–22 μ thick at the base. This ray is generally more or less curved. It is nearly cylindrical in its proximal part and gradually attenuated to a blunt end. The lateral rays of the same spicule usually differ in length, the longest being 200–290 μ, the shortest 145–221 μ long. They are at the base about as thick as the proximal ray, cylindrical, and blunt. The rounded end is usually one to two thirds as thick as the base of the ray. The lateral rays enclose angles of considerably less than 90° with the apical (probably proximal) ray, and are usually curved, concave to the latter. The lateral rays of these pentactines exhibit the same spinulation as the pentactines with long lateral rays described above. The proximal ray is less spiny, sometimes apparently quite smooth.

The rare *regular hexactines with fairly equal rays* measure 0.6–2 mm. in diameter and have mostly smooth, rather straight, cylindroconic, terminally rounded rays 0.35–1.1 mm. long and 15–40 μ thick at the base.

Besides these regular ones I have found a few *irregular hexactines*, one of which is represented on Plate **16**, fig. 18. This spicule has rays 250–830 μ long.

The *dermal spicules* are di- to hexactine, by far the greater number of them being tetractine (stauractine). Most of these stauractines are fairly regular, having four properly developed, straight rays differing only slightly in length and enclosing equal angles with their neighbours. Besides these a few stauractines occur in which either one, two, three, or all four rays are greatly reduced in length, or one or more rays are strongly bent, or the angles between the rays are unequal.

The *regular stauractines* (Plate **14**, fig. 11; Plate **15**, figs. 1, 2, 19; Plate **16**, figs. 13, 14) generally measure 80–215 μ in diameter. In specimen A, I have found besides the ordinary ones also, however, a few 220–320 μ in diameter. Their rays do not lie in one plane but form the edges of low obtuse pyramids with quadratic bases. In consequence of this and the fact that the rays are, in the same spicule, nearly equally long, the ray-length is a little more than half the diameter of the spicule. The basal thickness of the rays is in the regular stauractines 80–215 μ; the diameter is 4.5–9, generally 5–7 μ. The rays of the giant stauractines 220–320 μ in diameter, above referred to, are 6–15 μ thick at the base. The rays are generally terminally rounded and either cylindrical, at the end as thick as at the base; or, more frequently, cylindroconic, at the end only one to two thirds as thick as at the base; very rarely the ends are pointed. In respect to the degree of attenuation towards the end the rays of the same spicule are often unequal.

The whole of the spicule is densely and uniformly covered with sharp conic spines, its central part being quite as spiny as the distal parts of its rays. The proximal spines are nearly vertical, the distal ones directed more or less obliquely outward. Large and smaller spines are irregularly intermingled; the largest are sometimes 4 μ long.

Stauractines with one or more rays reduced in length (Plate 15, figs. 5, 9, 10, 18, 21, 22) are quite frequently met with. Apart from the ray-reduction these spicules resemble the regular stauractines above described. When two of their rays are reduced, these reduced rays may be either adjacent (Plate 15, fig. 21) or opposite (Plate 15, fig. 5). A stauractine in which all the four rays are reduced is represented (Plate 15, figs. 9, 10). This spicule is only 30 μ in diameter, and has cylindrical, terminally rounded rays 8 μ thick.

Irregular stauractines with unequal interactine angles (Plate 16, fig. 12) or with curved rays (Plate 15, fig. 11) are met with much more rarely. Apart from the irregularities characteristic of them, they also resemble the regular stauractines above described.

Among the dermal spicules with less than four rays, which are doubtlessly to be considered as *stauractine-derivates with reduced ray-number*, triactine and diactine forms occur. Most of the triactine stauractine-derivates (Plate 15, figs. 4, 6) are straight or curved rhabds, 83–125 μ long, from the central part of which arises a ray-rudiment 9–12 μ long. Some of them, however, appear as more or less regular triactines with rays nearly equally long, enclosing fairly equal angles with their neighbours. The diactine stauractine-derivates are straight, or slightly curved, or strongly angularly bent. The latter resemble more or less widely open compasses. In regard to the thickness of their rays and their spinulation the triactine and diactine stauractine-derivates resemble the regular stauractines above described.

The dermal spicules with more than four rays, which I am inclined to consider as *stauractine-derivates with increased ray-number*, are pentactines and hexactines. The pentactine forms (Plate 15, fig. 20), which are met with rather frequently, have four fairly equal rays similar to those of the regular stauractines, and a fifth shorter ray vertical to the plane of the tips of the four others. The hexactine forms (Plate 15, fig. 3) are very rare. They appear either as fairly regular hexactines with nearly equal rays, enclosing angles of 90° with their neighbours; or they are irregular, having rays unequal in length and irregular in position. These spicules are 100–200 μ in diameter. In regard to the thickness of their rays and their spinulation they resemble the regular stauractines above described.

The more or less *pinule-like gastral hexactines* (Plate 14, fig. 12; Plate 15, figs. 7, 8, 12–17; Plate 16, figs. 9–11) have five quite similar and one differentiated ray, which latter corresponds to the distal ray of true pinules. This differentiated (distal) ray is straight (Plate 15, figs. 12, 17; Plate 16, figs. 9, 10); or, much more frequently, curved (Plate 15, figs. 7, 8, 13–16; Plate 16, fig. 11), its curvature often being very considerable (Plate 15, figs. 8, 14, 16). It is at the base 2.5–6 μ thick and, measured along its chord, 70–145 μ. It is attenuated uniformly towards the end, or cylindrical in its proximal and conic in its distal part, or even slightly thickened near the middle, and always terminates in a fine point. It bears spines along the whole of its length. The spines are small, rather scarce, and nearly vertical on its basal part. Farther on they become more numerous, larger, and inclined towards the end of the ray. They attain their maximum length of 3–8 μ about half way up. Beyond this point the spines again become smaller, but retain their inclination towards the tip of the ray. The large spines are usually somewhat curved, concave towards the end of the ray. At its thickest (most bushy) point the distal ray is, together with the spines, 6–15 μ in transverse diameter. In some of the gastral hexactines of specimen A the distal ray is stouter and more bushy than in the gastral hexactines of specimen B, where its basal thickness does not exceed 4.5 μ, and its maximum transverse diameter, with the spines, 10 μ.

The four rays vertical to the differentiated one, which correspond to the four lateral rays of true pinules, are straight, usually rather abruptly pointed, 43–94 μ long, and 3–6 μ thick at the base. They are covered with spines 1.5–2.5 μ long, which either arise vertically, or are inclined towards the tip of the ray.

These four otherwise quite similar rays sometimes differ considerably in regard to their spinulation. Thus the right lateral ray of the hexactine (Plate **15**, fig. 7) bears more numerous, larger, and more inclined spines than the left one. The sixth ray, which lies in the continuation of the axis of the differentiated one and which corresponds with the proximal ray of the true hexactine pinule, is similar to the four (lateral) rays above described in size and spinulation, but is slightly, sometimes considerably, curved (Plate **15**, fig. 8). Also these rays are on the whole stouter in the gastral hexactines of specimen A than in those of specimen B.

The *oxyhexasters and (rare) hemioxyhexasters* (Plate **14**, figs. 16–32) measure 65–135 μ in diameter. The main-rays are cylindrical, smooth, 4–12 μ long, and 2–4 μ thick. They enclose angles of 90° with their neighbours. The main-rays of the same spicule are equal. From the distal end of each main-ray a verticil of from two to four end-rays, rarely only a single end-ray, arises. The main-rays are often unequal in respect to the number of end-rays which they bear. A single end-ray is found only on one or two of the main-rays of the spicule, the others bearing more than one. The spicules with a single end-ray on one or two of the main-rays, which must be designated as hemioxyhexasters, resemble the true oxyhexasters in every respect except in regard to the end-ray number. The end-rays arise very steeply from the main-rays but very soon curve outward, that is towards the continuation of the main-ray axis, and then straighten out, their distal and middle-parts being only slightly curved, or quite straight. The angle between the chord of the end-ray and the continuation of the main-ray axis is, on an average, about 45°. The end-rays are 30–60 μ long and, at the base, 1.6–2.5 μ thick, rarely as much as 3 μ. They are conic and taper gradually to a very fine point. The end-rays are covered with rather sparse, backwardly directed, slender spines, which decrease in size from the base to the tip of the ray (Plate **14**, figs. 24–32). The largest of these spines are 0.5–2 μ long.

The description given above shows that these sponges are most closely allied to *Bathydorus spinosus* F. E. Schulze [1] and *Bathydorus laevis* F. E. Schulze (Schulze and Ijima, *loc. cit.*) within which latter Wilson (Mem. M. C. Z., 1904, **30**, p. 51, pl. 5, figs. 11–13; pl. 6, figs. 1–2) has distinguished the subspecies *B. l. spinosus*. According to F. E. Schulze (*loc. cit.*, 1897, p. 535) *B. laevis* and *B. spinosus* are very similar and may be specifically identical. Judging from

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 153, pl. 59, figs. 6–9. Sitzungsb. Akad. Berlin, 1897, p. 534. *I. Ijima.* Annot. zool. Jap., 1898, **2**, p. 46. *E. Topsent.* Res. Voy. Belgica, 1901, p. 36, taf. **1**, fig. 1.

E. Topsent's description (*loc. cit.*, 1901, p. 36) the *B. spinosus* examined by him. resembles *B. laevis* F. E. Schulze and also Wilson's subspecies *B. laevis spinosus*. Of all the descriptions cited, Wilson's of *B. laevis spinosus* (*loc. cit.*, 1904, p. 51) agrees best with the sponges here under discussion. The latter differ, however, from that subspecies, and also from *B. laevis* and *B. spinosus*, by the pentactines being generally densely covered with small spines. For this reason, and because there are also other, minor differences, I establish a new systematic unit for them, which should, I think, be a subspecies of *Bathydorus laevis*, equivalent to Wilson's *B. laevis spinosus*.

However should future studies prove, as seems probable, that *Bathydorus laevis* and *B. spinosus* are identical, the latter having priority, the name *Bathydorus spinosus spinosissimus* would prevail.

The specific name of *Bathydorus laevis* is variously given as *laevis* and *levis*.

Lanuginellinae F. E. Schulze.

Rossellidae with plumicomes, but without discoctasters.

The collection contains one specimen of this subfamily, a new species of the new genus Lanugonychia.

LANUGONYCHIA, gen. nov.

Rossellidae (Lanuginellinae) with onychhexasters, discohexasters, and plumicomes. Without octasters. The superficial skeleton consists of hexactines in which all the six rays or only five, four, three, two or one are normally developed, the others being reduced to terminally rounded protuberances. The unreduced forms (true hexactines) preponderate in the gastral, the strongly reduced forms (hexactine-derivate diactines and monactines) are restricted to the dermal membrane.

Lanugonychia flabellum, sp. nov.

Plate 12, figs. 20–34; Plate 13, figs. 1–28.

The unique specimen of this species was found northeast of Easter Island at Station 4695 on 23 December, 1904; 25° 22.4′ S., 107° 45′ W.; depth 3694 m. (2020 f.); it grew on fine, light brown ooze.

On account of its being fan-shaped I name it *flabellum*.

Shape and size. The single specimen is somewhat fragmentary and macerated. It appears (Plate 13, fig. 8) as a flat, elongated, irregularly triangular lamella about 60 mm. long, 40 mm. broad, and 1 mm. thick, from the sharpest angle of which arises a uniformly curved stalk about 90 mm. long and 2–3 mm. thick. Whether the complete sponge, of which the specimen formed a part, was also fan-shaped, is hard to say. It may have been calyculate or even tubular, but it certainly was thin-walled and stalked.

The *colour* in spirit is rather dark reddish brown.

General structure. The lamellar body is reticulate in structure (Plate **13**, fig. 14), composed of a network of bands, mostly 0.2–0.5 mm. thick, which enclose round meshes, 1 mm. wide. These meshes are partly covered by remnants of superficial membranes.

The *skeleton* of the stalk (Plate **13**, fig. 7) consists chiefly of longitudinal beams 20–90 μ thick (usually 40–80 μ), about equally far apart, and joined at frequent intervals by short transverse bars. The latter are thickened, and trumpet-shaped at the base. The meshes of the whole ladder-like network formed by the beams and bars are rounded, usually oval, 35–210 μ long and 25–90 μ broad. Most of the longitudinal beams are rhabds; some appear to be elongated rays of pentactines and hexactines.

The interior of the lamellar body is occupied by rhabds and great numbers of onychhexasters, and large and small regular discohexasters. Plumicomes and a few irregular discohexasters with primary and secondary end-rays have also been found in it. Besides these spicules several large amphiasters have been observed. These are, however, most likely foreign to the sponge. Very probably small hexactines also occur in the choanosome. I am not, however, certain about these spicules; the ones observed may in truth have been gastral or dermal and brought down into the choanosome accidentally. Below the surface pentactines are met. The superficial (dermal and gastral) skeleton consists of hexactines and pentactine to monactine hexactine-derivates with only five to one properly developed and one to five reduced rays, which latter appear as short, terminally rounded protuberances of the centre of the spicule. The tetractine forms are stauractines; the diactine forms are mostly centrotyle amphioxes; a few of them appear compass-shaped. On one side of the lamella true hexactines, with all six rays fully developed, greatly predominate, spicules with only five or four fully developed rays (pentactines and stauractines) being rare, and spicules with only three or still fewer (triactines to monactines) absent altogether. On the other side of the lamella hexactine-derivates with fewer than six fully developed rays are more frequent than true hexactines and here also triactine to monactine forms with only from three to one fully developed rays are frequently met, the diactines being particularly abundant. Judging by analogy I should say that the surface, the skeleton of which consists chiefly of true hexactines, is gastral, the other dermal.

The hexactine and pentactine forms are orientated in such manner that four of their rays extend paratangentially whilst one protrudes vertically outward. The stauractines, triactines, diactines, and monactines are usually extended wholly paratangentially.

The *rhabds* are 4–20 mm. long and 5–140 μ thick near the middle. Those 5–50 μ thick are usually 4–7 mm. long. The slender ones are always distinctly centrotyle, the tyle being 1–6 μ thicker than the adjacent parts of the spicule. In the stout rhabds the central tyle is only slightly developed, inconspicuous, and often altogether absent. The axial cross is equally developed in the stout non-centrotyle and the slender centrotyle rhabds. The smallest rhabds are nearly cylindrical and rounded at the ends. The rhabds 20–40 μ thick in the middle taper gradually to 5–18 μ towards the ends, which are usually unequally stout and simply rounded off. The large, stout rhabds generally have blunt, somewhat irregular, conic termini and are, just below the end, considerably thinner than the small slender rhabds. The measurements of five rhabds, tabulated below, indicate that these spicules are the more centrotyle and the more cylindrical the smaller they are, and *vice versa.*

RHABDS.

Length mm.	Tyle		Thickness		
	transverse diameter μ	difference between transverse diameter of tyle and thickness of adjacent parts of the spicule	of the spicule close to the tyle, near the middle μ	of one end μ	of the other end μ
5	19	4	15	15	12
5	23	3	20	11	5
5.7	56	3	53	12	8
6.3	53	1	52	18	14
19	80	0 (no tyle)	80	5	4

The ends of the rhabds are, for a short distance, covered with small spines. Apart from this these spicules are smooth. The spiculation of the end-parts is more conspicuous in the small than in the large rhabds.

The (hypodermal and hypogastral) *pentactines* (Plate 13, figs. 10, 12, 13, 16b) have an apical (proximal) ray 0.6–1 mm. long, and lateral (paratangential) rays 400–800 μ. The lateral rays of the same spicule are more or less unequal, the longest usually being 150–250 μ longer than the shortest. All the rays are straight, conic, blunt, and 20–40 μ thick at the base. The end-parts of the lateral rays bear quite numerous sharp-pointed spines. Proximally these spines become more blunt, lower, and less numerous, and they pass gradually into slight, hardly perceptible, flattened protuberances, finally disappearing altogether. The proximal parts of the lateral rays are smooth.

Pentactines with very long apical rays (Plate 13, figs. 9, 16a) have also been observed. The apical (proximal) ray is in these spicules 3–9 mm. long. The lateral rays are usually broken; one intact one (Plate 13, fig. 9) was 1.85 mm. long and curved. These spicules may be foreign. Some of them are strongly corroded.

A few *large sword-like hexactines* with the rays of one axis differently developed from the rays of the other two axes have also been observed. The two rays in the differentiated axis represent the blade and the handle of the sword. The former is very long and broken off in the spicules observed. The latter is 165 μ long and covered with spines. At the base it is 24–30 μ thick and either cylindrical or terminally thickened, club-shaped. The other four rays, which represent the guard of the sword, appear to be long and equal among themselves. They were all broken off in the sword-like hexactine observed. These spicules seem to take part in the formation of the skeleton of the stalk; it is possible, however, that they are foreign.

The *small hexactines and hexactine-derivates* (Plate 12, figs. 24–34; Plate 13, figs. 5c, 28) always have fairly straight rays, but are, apart from this, remarkably variable and irregular. In the first place the angles between adjacent rays are not, as is generally the case in hexactinellid spicules, invariably 90°. In a good many of the tetractine (stauractine) (Plate 12, fig. 33), the triactine, and particularly the diactine (Plate 12, fig. 26; Plate 13, fig. 5c) forms, other than right angles are enclosed by them. This angular irregularity is particularly pronounced in some diactines which appear as variously opened compasses (Plate 12, fig. 26; Plate 13, fig. 5c). In the second place one to five of the rays may be reduced to mere terminally rounded protuberances arising from the centre of the spicule. Finally the reduced rays and, to a certain extent, also the fully developed rays of the same spicules are frequently unequal among themselves. In spite of this variability there are, however, absolutely no transitions between the reduced and the properly developed rays.

These hexactines and hexactine-derivates measure 134–318 μ in total diameter. Their fully developed rays are 83–180 μ long and 5–14 μ thick at the base. They are usually regularly conic and sharp-pointed, rarely cylindro-conic and somewhat blunt. The reduced rays are 6–25 μ long, 7–16 μ thick, cylindrical, and terminally rounded. The length and thickness of the properly developed rays is, as the subjoined table shows, in the monactine to pentactine forms in inverse proportion to their number. The hexactine forms apparently do not conform to this rule. Since, however, the state of preservation of the specimen renders it impossible to ascertain clearly whether the not numerous larger hexactines are choanosomal or superficial, it might be assumed that these large hexactines are choanosomal spicules and do not belong to the series represented by the dermals and gastrals, to which that rule applies. The small hexactines conform to the rule, and some at least of these are certainly superficial.

HEXACTINES AND PENTACTINE TO MONACTINE HEXACTINE-DERIVATES.

Number	Fully developed rays			
	Length		Basal thickness	
	limits μ	average of the longest three μ	limits μ	average of the thickest three μ
6	83–140	132	5–10	9
5	90–118	114	5–9	8
4	95–125	120	6–9	8
3	100–142	141	5–11	10
2	105–160	152	6–11	10
1	123–190	185	10–14	13

Both the fully developed and the reduced rays are covered with spines. On the basal parts of the fully developed rays the spines are somewhat sparse and here they arise vertically. On their distal parts the spines are more numerous and here they point obliquely outward. The extreme tip of the ray is usually free from spines for a distance of 4 or 5 μ. The spines are conic, sharp-pointed, and 0.5–2 μ high. Their size is in proportion to the thickness of the ray from which they arise, the stoutest rays bearing the largest spines.

The cylindrical, terminally rounded, more or less knob-like, reduced rays are covered with similar spines, which are either similarly distributed as on the fully developed rays or more crowded.

It has been stated above that some of the fully developed rays are more cylindroconic and less sharply pointed than the great majority of rays. Such blunt rays have only been observed in the hexactines and pentactines, and it is always the distal protruding ray of these spicules which exhibits this peculiarity. This differentiation is interesting, since it would, if further developed and associated with an increase in the size of the spines, convert these superficial hexactines and pentactines into pinules.

The *onychhexasters* (Plate 13, figs. 6b, 15b, 27) measure 86–135 μ in total diameter. Their main-rays, which are regularly arranged and enclose angles of 90° with their neighbours, are 5–8 μ long, thickened at both ends, and, in the middle, where thinnest, 2–3 μ in transverse diameter. From the end of each main-ray several, most frequently four, branch-rays arise. These are considerably curved, convex to the centre of the spicule, at the base, but soon straighten out, often, however, exhibiting slight bends farther on. They are 48–60 μ long, 1.3–2 μ thick at the base, and gradually attenuated to 0.3–0.6 μ at the end. They bear along their length sparse, minute, backwardly directed spines, and on their ends two to four, most frequently three, slender terminal spines, 3–5 μ long. These usually enclose angles of 90–120° with the end-ray, and are curved, concave towards the centre of the spicule, or nearly straight. They generally arise from the same point, quite terminally, and form a verticil. Sometimes, however, one is situated a little below the end of the end-ray.

All the *discohexasters* (Plate 13, figs. 1–4, 5a, 6a, 15a, 17–26) have very much the same shape, but they differ quite considerably in regard to their size and the number of their end-rays. I measured 22 of them and found that

0	was under	80
2	were	81–100
6	"	101–120
3	"	121–140
0	was	141–160
2	were	161–180
6	"	181–200
3	"	201–220
0	was	over 221 μ

in total diameter.

This gives the following frequency-curve (Fig. 3).

From this remarkably regular double curve I conclude that two kinds of discohexasters are to be distinguished, a large kind over 150 μ in diameter and a small kind under 150 μ.

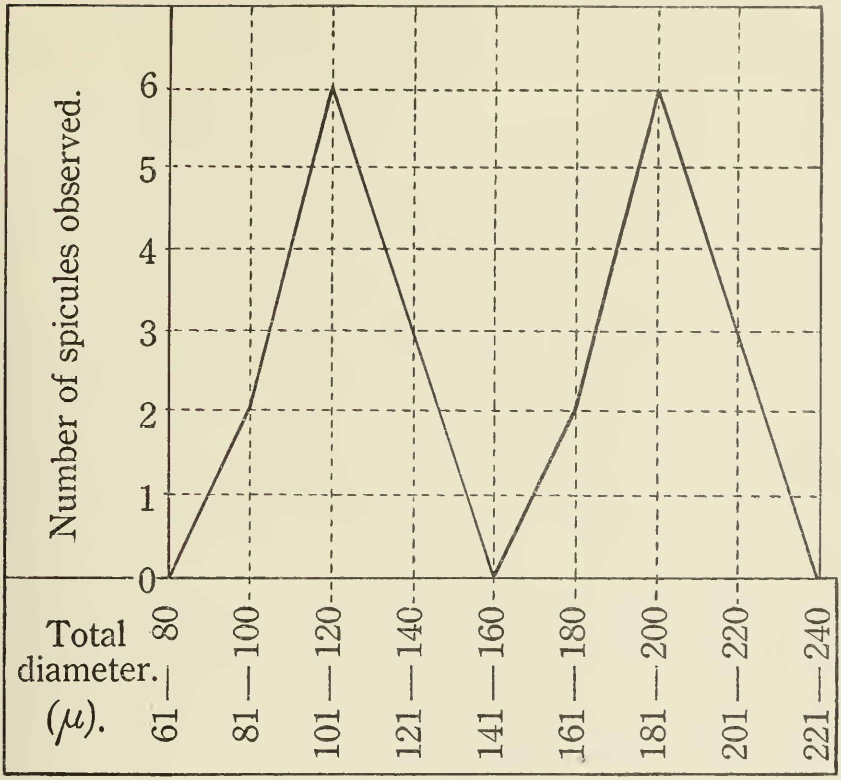

Fig. 3.— Discohexasters.

The *large discohexasters* measure 165–220 μ in total diameter. Their main-rays, which are regularly arranged and enclose angles of 90° with their neighbours, are 8–10 μ long and 4.5–7 μ thick. Each main-ray bears a terminal verticil of usually four end-rays, which arise steeply from the main-rays, but at once curve outwards, and are quite straight, apart from the short, curved, basal part. The basal curvature is such that the distal straight and middle-parts of all the end-rays become fairly concentric with the centre of the spicule, and also fairly equidistant; the whole discohexaster in consequence appearing as a quite regular rosette. The end-rays are 90–105 μ long and 3.5–6 μ thick at the base. They are attenuated distally and are 1.5–3 μ thick at their thinnest point, a short distance below the end. From here they again thicken and measure, at the end itself, 3–5 μ in transverse diameter. Below the thinnest point the end-rays bear minute backwardly directed spines. The spines are rather sparse at the base of the ray but become very numerous distally towards its thinnest point.

The distal part of the end-rays, beyond the thinnest point, is smooth. At the end each end-ray bears a verticil of seven large anchor-teeth, like recurved spines with a maximum length of 11 μ. The basal parts of these terminal spines coalesce to form a kind of convex terminal disc. The transverse diameter of these terminal spine-verticils is 12–16 μ. The constancy of the number (seven) of these terminal spines seems very remarkable, since this number is apparently in no way connected either with the triaxon (hexactine) ground plan of all hexactinellid spicules, or the physical (crystallographic) properties of the silica of which they consist.

The *small discohexasters* differ from the large ones described above only in regard to their size and the number of their end-rays. They measure 82–140 μ in total diameter, and have main-rays 5–8 μ long and 2.7–5 μ thick. Each main-ray usually bears seven or eight end-rays 36–62 μ in length. These measure in thickness 1.5–3 μ at the base, and 0.5–1.2 μ at the thinnest point near the end, and 1–1.5 μ at the end itself. The terminal spine-verticils measure 6–11 μ in transverse diameter.

The *plumicomes* (Plate **12**, figs. 21–23) have a central thickening about 3.5 μ in diameter and regularly arranged main-rays, enclosing angles of 90° with their neighbours. The proximal part of the main-rays is cylindrical, and 1–1.5 μ thick. Near their end they are thickened to an oval knob, 2–3 μ in transverse diameter, from which the end-rays arise. A terminal cylindrical rod, 0.8–1.4 μ thick, 2–4 μ long, and rounded at the end, arises from each knob. This rod, which lies in line with the proximal part of the main-ray, appears as its termination. The total length of the main-rays (including the terminal rod) is 10–14 μ. The end-rays, of which there may be about twenty on each main-ray, are curved in an S-shaped manner, and are 30–40 μ long.

The *irregular discohexasters* with primary and secondary end-rays (Plate **12**, fig. 20) are very rare. I found only three. These spicules may be malformed discohexasters. Since, however, the three observed are very much alike and since no intermediate forms connect them with the other hexaster-forms, they may also be spicules *sui generis*.

They measure 120–140 μ in total diameter. Their main-rays, which are regularly arranged and enclose angles of 90° with their neighbours, are 5–11 μ long and 3–7 μ thick. Each main-ray bears two or three basally curved, but for the greater part of their length fairly straight, strongly spined, primary end-rays. These are 50–60 μ long, 3–4 μ thick at the base, and about 2 μ at the end. The ends of many of them are divided into short and stout, irregularly bent, transverse branches. Slender secondary end-rays 8–17 μ long arise from the sides and ends of the primary end-rays and their terminal branches. The basal parts of these are directed obliquely backwards towards the centre of the spicule, but they at once curve strongly outward, their distal and middle-parts being fairly straight and directed obliquely outwards. Each of these secondary end-rays bears a terminal verticil of relatively large, recurved spines, which appears as a terminal disc with strongly serrated margin. These terminal spine-verticils, which measure as much as 10 μ in transverse diameter, closely resemble the terminal spine-verticils of the discohexasters above described. In examining these remarkable spicules I gained the impression that their secondary end-rays, the basal parts of which are in exactly the same position relative to the primary end-rays as the spines, might be considered as hypertrophic spines.

The *amphiasters*, which, as stated above, I believe to be foreign, have a shaft about 13 μ long and 1.2 μ thick, from each end of which arise three branch-rays, sometimes 23 μ long. These branch-rays bear secondary branches at the end.

The known species most closely allied to the sponge described above are *Mellonympha velata* (Wyv. Thoms.), *Lanuginella pupa* O. Schm., and certain rossellinas. It differs from all these by its spiculation to such an extent, however, that a new species must be established for it. About this there can be no doubt. It is more difficult to decide in which genus this species should be placed. Is it to be assigned to one of the already established genera and if so to which one, or is a new genus to be established for it?

In regard to its internal microscleres and to its large pentactines *Lanugonychia flabellum* resembles most closely *Mellonympha velata*, the only species of Mellonympha. Since, however, its body is lamellar and thin, since its dermal spicules are reduced hexactines, mostly with only from one to four fully developed rays, since it is very doubtful whether the large pentactines observed in it protrude beyond the surface to form a veil, and since ordinary small, not protruding hypodermal pentactines certainly occur in it, I hardly think it advisable to place it in the same genus as this ovoid sponge with its large, freely protruding velar hypodermal pentactines and its pentactine dermals.

Lanuginella pupa, the only species of Lanuginella, although also differing from Lanugonychia very considerably in shape, resembles it more closely in regard to its dermal and gastral spicules. It is, however, destitute of onychhexasters, spicules which are very abundant in *Lanugonychia flabellum*. Ijima [1]

[1] *I. Ijima.* Studies on the Hexactinellida. IV. Journ. Coll. sci. Tokyo, 1904, **18**, p. 12.

has indeed observed small and delicate oxyhexaster-like spicules in rare instances in *Lanuginella pupa*. Since, however, he considers these spicules as young stages of the discohexasters, this observation does not invalidate the correctness of F. E. Schulze's statement [1] that the absence of onychhexasters (to which kind of spicules F. E. Schulze considers the onychhexasters to belong) is characteristic of Lanuginella. There being therefore no reason for altering this characteristic of Lanuginella I accept it and am consequently unable to place the sponge above described in Lanuginella.

Since the otherwise similar species of Rossellinae differ from *Lanugonychia flabellum* by the absence of plumicomes, and since F. E. Schulze and I. Ijima consider the absence or presence of plumicomes in the Rossellidae as a difference sufficient for generic distinction, I do not think it advisable to place *Lanugonychia flabellum* in any of the described genera. As it seems to be most closely allied to Lanuginella and as it differs from this genus chiefly in that it possesses onychhexasters, I propose Lanugonychia, the type and, at present, only species of which is the *Lanugonychia flabellum*.

Acanthascinae F. E. Schulze.

Rossellidae with discoctasters.

The collection contains one specimen of this subfamily, a new species of Staurocalyptus.

STAUROCALYPTUS Ijima.

Rossellidae (Acanthascinae) with oxyhexasters, small discohexasters, and discoctasters, and with hypodermal pentactines the lateral rays of which are destitute of long curved spines.

Staurocalyptus hamatus, sp. nov.

Plate 16, figs. 25–43; Plate 17, figs. 1–25; Plate 18, figs. 1–14.

One specimen of this species was trawled at Station 4642 on 7 November, 1904; 1° 30.5′ S., 89° 35′ W.; depth 549 m. (300 f.); the bottom was composed of broken Globigerina and molluscan shells; the bottom-temperature was 48.6°. It is characterised by the possession of numerous oxyhexactines and a few hemioxyhexasters with hook-like rays (end-rays). To this the name refers.

Shape and size. The specimen has the shape of a shallow, inverted cup.

[1] *F. E. Schulze.* Revision des systemes der Asconematiden und Rosselliden. Sitzungsb. Akad. Berlin, 1897, p. 548.

Its lower, concave side fits the dorsal side of a crustacean, apparently a species of Dicranodromia, which firmly holds the sponge on its back by the dorsally directed, last pair of thoracic extremities. In its original position the sponge completely covered the Dicranodromia dorsally (Plate 18, fig. 14). Seen from above (Plate 18, fig. 5) or below (Plate 18, fig. 6) the sponge appears oval in outline, with a protuberance at one end. It is 35 mm. long and 28 mm. broad. The wall of the inverted cup, formed by it, is about 3 mm. thick. Scattered pores are observed both on the free upper convex side and the lower concave side which rested on the back of the Dicranodromia. Those of the upper side are mostly oval, with a maximum measurement of 1 mm. in length and 0.5 in breadth. Those of the lower side are relatively broader, more nearly circular, and reach 1.5 mm. in diameter. Large prostal rhabds protrude both from the upper and the lower side.

The *colour* in spirit is light brown.

General structure. I found a few remnants of a dermal membrane both on the concave, lower, and the marginal part of the convex, upper side. Of a gastral membrane no trace could be detected. The remnants of the soft parts in the interior indicate that the sponge has sac-shaped flagellate chambers, 80–100 μ long and 50–70 μ broad.

Skeleton. Spicule-bundles, 40–200 μ thick, traverse the sponge. These bundles appear to be most numerous just below the lower, concave face of the sponge, where they extend chiefly paratangentially. They are composed of rhabds — of small rhabds only, or of a large rhabd accompanied and more or less enveloped by numerous, comital, small rhabds. Besides the rhabds forming the bundles, isolated rhabds also occur in large numbers. Oxyhexasters, hemioxyhexasters, and oxyhexactines with straight rays and end-rays, oxyhexactines with terminally curved, hook-like rays, and discoctasters of various size are very numerous. The last appear to be much more frequent in the interior than near the surface of the sponge. Small discohexasters, and hemioxyhexasters with rays, either all hook-like or partly hook-like and partly straight, are met with in smaller numbers. Hypodermal pentactines and a few triactine megascleres occur at, or just below, the surface. On those parts of the surface where remnants of the dermal membrane are left, spiny rhabds are observed. Most of these are simple diactine rhabds. Some are centrotyle, and a few possess, besides the two properly developed rays, short rudiments of one or two further rays. These spicules and a few angular diactines and stauractines, similar in regard to size and spinulation, found in the spicule-preparations, I consider as the dermal spicules of the sponge. Spicules which might be considered as gastrals were not observed.

The *choanosomal and prostal rhabds* (Plate 16, figs. 25–38, 39a, b; Plate 18, fig. 13) are usually more or less curved, and exceedingly variable in size. They are 0.67–13 mm. long, and 5–175 μ thick at the thickest point. The rhabds under 3 mm. in length are less than 50 μ thick, those 3–9 mm. in length are 40–100 μ thick, those over 9 mm. in length, usually 100–160 μ. Although there is, as this shows, on the whole, a certain correlation between thickness and length, the proportion between these two dimensions is nevertheless very far from being constant and varies between 50 to 1 and 122 to 1. The thickest point of the rhabd may be situated at or near the middle of its length (Plate 16, figs. 29, 39a), or it may be more (Plate 16, fig. 30) or less (Plate 16, fig. 34) approximated to one of the ends. A tyle is met with only exceptionally. It is, when present, in the small rhabds 4–6 μ more in transverse diameter than the adjacent parts of the spicule, and may be situated near the middle or nearer one end. Occasionally it lies quite terminally, in which case the spicule appears as a tylostyle. In the large rhabds the axial thread is usually somewhat thickened (Plate 16, fig. 36) at several points, but an axial cross can only rarely be made out. In the small rhabds an axial cross can generally be found. When a tyle is developed the axial cross generally lies in its centre. In the large rhabds the two rays taper towards the end and are usually abruptly and bluntly pointed (Plate 16, figs. 27, 33, 35, 37), rarely rounded or sharp-pointed. In these spicules the ends are $\frac{1}{50}$–$\frac{1}{3}$ as thick as the thickest portion of the middle-part. In the small rhabds the ends are cylindroconic or quite cylindrical and terminally either abruptly and bluntly pointed, like the ends of the larger rhabds (Plate 16, fig. 26), or more rounded (Plate 16, figs. 25, 27). In these spicules the ends are from half as thick to quite as thick as, or even slightly thicker than, the thickest portion of the middle-part. In the rhabds in which the thickest part lies near one end, this end is conic and stout (Plate 16, fig. 33), the other being cylindrical and slender (Plate 16, fig. 31).

The whole of the rhabd, with the exception of the two ends, is smooth. The ends are covered with broad, conic, vertically arising spines 0.5–1 μ, rarely 2 μ long. The terminal spiny region is 40–230 μ long and passes, as the spines become scarcer and lower, gradually into the smooth middle-part of the spicule.

In some of the rhabds an abrupt step-like attenuation occurs at a shorter or longer distance from one of the ends. Of other rhabd-irregularities noticed I mention slight transverse grooves which give to the contour an indented appearance. As the figure (Plate 18, fig. 13) of such a spicule clearly shows, these indentures are not restricted to the outer surface but affect the whole of its superficial, clearly stratified part, down to the more homogeneous central part, the surface of which also shows the indentures.

The *hypodermal pentactines* (Plate 18, figs. 8–10) have a straight or slightly curved proximal ray, which is 0.5–2.2 mm. long and 9–22 μ thick at the base. The lateral rays are vertical to the proximal ray and in the same spicule often unequal, the longest being 120–210 μ, the shortest 80–170 μ long. All these rays are blunt. The tips of the lateral rays are spiny.

A *triactine* with one longer and two shorter rays, opposite in the same straight line (axis), which enclosed an angle of 70° with the axis of the long ray was observed in the spicule-preparations. The long ray of this spicule was 860 μ long, the two short rays were 260 and 280 μ. The distal parts of all the rays were spined.

The *dermal spicules* (Plate 16, figs. 40–43) are usually simple, straight or slightly curved, diactine rhabds (Plate 16, figs. 42, 43), 335–470 μ long, and 7–13 μ thick at the thickest point, which is usually situated near the middle. An axial cross can usually be discerned at or near the middle. The two rays are cylindroconic and terminally rounded. Their ends are usually a half to a third as thick as the thickest portion of the middle-part of the spicule. Sometimes, however, they are thinner than that, down to a quarter of the maximum thickness of the middle, or thicker, up to nine tenths of this, or even slightly more. The two ends of the same spicule are usually somewhat unequal, one being 1 μ or so thicker than the other. The whole spicule is covered with conic, vertically arising spines, 0.5–2 μ long. The spines are more numerous at the ends than in the middle. This difference in the degree of spinulation of the different parts is the more clearly pronounced the longer the spicule is.

Besides these simple diactine dermal rhabds similar ones with a tyle, situated either more or less centrally or, rarely, terminally, are met with. The tyle may be a simple thickening, and concentric with the axis of the spicule, or it may be one sided (Plate 16, fig. 41), or composed of two protuberances (Plate 16, fig. 40). These protuberances, which are obviously ray-rudiments, are up to 10 μ long and covered with spines like the other parts of the spicule.

I found in the spicule-preparations a few tetractines (stauractines) and angularly bent diactines with rays similar in regard to their spinulation to those of the rhabds above described. The former have rather unequal rays 160–230 μ long and 9–10 μ thick at the base. One of the latter had rays 48 μ long, 8 μ thick at the base, and 5 μ at the end.

The *oxyhexasters, hemioxyhexasters*, and *oxyhexactines with straight rays*

(Plate 16, fig. 39c; Plate 17, figs. 5–8, 9b, 10b) measure 96–165 μ in diameter and have from one to four end-rays. The forms with partly simple and partly bifurcated rays, that is the hemioxyhexasters with two end-rays on the branched main-rays, appear to be the most frequent. The true oxyhexasters usually have two or three, rarely three or four end-rays. The size of the spicule is, on the whole, in inverse proportion to the number of end-rays. The oxyhexactines and the hemioxyhexasters and oxyhexasters with two end-rays are 110–165 μ in diameter, the oxyhexasters with more than two end-rays on all or some of the main-rays 96–130 μ in diameter. The main-rays (and simple end-rays) enclose angles of 90° with their neighbours. The simple rays are 54–84 μ long, 3–4.5 μ thick at the base, and conic. Their end is very slender and they terminate in an exceedingly fine point. The basal part of the ray is for a short distance smooth. Farther on it bears slender, straight, very oblique spines, which point backwards towards the centre of the spicule. The proximal spines are the largest and attain 1 μ in length. Farther on they rapidly become smaller and on the distal part of the ray no spines at all can be detected. This decrease of the size of the spines towards the ray-end is either gradual throughout, or there is a step-like, abrupt decrease a short way up. The rays of these spicules, particularly those in which there is such an abrupt decrease of the size of the spines, resemble the threads of exploded cnidoblasts of certain hydroids. I consider these simple rays as main-rays with a single end-ray; their proximal smooth part is their main-ray, their middle and distal spined part, their end-ray. The main-rays which bear end-rays are smooth and very short, only 4–8 μ long, and 3–5.5 μ thick. The end-rays arise very steeply, often nearly vertically, from the main-rays and at once curve outwards, so that their nearly straight distal and middle-parts enclose angles of 30–35° with the continuation of the main-ray axis. Apart from their basal curvature these end-rays resemble in shape and spinulation the middle and distal spined part of the simple rays above described. The end-rays are spined quite down to the base, are 37–75 μ long and 2.5–4 μ thick at the base.

Rarely hemioxyhexasters are met with some rays (end-rays) straight and others hook-like (Plate 17, fig. 4). These spicules appear as *transitions* between the straight-rayed spicules described above and the spicules with hook-like rays to be described below. The transitional hemioxyhexaster represented (Plate 17, fig. 4) measures 170 μ in diameter, has two hook-like simple rays, two straight simple rays, and one main-ray with two straight end-rays.

The *oxyhexactines with hook-like rays* (Plate 16, fig. 39d; Plate 17, figs. 1–3, 10c) measure 140–227 μ in diameter. The rays of the same spicule may be equal or unequal. The rays are, measured along the chord, 75–120 μ long, and 2.5–8 μ thick at the base. They are conic and gradually attenuated to a fine point. The proximal parts of the rays are straight and regularly arranged so as to enclose angles of 90° with their neighbours. At a distance from the centre usually equal to from one half to three quarters of the length of the chord of the whole ray, the rays begin to curve either gradually or more often abruptly with a distinct angular bend. The distal part of the ray, beyond this point, is uniformly curved through an angle of at least 90°, usually more. Sometimes the curvature is so great that the end points directly backwards and the end-tangent becomes nearly parallel to the axis of the basal part of the ray (Plate 17, fig. 1). Exceptionally the curved end-part forms nearly a whole turn (Plate 17, fig. 10c, the upper ray). In such cases it is clearly to be seen that the curvature is spiral, and it seems probable that it is of this nature also in those cases where the curved part of the ray is shorter, and the true nature of its curvature not so clearly discernible.

Like the simple rays of the straight-rayed hemioxyhexasters and oxyhexactines described above, the rays of these spicules are smooth at the base, and farther on covered with slender, oblique, backwardly directed spines, which decrease in size distally, so that the end-part appears merely roughened or nearly smooth.

Of *hemioxyhexasters with hook-like rays* I found only two or three. These had one bifurcate and five simple rays. One of these spicules measured 210 μ in diameter; its simple rays were 3 μ thick at the base.

The *small discohexasters* (Plate 17, fig. 10e; Plate 18, figs. 1–4, 7, 11b, 12b) measure 20–23 μ in total diameter. The main-rays of the same spicule are equal and enclose angles of 90° with their neighbours. A central thickening, 3–4 μ in diameter, can clearly be made out. The main-rays are smooth, 3.5–4.5 μ long, 1.2–1.6 μ thick in the middle, and thickened at both ends, proximally to the centrum, distally to the somewhat extended base, from which the end-rays arise. Each main-ray bears about 16 end-rays. The end-rays are curved, concave to the continuation of the main-ray axis, quite considerably at the base, but only very slightly, or not at all, towards the end. They are 7–8 μ long, about 0.2 μ thick at the base, and attenuated towards the end, which bears a thickening about 0.8 μ in transverse diameter. This terminal thickening is certainly broader than high and convex on the outer side. However, in consequence of its small size more cannot be made out about its shape. This thickening may be, and, judging by analogy, probably is, a verticil of terminal, recurved spines.

The *discoctasters* (Plate 16, fig. 39e; Plate 17, figs. 9d, 10d, 11, 12, 13d, 14–25) measure 58–320 μ in diameter, usually 70–260 μ. They consist of six short and stout main-rays, each of which bears several, in the regular forms, four end-rays. Eight groups of three of these (24) end-rays, belonging to three different main-rays, usually coalesce to as many single rays, which are divided distally into verticils of about six terminal branches. The main-rays in the same spicule are equal and their axes enclose angles of 90° with those of their neighbours. They are distally rounded, 6.5–9 μ long and about as thick. The six main-rays together appear as a compact central body from which arise six dome-shaped protuberances, placed in the positions of the corners of an octahedron. Seen from above this structure appears, when standing upright (on a corner of the octahedron), as a cross with short stout arms (Plate 17, figs. 11, 19–23); when lying on one of the sides (of the octahedron) it is six-lobed in shape (Plate 17, figs. 16–18). The eight coalesced end-ray groups of three arise from the eight depressions between the dome-shaped tips of the main-rays, at points corresponding to the eight faces of the octahedron. These coalesced end-ray groups, which might be designated as pseudomain-rays, are 16–49 μ long and 3–10 μ thick. They are on the whole, cylindrical, but usually somewhat irregular, thickened here and there (Plate 17, figs. 14–16). The terminal branches of these pseudomain-rays, which may be designated as secondary end-rays, are slightly curved, convex to the continuation of the pseudomain-ray axis, and diverge from it at angles of 12–16°. They are 15–115 μ long, 0.7–2 μ thick at the base, and attenuated towards the end, where they measure 0.4–1.5 μ in transverse diameter. They bear, along their length, very obliquely situated, backwardly directed spines, which are sometimes 1.5 μ long and somewhat curved. Their end is crowned by a terminal verticil of similar but stouter and more divergent recurved spines, which together form a sort of terminal disc with serrated margin, 1–2.5 μ in transverse diameter (Plate 17, fig. 24).

The great differences in the size of the discoctasters is due chiefly to differences in the length of the secondary end-rays, 15 μ in the smallest, 115 μ in the largest, and to a small extent also to differences in the length of the pseudomain-rays, 16 μ in the smallest, 49 μ in the largest. The main-rays are in the largest discoctasters only 3 μ longer than in the smallest.

Not infrequently (Plate 17, figs. 13d, 14) a simple ray (end-ray), curved at the base and straight farther on, arises directly from the central mass composed of the main-rays, between the pseudomain-rays. These simple main-rays are 27–31 μ long, and 1.5–2 μ thick at the base. They are attenuated distally and provided with lateral spines and a terminal verticil ("disc") of such, like the secondary end-rays. I consider these simple rays as ordinary end-rays which have not coalesced with others to form pseudomain-rays and which are not divided distally into branches (secondary end-rays).

I am inclined to consider the specimen above described as the basal part of a higher, perhaps cup-shaped, sponge, the upper parts of which may have been either nipped off by the Dicranodromia, which used it as tent and shield, or torn off during capture.

Since hexactine megascleres are absent and since the sponge possesses hypodermal pentactines, mostly diactine spiny dermals, oxyhexasters, hemioxyhexasters, microoxyhexactines, small discohexasters, and discoctasters, I think there can be little doubt that it belongs to Staurocalyptus, although its gastral spicules are unknown. It differs from all the species of this genus hitherto described by the possession of oxyhexactines and hemioxyhexasters with hook-like rays. This and other minor differences necessitate the establishment of a new species for it.

EURETIDAE Zittel.

Hexasterophora the body of which is calyculate or composed of ramified or anastomosing, thin-walled tubes. With a firm reticulate supporting skeleton-net. Among the free spicules are always uncinates and either scopules or clavules. With oxyhexasters or discohexasters or both.

The collection contains nine more or less complete specimens and twenty fragments of this family. The generic position of two specimens and twelve fragments is doubtful. The others belong to the two genera Farrea and Eurete.

FARREA Bowerbank.

Euretidae with clavules, without scopules.

There are four more or less complete specimens which represent a new variety of *Farrea occa* Bowerbank. Eight fragments apparently belong to two distinct forms which, however, cannot be specifically determined.

Farrea occa scutella, var. nov.

Plate 25, figs. 25–29; Plate 26, figs. 1–21; Plate 27, figs. 1–17.

The collection contains four more or less fragmentary specimens of this sponge, all trawled off the southern coast of western Panama at Station 4621 on 21 October, 1914; 6° 36′ N., 81° 44′ W.; depth 1067 m. (581 f.); they grew on green mud and rock; the bottom-temperature was 40.5°.

They resemble portions of wine-glasses with stems. To this the name of the new variety refers.

Shape and size. From an extensive basal plate, which at one time was obviously attached to something hard on the sea-bottom, a short stem arises, which spreads out above to form a thin, curved, lamellar body (Plate **26**, figs. 16–21). One of the specimens has two basal plates and two stems (Plate **26**, figs. 18, 19). This is probably the product of a concrescence of two specimens, originally distinct, which grew side by side.

The basal plate measures 5–17 mm. in maximum transverse diameter, is 1–2 mm. thick near the middle, and thins out towards the somewhat irregular lobose margin. The stem is 4–7 mm. broad and 2–3 mm. high. It consists of a vertical curved lamella, about 1 mm. thick, which appears as a portion of the wall of an upright cylindrical tube cut through longitudinally or obliquely. Above it is generally curved outward and abruptly extended into the lamella which forms the body proper of the sponge. This lamella is elegantly curved in a cylindroid or saddle-shaped manner and at the base, where it arises from the stem, is about 1 mm. thick. Towards the margin it gradually thins out. In all the specimens this lamella is more or less fragmentary. In the largest it is 19 mm. long and 18 mm. broad, measured along the chord.

The *colour* in spirit is light brown.

The *skeleton* consists of a network and loose hexactines, pentactines, uncinates, oxyhexasters, clavules with large teeth, and clavules with small teeth.

The *skeleton-net* (Plate **25**, figs. 25, 27–29; Plate **26**, figs. 8–14, 16–21) pervades all parts of the sponge. On the lower side of the basal plate (Plate **26**, figs. 10, 11) it is very dense and consists of smooth beams, 8–20 μ thick, which enclose round meshes 10–40 μ in diameter, so that this part of it appears as a perforated plate. On the upper side of the basal plate and in the stem (Plate **26**, figs. 12, 13) it is composed of more or less spiny beams, 6–35 μ thick, which enclose irregular, square, or triangular meshes 30–180 μ wide. In this region numerous small hexactines are attached to the beams of the network (Plate **25**, figs. 25, 27–29; Plate **26**, figs. 12, 13) with one thickened ray. These attached tree-like hexactines are 75–135 μ high. In some places other similar hexactines are soldered to these attached ones, whereby rudiments of a slender secondary network are here and there formed. In the proximal part of the lamellar body proper of the sponge the skeleton-net consists of an inner, regular layer with square, rectangular meshes (Plate **26**, fig. 17), and an outer, irregular layer, with chiefly triangular meshes (Plate **26**, fig. 16). The marginal and middle-parts of the skeleton-net of the body-lamella (Plate **26**, figs. 8, 9, 14) consist of a single layer composed of longitudinal and transverse beams. The former are in some places curved, in others straight, and spread out towards the margin of the lamella in a fan-shaped manner. Here and there they divide into two equal branches, which, at first, diverge at an angle of about 30°, but very soon become parallel; thus the number of the longitudinal beams increases towards the margin of the body-lamella. The transverse beams are vertical to the longitudinal ones and accordingly also in some places curved, in others straight. All the beams of this network are quite smooth. The longitudinal ones are mostly 73–80 μ thick, the transverse 75–90 μ. The meshes are mostly square and rectangular, more rarely quadratic, and exceptionally (where the longitudinal beams branch) triangular. The rectangular ones are 280–510 μ long and 200–400 μ broad. In some places this network is remarkably regular (Plate **26**, fig. 8). From each node of this network two thorns, 32–45 μ thick at the base, arise in opposite directions. Both are vertical to the surface in which the network extends. One is directed dermally, the other gastrally. These thorns are fairly straight, either conic or thickened near the end, and covered with protuberances. At the base these thorns are broad, rounded, and 6–8 μ high; towards the end they become smaller and much more slender.

Of the *loose spicules* the uncinates and clavules with short teeth are very rare and also the hexactines rather scarce. The other kinds of loose spicules, particularly the oxyhexasters, are abundant (Plate **26**, fig. 8). The fragmentary condition of the specimens renders it difficult to ascertain the position of these spicules in the sponge. I can say, however, that there is no reason to assume that they are arranged otherwise than in the type of this species where their position has been described by Schulze.[1]

The loose *hexactines* (Plate **25**, fig. 26) are 110–190 μ in total diameter, and have straight, conic, spined rays usually 3.5–4 μ thick at the base.

The *pentactines* (Plate **26**, figs. 8a, 15; Plate **27**, fig. 6a) have regularly arranged lateral rays, usually 180–255 μ long. The lateral rays of the same spicule are as a rule somewhat unequal. The difference in length between the longest and shortest is usually 15–30 μ. Very rarely one lateral ray is greatly reduced in length, only 120 μ long, and terminally thickened. When that is the case this difference is of course much greater. The lateral rays are straight or, more frequently, slightly and uniformly curved, concave to the proximal ray.

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 277 ff., pl. 71–73, 76, figs. 1–3.

They are on the whole cylindroconic, about 9 μ thick at the base, and attenuated distally to 4–6 μ. The end is rounded off. Frequently a slight thickening is observed just before the end. The lateral rays are spiny. On the basal and middle-part of the rays the spines are 2–4 μ high and arise vertically; on the end-part they are 1–1.5 μ high and obliquely inclined towards the end of the ray. The spines of the lateral rays are larger in the dermal pentactines than in the gastral. In the former they are larger and much more numerous on the outer side of the rays than elsewhere, the inner side being often nearly destitute of spines. On the lateral rays of the gastral pentactines the concentration of spines on the outer side is not so pronounced. The axial thread traverses the lateral rays quite to their ends. The proximal ray is straight, 180–260 μ long, and usually bears only small spines near the end. In most of the pentactines, particularly the dermal ones, a rudiment of the sixth distal ray is present. This is 14–17 μ long, and as thick as the other rays. It bears a few large, upwardly directed spines. Sometimes only a single terminal spine is present. In this case the distal ray (together with the spine) appears a sharp-pointed, conic thorn.

The *uncinates* are very rare and I cannot positively assert that those observed in the preparations really belong to the sponge. An intact one was straight, pointed at both ends, and measured 1.6 mm. long and 10 μ thick near the middle. Its spines were slender and 8 μ long.

The *oxyhexasters* (Plate **26**, figs. 1–7, 8c; Plate **27**, fig. 6c) are 105–140 μ in total diameter. Their main-rays enclose angles of 90° with each other and are, in the same spicule, usually equal; sometimes, however, considerable inequalities are observed in them, the proportion of the length of the shortest to that of the longest sometimes being 3:5. The main-rays are 22–37 μ long, straight, cylindroconic, 2.8–3.8 μ thick at the base, and attenuated distally to 2–2.7 μ. They are perfectly smooth and traversed by an axial thread, which terminates below the end and does not give off branches for the end-rays. Of end-rays there are one to four, usually two or three. The end-rays are slightly curved, concave to the continuation of the main-ray at the base, and farther on usually fairly straight, rarely considerably and irregularly curved. They are conic, uniformly attenuated to a fine point, 30–44 μ long, 1.3–2.2 μ thick at the base, destitute of axial threads, and, like the main-rays, perfectly smooth. When only one end-ray is present, it extends in the continuation of the axis of the main-ray to which it belongs. When there are two they usually enclose an angle of about 60° and lie in or near a plane which passes through the main-ray from which they arise. The planes in which such end-rays extend are usually oblique to the two axial planes, passing through the axis to which these forks belong and either of the two other axes of the spicule. The end-ray forks of opposite main-rays do not lie in the same plane. As far as I could make out the planes of such forks are opposite, and usually symmetrical, in such manner that the angle enclosed by them with either of the two axial planes above mentioned are supplementary; added together they give 180°. When there are three or four end-rays the most divergent usually enclose an angle of about 90°.

The *clavules with large teeth* (Plate 27, figs. 1–5, 6b, 7–11, 13–17) are generally 300–370 μ long; a few are shorter, down to 210 μ in length. They consist of a centrum, from the lower end of which there arises a shaft, and from the opposite, upper end of which arises a verticil of recurved teeth. The centrum is a short cylinder, 6.5–12.5 μ, usually 9–12 μ, in transverse diameter, which generally bears one or a few spines at its lower end. These spines are oblique, inclined towards the shaft, and 0.5–2.3 μ long. Their size seems to be in inverse proportion to their number; the solitary ones are the largest. At the base, where it arises from the centrum, the shaft is 4–8 μ thick; its basal part is conic; farther on it becomes nearly cylindrical; just before the end it is 2.5–4.5 μ thick. The end is abruptly and bluntly pointed and frequently slightly thickened. The proximal and middle-parts of the shaft bear oblique spines, inclined towards its end. These spines are similar to those on the centrum, but smaller. The end-part bears stouter, vertical spines, 0.6–1.5 μ long. The number of these spines is variable. Their size appears to be in inverse proportion to their number. A smooth belt sometimes intervenes between the middle region with oblique, and the terminal region with vertical spines. There are usually nine, more rarely ten, recurved teeth which form the verticil at the upper, distal end of the centrum. They are fairly equal in the same spicule, and regularly arranged, the angle between adjacent ones being the same. The verticils formed by these teeth measure 39–53 μ in transverse diameter. The individual teeth are conic, 5–7 μ thick at the base, and uniformly attenuated towards the sharp-pointed end. They are uniformly curved, concave to the centrum, and their chords usually enclose angles of 55°–63° with the axis of the centrum and shaft. The teeth generally bear spines, sometimes 0.7 μ long, some distance below their ends. These spines are confined to a median line following the outer, convex side of the teeth. Usually they form short saw-like rows on the upper margin. Sometimes they are very conspicuous (Plate 27, figs. 13, 14), sometimes so small as to be hardly visible (Plate 27, figs. 16, 17). The apex of the tooth-verticil is generally smooth and dome-like (Plate 27, figs. 1–5, 6a, 7, 8, 11, 13, 14, 16, 17).

Sometimes a continuation of the shaft extends beyond it, forming an apical, distally rounded, smooth protuberance, 6–7 μ long and 4.5–6 μ thick (Plate **27**, figs. 9, 10, 15).

The rare *clavules with short teeth* (Plate **27**, fig. 12) are, apart from their teeth, similar to but smaller than the large-toothed ones above described. Their teeth are very short, hardly at all recurved, and the verticils formed by them only 18 μ in diameter. Whether these clavules are young forms of the large-toothed ones, or a distinct kind of spicule, I cannot say.

Their spiculation assigns these sponges to Farrea. Their shape, however, does not accord with F. E. Schulze's diagnosis [1] of the Euretidae to which Farrea belongs, for in this diagnosis it is stated that these sponges are tubular. E. Topsent [2], who has studied a sponge very similar to the one described above, says, concerning this part of Schulze's diagnosis, "Il ne faut évidemment pas prendre ce caractère trop à la lettre" and places these sponges of his, in spite of their non-tubular shape, in Farrea. I also am disinclined to attach any great systematic importance to that difference of shape and therefore also place the sponges above described in Farrea.

Of all the known species *Farrea occa* Bowerbank is obviously most closely related to them. A great many specimens, by no means identical in structure and appearance, have been assigned by various authors to this species, and for some of them distinct varieties and subspecies have been established by Topsent and Wilson. Although it seems to me very doubtful whether all the sponges assigned to *Farrea occa* are really specifically identical and belong to this species, and although I think that the forms described as varieties and subspecies of it might very well be considered as distinct species, I provisionally accept this arrangement, because it would lead much too far to reinvestigate all these sponges, and if we accept this arrangement, we must assign to this species so wide a range of variation that the sponges described above find a place in it. Among the sponges described as *Farrea occa,* those for which Topsent [3] established the variety *F. o.* var. *foliascens* are obviously most closely allied to *F. o.* var. *scutella*. From these they differ by the abundance of clavules, the scarcity and size (or absence, *vide supra*) of the uncinates, and the larger dimensions of the superficial pentactines. Although these differences are not very great, they are, in my opinion, quite sufficient for varietal distinction particularly

[1] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 177.

[2] *E. Topsent.* Farrea occa (Bowerbank) var. foliascens n. var. Bull. Mus. océanogr. Monaco, 1906, no. 83, p. 4.

[3] *E. Topsent.* *Loc. cit.*, 1906, p. 1.

when held together with the fact that the specimens of *F. o. foliascens* were trawled in the tropical Atlantic, whilst the sponges described above come from the eastern Pacific.

Farrea sp.?

Plate 32, figs. 1–3.

There are in the collection one large and three small fragments of skeleton-nets of this sponge, all trawled off the southern coast of western Panama, at Station 4631, 3 November, 1904; 6° 26′ N., 81° 49′ W.; depth 1415 m. (774 f.); they grew on green sand; the bottom-temperature was 38.0°.

The large fragment (Plate 32, fig. 1) is 36 mm. long and appears as a part of the skeleton-net of a tube nearly circular in transverse section and about 10 mm. wide. Very short branch-tubes about 6 mm. wide arise from this tube, which can be considered as a main-tube. Attached to both sides of this skeleton-net are portions of network which form short tubular covered ways about 3 mm. high and broad.

The *skeleton-net* (Plate 32, figs. 2, 3) of the main-tube and its branches forms a single layer and chiefly consists of smooth, longitudinal, and transverse beams, mostly 80–140 μ thick. Here and there a short oblique beam of similar thickness is observed. The meshes are mostly square, rectangular, 350–600 μ long, and 180–240 μ broad. A few are triangular. From each node of this network two thorns arise, one directed towards the inner gastral surface, the other towards the outer dermal surface. These thorns are conic, vertical to the surface, about 50 μ thick at the base, and covered with very blunt spines. The gastral ones attain a considerable length. The skeleton-net composing the walls and roofs of the covered ways above mentioned is irregular and has mostly triangular meshes.

A large number of hexactines 80–140 μ in diameter are attached, with one ray, to the beams of these networks. In places, other similar hexactines are soldered to these, forming here and there a fine net.

The sponges to which these skeleton-nets belonged can be assigned with a considerable degree of certainty to Farrea.

Farrea sp.?

There are in the collection four slightly curved, small fragments, the largest 19 mm. long, of simple skeleton-nets extending in two directions (one surface) only. These skeleton-nets were trawled in the southeastern Pacific, at Station

4685, on the 10 December, 1904. 21° 36.2′ S., 94° 56′ W.; depth 4033 m. (2205 f.); they grew on dark brown clay; the bottom-temperature was 35.3°.

These *skeleton-nets* are very regular and composed of smooth longitudinal and transverse beams, 40–60 μ thick, which enclose square rectangular meshes about 750 μ long and 200–350 μ broad.

The sponges to which these skeleton-nets belonged can be assigned with a considerable degree of certainty to Farrea.

EURETE Semper.

Euretidae composed of anastomosing tubes without central calyculate structure. With scopules, without clavules.

The collection contains three specimens of this genus which belong to three species, one of which is new.

Eurete erectum F. E. Schulze.

Plate 30, figs. 1–17; Plate 31, figs. 1–28.

Eurete erectum F. E. Schulze, Amerikanische Hexactinelliden, 1899, p. 72, taf. 17, figs. 1–3.
Eurete erectum subsp. *tubuliferum* H. V. Wilson, Mem. M. C. Z., 1904, **30**, p. 63, pl. 7, figs. 9, 12; pl. 8, figs. 1–3, 6.
Eurete erectum subsp. *gracile* H. V. Wilson, Mem. M. C. Z., 1904, **30**, p. 69, pl. 8, figs. 4, 5, 8, 9; pl. 9, figs. 1, 3, 5.

Two specimens of this species, a fairly complete larger and a fragmentary smaller one, were trawled off the southern coast of western Panama, at Station 4622 on 21 October, 1904; 6° 31′ N., 81° 44′ W.; depth 1067 m. (581 f.); they grew on green sand and rock.

Shape and size. The larger specimen (Plate **30**, fig. 16) is a tube with quite regular circular transverse section. This tube is slightly spirally twisted, 67 mm. long, and throughout about 14 mm. in (outside) diameter. Its wall is 1–1.5 mm. thick and perforated by seven apertures. These are circular, arranged in a regular spiral, about 10 mm. wide, and surrounded by slightly protruding rims. The rims are in some places 5 mm. high and above strongly curved outward. They appear as rudiments of wide calyculate branches of the main-tube. The smaller specimen is a fragment of a similar but wider tube. It is 30 mm. long and the main-tube, of which it formed a part, must have been about 17 mm. in diameter.

A thin, membranous alcyonarian colony, the outer surface of which extends in the level of the tips of the distal pinule-rays, covers large tracts of the outer dermal surface of the sponge.

The *colour* in spirit is light yellowish brown. When the tube-wall is observed by transmitted light, numerous small dark brown spots, about 1 mm. apart, make their appearance in it. These appear to be accumulations of deep-sea ooze in the bottoms of wide, vertical, sacular canals which lead from the outer surface into the deeper parts of the tube-wall.

Canal-system. The flagellate chambers (Plate **30**, figs. 7c, 10c, 17c) are spherical or short oval, and measure 60–80 μ in diameter.

Skeleton. A special dermal and a special gastral skeleton are developed besides the internal. The internal skeleton consists of a supporting network and loose spicules; the dermal and gastral skeletons are exclusively composed of loose spicules.

The supporting *skeleton-net* (Plate **30**, figs. 4–6, 10–12, 17; Plate **31**, fig. 24) appears as a lamella corresponding in shape to the tube-wall, but thinner than this. It is composed of smooth beams, 30–105 μ thick. In its outer part (Plate **30**, fig. 4) the meshes are irregular, mostly triangular, the larger ones generally a little under 200 μ wide. Its inner part (Plate **30**, figs. 6, 11) is more regular, composed chiefly of longitudinal and transverse beams enclosing square, rectangular meshes, mostly 370–400 μ long, and 170–400 μ broad. Here and there small hexactines, 80–120 μ in diameter, are attached vertically to the beams of the net by one of their rays. From both faces of the lamella formed by the skeleton-net large thorns protrude. These thorns arise from the superficial nodes of the net, point outwards, and are nearly vertical or, more rarely, oblique to the surface. They are straight or slightly curved, and quite regularly conic, pointed or, rarely, inflated at the end, and covered with broad and low, terminally rounded spines, which decrease in size distally. The thorns on the outer, dermal side (Plate **30**, figs. 7e, 10e) are mostly 140–340 μ long, and 20–50 μ thick at the base. The thorns on the inner, gastral side (Plate **31**, fig. 24g) are larger, 230–430 μ long, usually 270–400 μ, and 35–60 μ thick at the base.

The *loose spicules of the choanosome* are uncinates and discohexasters. The former are fairly abundant, the latter rather scarce.

The *dermal skeleton* is composed of hexactine pinules and small scopules. The dermal pinules are very numerous and form a continuous layer on the outer surface. Their lateral rays (Plate **30**, figs. 7a, 10a, 12a, 17a; Plate **31**, fig. 22) extend paratangentially and together form a network, usually with more or less quadratic meshes (Plate **31**, fig. 22). Their proximal and distal apical rays are situated radially (Plate **30**, figs. 7d, 10d, 12d, 17d). Their centres are on an average 130 μ apart. The dermal scopules are situated radially. Most of them lie below the pinule-layer and their end-ray bunches do not, as a rule, protrude beyond the surface. They are not numerous.

The *gastral skeleton* consists of hexactine pinules, regular and irregular, derivates of such with reduced distal apical (pinule) ray, and scopules. The pinules and pinule-derivates are very numerous and irregularly intermingled. They form, like the corresponding dermal spicules, a continuous superficial layer. Their lateral rays (Plate **30**, figs. 12b, 15b, 17b; Plate **31**, fig. 24b) extend paratangentially, their apical proximal and distal rays (Plate **30**, figs. 12h, 17h; Plate **31**, fig. 24h) radially. The gastral scopules are situated radially. Most of them protrude a considerable distance beyond the zone of the lateral pinule-rays, and the end-ray bunches of many lie at a considerably higher level than the tips of the distal pinule-rays. The gastral scopules are much more numerous than the dermal.

The *dermal pinules* (Plate **30**, figs. 7a, d, 10a, d, 12a, d, 17a, d; Plate **31**, figs. 2–5, 22) have a straight distal ray, 85–145 μ long, usually 105–140 μ, and at the base 8–18 μ thick, usually 10–12 μ. This ray is thickened above in a club-shaped manner and rounded distally. Its proximal part is smooth, its (thickened) middle- and end-parts covered with large spines. The maximal thickness of the distal ray (together with the spines) is 30–50 μ, usually 40–48 μ. The proximal spines are 5–8 μ long, and nearly vertical to the ray, directed only slightly upwards. Distally the spines increase in size and become more and more inclined towards the tip of the ray; those arising from its summit are parallel to its axis. Half way up the spines attain the largest size. Here they are 8–13 μ long. The proximal ray is usually straight. In its basal and middle-parts it is attenuated only slightly, at the end abruptly, towards the pointed end, like a Roman sword. It bears small spines near the end. The other parts of it are smooth. The proximal ray is 78–222 μ long, usually 110–200 μ, and at the base 6–13.5 μ thick, usually 7–11 μ. The lateral rays enclose angles of 90° with each other and are, in the same spicule, fairly equal. They are similar to the proximal ray in shape and spiculation, 108–152 μ long, usually 110–142 μ, and at the base 6.5–15 μ thick, usually 8–10 μ.

The *gastral pinules* (Plate **30**, figs. 1, 2, 9, 12h; Plate **31**, fig. 24h) have a straight distal ray, 70–130 μ long, and 11–17 μ thick at the base. Its proximal part is smooth, its middle- and end-parts covered with short spines 10–17 μ long. The number of these spines is variable and never great. Sometimes there are only a few. The spines point obliquely upward and are rather irregularly distributed. The fewer there are, the more marked does this irregularity of their arrangement become. The proximal ray is straight, or slightly curved, and attenuated, proximally and medially very gradually, distally very abruptly towards the pointed end. It is 160–235 μ long, rarely as much as 290 μ, and 8–13 μ thick at the base. Its basal and middle-parts are smooth. Near the end it bears small spines. The lateral rays are in the same spicule usually fairly equal. They are straight or very slightly curved and generally not extended in a plane, but just perceptibly bent downward towards the proximal ray. The angles enclosed between their chords and the proximal ray are consequently somewhat smaller than 90°, those between them and the distal ray somewhat larger. Apart from this they are regularly arranged, their projections on a plane vertical to the axis of the apical rays enclosing angles of 90° with each other. The lateral rays are 187–240 μ long, 10–15 μ thick at the base, and slightly attenuated to the rounded end. Their middle- and end-parts bear small and pointed (Plate **30**, figs. 1, 9) or large and blunt spines (Plate **30**, fig. 2). The number of these spines is never great and on the whole in inverse proportion to their size.

The *gastral pinule-derivates* are connected with the gastral pinules above described by transitional forms, but these are remarkably rare. Most of them are fairly regular pentactines with an apical knob, the reduced distal ray; some are irregular.

The *regular pentactine-like gastral pinule-derivates* (Plate **30**, figs. 8, 13, 14). The proximal ray is usually straight, 250–320 μ long, and 13–16 μ thick at the base. In regard to shape and spinulation it resembles the proximal ray of the gastral pinules above described. The reduced distal ray is a rounded apical protuberance, usually 7–12 μ high, 14–18 μ broad, and beset with a few large spines. The lateral rays of the same spicule may be fairly equal or very unequal. In extreme cases the largest are 30% longer than the smallest. The lateral rays are slightly inclined toward the proximal ray and also a little curved in this direction (concave to the proximal ray); sometimes they are curved also in a transverse direction. The projections of their basal parts on a plane vertical to the axis of the proximal ray, however, always enclose angles of 90° with each other. The lateral rays are 200–328 μ long, and 14–23 μ thick at the base. Distally they taper gradually and they are, at the rounded end, 7–13 μ thick. They bear thick, usually quite blunt, vertically arising spines, 4–10 μ long. In the middle-part of the ray these spines are large and sparsely scattered; towards the end they become smaller, particularly more slender, and more numerous, the end itself often being quite crowded with spines. I had the impression sometimes that the spines were arranged in elongate spiral rows; in other cases no such spiral arrangement could be made out. Often the spines are restricted to the distal and lateral sides of the rays; sometimes, however, they are also found on the proximal side.

The *irregular gastral pinule-derivates* (Plate **30**, fig. 3) are similar to the regular pentactine-like ones and differ from them only in one or two of their lateral rays resembling the distal rays of pinules.

The *uncinates* (Plate **31**, figs. 13, 14) are slightly curved or nearly straight, pointed at both ends, 0.5–1.6 mm. long, and 4–9 μ thick. Their spines are 7–27μ long, and 0.6–1 μ thick at the base. They either diverge considerably (Plate **31**, fig. 14) or are nearly parallel to the shaft (Plate **31**, fig. 13). Their tips are 1.5–4 μ distant from the shaft. This elevation of their tips is by no means always in proportion to their length.

The *discohexasters* (Plate **31**, figs. 15, 18, 21) measure 50–70 μ in total diameter. Their main-rays are regular, smooth, straight, 6–10 μ long, and 1.6–3 μ thick. Each main-ray bears from one to four end-rays. These are usually curved, concave to the continuation of the main-ray at the base, and nearly straight farther on. They are 18–26 μ long, 1.2–2 μ thick at the base, and attenuated distally to 0.8–1.5 μ. The end-rays bear along their length minute recurved spines, and at the end a terminal verticil of similar but larger spines, which together form a kind of terminal disc with deeply serrated margin 2.5–4 μ in transverse diameter.

It is possible that there are two kinds of discohexasters similar in size, but differing in respect to the end-rays, one with more slender and less spiny, the other with stouter and more spiny end-rays. Since, however, these asters are scarce I was unable to decide whether they all belong to the same series of forms, or whether two distinct varieties of them, as indicated above, should be distinguished.

The *dermal scopules* (Plate **31**, figs. 16b, 17, 19) are 200–420 μ long and consist of a centrum 4–10 μ long and 5.5–11.5 μ broad, from which arises at one end (the inner) a simple shaft, and at the opposite (the outer) a bunch of end-rays. The centrum is not well-defined, often it passes quite gradually into the shaft. It and the proximal part of the shaft are densely covered with minute spines. The shaft is straight, cylindroconic, 170–330 μ long, 3–6 μ thick at the base, and pointed at the end. Sometimes, particularly in the dermal scopules with only two end-rays, this spinulation extends quite to the end of the shaft. Some of the dermal scopules have four end-rays, others only two, and a few have three. The dermal scopules with only two end-rays are fork-like. The end-rays are 20–76 μ long and 1–3.5 μ thick at the base. They are usually attenuated towards the end, more rarely of uniform thickness throughout. The end itself is pointed, blunt, rounded or slightly thickened to a terminal "disc," which, however, is always small, only rarely over 3 μ in transverse diameter. The end-rays are usually curved in an S-shaped manner, rather strongly concave to the continuation of the axis of the shaft at the base, and very slightly, in the opposite direction, in their middle- and end-parts. These curvatures, particularly the basal, are subject to considerable variation. The breadth of the bunches formed by the end-rays is 11–25 μ. The end-rays are uniformly covered by densely crowded minute spines. The terminal "disc" is, when present, composed of similar but slightly larger spines.

The *gastral scopules* (Plate **30**, fig. 15i; Plate **31**, figs. 1, 6–12, 16a, 20, 23, 24i, 25–28) are 0.6–1.18 mm. long, and consist of a centrum, from one (the inner) end of which arises a simple shaft, and from the opposite (outer) a bunch of end-rays.

The centrum is sometimes (Plate **31**, fig. 27) rather clearly defined, sometimes it passes gradually into the shaft. It is 5–18 μ long, 6.5–17 μ broad, and bears small backwardly directed spines, like those on the adjacent parts of the shaft and the end-rays. An axial cross, composed of six axial threads regularly arranged in the usual manner, can always be detected in the centrum. One of these axial threads is long and continued in the axial thread of the shaft. The one opposite this one is short, and terminates a considerable distance below the distal end of the centrum, without giving off branches for the end-rays. The other four axial threads are still shorter and equal among themselves. Sometimes four very slight elevations arise from the sides of the centrum over them.

The shaft is 0.52–1.05 mm. long, straight or slightly curved, and 3–11 μ thick at the base, where it arises from the centrum. In some gastral scopules it tapers toward the end, in its basal and middle-part, very gradually, in its distal part rapidly. In most, however, its middle-part is cylindrical or thickened and is 1–3 μ, sometimes 13.5 μ thicker than the base in transverse diameter. The shaft terminates in a sharp point and is traversed throughout by an axial thread. At the base it is covered with a greater or smaller number of minute recurved spines, similar to those on the basal parts of the end-rays and on the centrum. Farther on it bears a few minute, isolated, vertical spines or is quite smooth. A little distance below the end larger vertical spines are observed.

Of end-rays there are usually four; in some gastral scopules, however, three, five, or six have been observed. The end-rays are 75–133 μ long, and 2–8 μ thick at the base. Generally the end-rays become thicker toward the distal end (Plate **31**, fig. 1); sometimes they are of uniform thickness throughout (Plate **31**, figs. 10–12). Just below the distal end they measure 4–8 μ in transverse diameter. In these measurements the fact finds its expression that the basally thin end-rays are distally thickened, whilst the basally stout ones are of uniform thickness throughout. The end-rays are destitute of axial threads and usually rather densely covered with minute recurved spines, which increase in size from the base, where they are about 0.7 μ long (Plate 31, fig. 27), to the end, where they are 1.5–3 μ long (Plate 31, figs. 6–9, 26). The end of the end-ray is thickened to a tyle, 12–17 μ in transverse diameter. This is particularly conspicuous in the end-rays which are thin at the base and thickened distally. The distal, apical face of the tyle is dome-shaped and usually quite smooth (Plate 31, figs. 6–9). Its sides are densely covered with spines, directed obliquely downwards. The spines nearest its apex are small, farther down they rapidly increase in size, and the lowest attain 2 μ or more in length. The spines of the tyle are, like those on the other parts of the end-ray, distinctly curved downwards. The end-rays are curved in an S-shaped manner, strongly, concave to the continuation of the axis of the shaft at the base, and slightly in the opposite direction in their distal and middle-parts. This second (outward) curvature is sometimes so light that the distal part of the end-ray appears straight. The degree of divergence of the end-rays is variable. The bunch formed by them is 60–102 μ broad.

As examples the measurements of three gastral scopules of various dimensions are tabulated below.

Total length			μ	760	920	1180
Breadth of the bunch of end-rays			μ	64	80	62
Shaft	length		μ	642	789	1050
	thickness	in the middle	μ	8.5	9	12
		at the base	μ	6.5	8	9
Centrum	length		μ	13	18	10
	thickness		μ	12	15	13
End-rays	length		μ	105	113	120
	thickness	at the base	μ	3.5	5	5
		just below the terminal tyle	μ	4.5	8	5
	transverse diameter of the terminal tyle		μ	15	16	12

The statements given above show that the sponges here described are very similar to *Eurete erectum* F. E. Schulze.[1] Wilson has established three subspecies of this species: — *tubuliferum*,[2] *mucronatum*,[3] and *gracile*.[4] One of these, *E. e. mucronatum*, differs from the sponges above described, and also from Schulze's type, and from the other two of Wilson's subspecies, by possessing oxyhexasters instead of discohexasters. This difference is in my opinion of such systematic importance that I consider it distinct from the other sponges placed in *Eurete erectum*.

After the exclusion of this subspecies, Schulze's *Eurete erectum*, Wilson's *E. e. tubuliferum*, Wilson's *E. e. gracile*, and the sponges described above, remain as forms of one species. A comparison of these shows, that, although similar in the main, they differ from each other in several minor points. The tubular body of the sponge is in Schulze's type dichotomously branched, in the three others simple. This tube is in Wilson's *E. e. tubuliferum* and in my specimens 14–17 mm. wide, in Schulze's type and in Wilson's *E. e. gracile* 8–12 mm. The distal rays of the dermal pinules are in Wilson's *E. e. gracile* 50 μ thick, in Schulze's type and in Wilson's *E. e. tubuliferum* only 35–40 μ. In the specimens examined by me, dermal pinules occur together with distal rays as stout as those of *E. e. gracile* and as slender as those of the other two. In my specimens the lateral and proximal rays of the gastral pentactine-like pinule-derivates are considerably larger than the corresponding rays of the gastral pinules proper. In the other three no such difference occurs, their gastral pinules and pinule-derivates being about as large as the gastral pinules of my specimens. The greatest differences between these sponges are met with in their scopules. To facilitate a comparison between the scopules of these sponges, short descriptions of them are tabulated on p. 134.

In respect to their other characters, particularly the shape and size of the uncinates and discohexasters, the four groups of forms appear to agree quite closely. Schulze's type was collected at Albatross Station 2819, near the Galapagos Islands, depth 717 m.; Wilson's *E. e. tubuliferum* at the Albatross Stations 3358 and 3359, off the south coast of western Panama, depth 875 and 1015 m.; Wilson's *E. e. gracile* at Albatross Station 3380, Gulf of Panama, depth 1693 m.; and the specimens examined by me at Albatross Station 4622, off the south coast of western Panama, depth 1067 m. The differences between

[1] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, p. 72, taf. 17, figs. 1–3.
[2] *H. V. Wilson.* Mem. M. C. Z., 1904, **30**, p. 63, pl. 7, figs. 9, 12; pl. 8, figs. 1–3, 6.
[3] *H. V. Wilson.* *Loc. cit.*, p. 68, pl. 8, fig. 7.
[4] *H. V. Wilson.* *Loc. cit.*, p. 69, pl. 8, figs. 4, 5, 8, 9, pl. 9, figs. 1, 3, 5.

SCOPULES OF THE DIFFERENT FORMS OF EURETE ERECTUM.

	A In Schulze's type.	B In E. e. tubuliferum Wilson.	C In E. e gracile Wilson.	D In the specimens examined by me.
Dermal scopules	Total length 200–600 μ; 4–6 end-rays with pointed, recurved spines and terminal tyle with larger spines on lower side.	Two kinds. In one 3–4 cylindrical end-rays, 40 by 2 μ, with minute sharp denticulations and small smooth terminal tyle; centrum distinct; shaft 200–240 by 4 μ. In the other 4–10 end-rays, 60–100 by 2–3 μ, with minute sharp denticulations and a terminal tyle 5–8 μ in diameter, sometimes with recurved spines; shaft a little longer than in the other form, 6 μ thick.	Two kinds. In one 4 end-rays, 50–70 by 4–6 μ, tapering distally, with minute denticulations basally, smooth distally, without tyle or a very small terminal tyle; shaft 300 by 6–8 μ. In the other 4–6 cylindrical end-rays, 70–100 by 3–5 μ, slightly roughened, with terminal tyle 6–12 μ in diameter, and spines. Total length 600–700 μ.	Total length 200–420 μ. 2 or 4, rarely 3 end-rays. 20–76 by 1–3.5 μ at the base, attenuated distally or cylindrical, the end pointed, rounded, or slightly thickened, densely covered with minute spines. Shaft 3–6 μ thick.
Gastral scopules	Similar to the dermal but larger on the whole and with more divergent end-rays, these more frequently angularly bent.	4–6 end-rays 70–80 μ long, either smooth, 2 μ thick at base, and thickened to 4 μ distally, with terminal tyle 12 μ in diameter with recurved spines on the lower side; or cylindrical, with minute denticulations, with terminal tyle 8 μ in diameter; or transitions between these; shaft 300 by 5 μ.	3–6 end-rays, 100–120 μ long, either cylindrical, 4–5 μ thick, with terminal tyle, 12 μ in diameter with recurved spines; or 12 μ thick at base and tapering distally, without terminal tyle; or transitions between these. Total length 0.6–1.5 mm.; shaft 8–16 μ thick.	Total length 0.6–1.18 μ. 3–6, usually 4 end-rays, 75–133 by 2–8 μ at base, thickened distally or, rarely, cylindrical. Densely covered with minute recurved spines, with semispherical terminal tyle 12–17 μ in diameter, with large recurved spines below. Shaft at base 4–11 μ thick.

the specimens examined by Schulze and Wilson and those described in this paper indicate that the former differ from the latter quite as much as the latter differ among themselves. This is particularly noticeable in that the former possess dermal scopules with only two end-rays, which are absent in the latter, and that the gastral pentactine-like pinule-derivatives of the former are much larger than the corresponding spinules of the latter. The general agreement of all these sponges, the localities from which they were obtained, and particularly the fact that the differences between them appear to be virtually confined to the *superficial* spicules, which are of course most liable to be influenced by the environment, make it very doubtful, however, whether they should be considered as distinct subspecies. To me it seems that a subdivision of the species into four local forms (A, B, C, and D) adapted to different surroundings, but congenitally hardly at all different, would more correctly express the relation between them. Their distinctive features are the following: —

Eurete erectum A. (*Eurete erectum* F. E. Schulze, 1899).

Main-tube dichotomous. One kind of scopule with 4–6 end-rays with terminal tyle. Total length of scopules 400–600 μ.

Eurete erectum B. (*Eurete erectum* subsp. *tubuliferum* Wilson, 1904).

Main-tube simple. Several kinds of scopules with 3–10 end-rays, all with terminal tyle. Total maximum length of scopules 400 μ. Distal ray of dermal pinules under 40 μ thick.

Eurete erectum C. (*Eurete erectum* subsp. *gracile* Wilson, 1904).

Main-tube simple. Several kinds of scopules with 3–6 end-rays. These in some with terminal tyle, in others distally attenuated and without tyle. Total length of longest gastral scopules 1.5 mm. Distal ray of dermal pinules 50 μ thick.

Eurete erectum D.

Main-tube simple. Several kinds of scopules. Some small dermal ones with only 2 end-rays without terminal tyle. The others with 3–6 end-rays. These either distally thickened and with terminal tyle or, more rarely, cylindrical or attenuated distally, without terminal tyle. Total length of largest gastral scopules 1.18 mm.

Eurete spinosum, sp. nov.

Plate 29, figs. 1–26.

One fragmentary specimen of this species was trawled off northern Peru, west southwest of Aguja Point, at Station 4656 on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4062 m. (2222 f.); it grew on fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°.

The lateral rays of its superficial pentactines bear exceedingly large spines. To this the name refers.

Shape and size. The single specimen is a lamellar fragment 25 mm. long, 20 mm. broad, and 2 mm. thick. It is curved in one direction, the radius of curvature being about 20 mm., and may originally have formed part of a cylindrical tube about 40 mm. in diameter.

The *colour* in spirit is dirty brown.

The *skeleton* consists of a continuous net, which pervades the whole lamella, and of loose pentactines, hemioxyhexasters, and scopules. Long, slender rhabds have also been observed, but it is doubtful whether they belong to the sponge. The pentactines form a continuous layer on the intact parts of the surface. Their lateral rays extend paratangentially, their apical ray points inward. The hemioxyhexasters are exceedingly numerous and appear, so far as can be judged by the fragmentary specimen, to occur in dense masses in all parts of the choanosome. The large (perhaps foreign) rhabds lie more or less parallel to the surface.

The *skeleton-net* (Plate **29**, figs. 18, 19, 23–25) is by no means uniform in structure throughout the thickness of the lamella. In the dermal zone (Plate **29**, figs. 18, 23) it is rather irregular, composed of beams 8–40 μ thick, usually 20–35 μ, and here its meshes are triangular or irregularly square, not rectangular, and 0.2–0.4 mm. wide. In the gastral zone (Plate **29**, figs. 19, 25) on the other hand the network is very regular, composed of longitudinal and transverse beams. The former are 18–50 μ thick, and on an average about 0.23 mm. apart; the latter are 8–36 μ thick, and individually usually extend obliquely but collectively from zones which are 0.8–1 mm. apart, and extend transversely, vertical to the longitudinal beams, quite across the whole specimen. With the exception of a few, usually thin ones, which are quite smooth, the beams of the skeleton-net are covered with conic spines, 2.5–8 μ high, mostly 5–6 μ. The spines of the thin and thick beams are nearly equal in height but differ, often very considerably, in breadth, those on the thicker beams being usually much stouter than those on the thinner beams. Freely terminating rays of the hexactines, by whose concrescence the network seems chiefly to be formed, arise from the beams in many places. These spine-like protuberances are thinner than the beams of the network and are only 4 μ thick. Here and there local thickenings are observed in the beams. Cylindroconic, terminally rounded spines attaining 25 μ in length and 9 μ in thickness arise from these thickenings. These spines are parallel to the surface of the sponge and the thickenings from which they arise also chiefly extend in this direction. The thickenings with their spines have a cockscomb-like appearance (Plate **29**, fig. 24). The comparison of a number of these structures has convinced me that they are in truth hemioxyhexasters which have been soldered to the growing skeleton-net and the rays of which have been secondarily thickened by the apposition of silica-layer, together with the beams of the skeleton-net which had, as it were, incorporated them.

The *rhabds*, which may, as above mentioned, be foreign, are long, smooth centrotyles. They are about 15 μ thick near the centre. The tyle measures about 17 μ in transverse diameter.

The *superficial pentactines* (Plate **29**, figs. 20–22) usually have fairly equal, straight, conic, terminally rounded lateral rays, which enclose angles of 90° with their neighbours (Plate **29**, fig. 20). Rarely (Plate **29**, fig. 21) the lateral rays are cylindroconic, curved, and irregularly arranged. The lateral rays are 150–270 μ long, 12–22 μ thick at the base, and covered throughout with vertically arising spines. The spines on the proximal part of these rays are 8–12 μ long; distally they become smaller. The apical (proximal) ray is smaller than the lateral rays and destitute of large spines.

The *hemioxyhexasters* (Plate **29**, figs. 9–17, 26b) measure 80–122 μ in total diameter, usually 90–110 μ. Two of their rays, which extend in the same axis and lie opposite each other, are usually conic, short and simple, and only exceptionally bear an end-ray. These two rays I designate the apical. The four other rays, which lie in a plane vertical to the axis of the other two, nearly always bear end-rays. These four rays I designate the lateral. The simple stems (main-rays) of these lateral rays always enclose angles of 90° with their neighbours and are, in the same spicule, usually fairly equal (Plate **29**, fig. 10); only exceptionally they differ in length (Plate **29**, fig. 12). In the ordinary regular hemioxyhexasters the lateral main-rays are 16–24 μ long; in the rare irregular forms the shortest is sometimes only 14 μ long, or still shorter. The lateral main-rays are cylindroconic, at the base 3.5–6.5 μ thick, usually about 4 μ, and uniformly attenuated towards the end, the transverse diameter of which is about three quarters of that of the base. The thickness of these main-rays is not in proportion to their length, the thickest not being longer, often indeed shorter than the thinner ones. The lateral main-rays bear minute spines which decrease in size proximally. In the thinner ones these spines can only be made out in the distal part, and also here only in the u. v. photographs (Plate **29**, fig. 9). The thick ones are covered with clearly visible spines throughout (Plate **29**, fig. 12).

Each lateral main-ray bears three regularly disposed end-rays which lie in the plane of the four lateral main-rays. One of them extends in the same direction as the main-ray to which it belongs, and appears as a continuation of the latter. The other two lie symmetrically on the two sides of this central one. These regularly disposed end-rays are, in the same spicule, usually equal (Plate

29, fig. 10). In the few hemioxyhexasters, however, in which the main-rays are unequal, a corresponding irregularity is also observed in the end-rays (Plate 29, fig. 12). The regularly disposed end-rays are conic, sharp-pointed, and covered with minute, backwardly directed spines (Plate 29, fig. 14). In a few hemioxyhexasters with exceptionally thick lateral main-rays the regularly disposed end-rays are reduced in length and terminally rounded. In the normal, regular hemioxyhexasters the end-rays are 25–44 μ long, and 1.8–3.7 μ thick at the base. In the irregular forms the shortest are sometimes only 13 μ long. The central end-ray of each group of three is straight throughout; the two lateral ones are either also straight throughout (Plate 29, fig. 12) or, much more frequently, straight only in their middle- and end-parts, but curved at the base, concave to the central end-ray. The chords of the lateral end-rays enclose angles of 47–52° with the central end-ray.

Besides these regularly disposed end-rays other end- or branch-rays sometimes arise from the lateral main-rays. Occasionally one or two supernumerary end-rays are added to the regularly disposed three. These additional end-rays extend, like the latter, in the plane of the lateral main-rays. More frequently a branch-ray is seen arising some distance below the end of the lateral main-rays. These branch-rays extend more or less vertically to the plane of the lateral main-rays, and are parallel to the apical rays. In size and spinulation the supernumerary end- and branch-rays are similar to the regularly disposed end-rays; they are, however, more frequently irregularly curved.

The axis of each lateral main-ray is occupied by an axial thread (Plate 29, figs. 14–17, 19). This terminates at the end of the main-ray and does not send branches into the end-rays. The latter are destitute of axial threads.

The *scopules* (Plate 29, figs. 1–8, 26a) are 140–288 μ long. They consist of a centrum, 3.8–7 μ in diameter, usually 4–5 μ, from one side of which arises a shaft, and from the other arise four or, rarely, five or six end-rays. The shaft is conic, straight, or slightly curved, 115–261 μ long, and 1.9–2.4 μ thick at the base. Near the distal end and often also near the base it bears minute spines. The end-rays diverge distally and together form a brush-like verticil 9–18 μ broad at the end. The individual end-rays are very slightly curved, concave to the continuation of the shaft at the base, and nearly straight in their remaining part. They are 20–44 μ long, 0.9–1.5 μ thick at the base, very slightly attenuated towards the end, and densely covered with minute, backwardly directed spines. At the end they bear a verticil of larger, recurved spines, which together form a kind of terminal disc with strongly serrated margin (Plate 29, figs. 7, 8).

Although the specimen at my disposal is but a small fragment there can be little doubt that it belongs to the group of sponges represented by *Eurete bowerbankii* F. E. Schulze and *Eurete marshalli* F. E. Schulze [1]. Since, however, it differs from these species by its superficial pentactines, which are much more spiny than in either *E. bowerbankii* or *E. marshalli*, and since its hemioxyhexasters have relatively longer end-rays than those of *E. bowerbankii* [2] and relatively shorter end-rays than those of *E. marshalli*,[3] it cannot be assigned to either of them and must be considered as a new species.

Euretid from Station 4641.

Plate 106, figs. 1–3.

The supporting skeleton-nets of three euretids, one large fairly intact, and two small fragmentary ones, were trawled near Chatham Island, Galapagos, at Station 4641 on 7 November, 1904; 1° 34.4′ S., 89° 30.2′ W.; depth 115 m. (633 f.); they grew on a light gray Globigerina ooze; the bottom-temperature was 39.5°.

The larger supporting skeleton-net (Plate **106**, fig. 3) is 47 mm. long and consists of a tube, 7 mm. wide, with nearly circular transverse section, which rises vertically from the base of attachment. This tube is straight for the greater part of its length, but bent abruptly to one side a little below its free upper end. Eighteen tubular branches, with a maximum length of 7 mm., and about as wide as the main-tube, arise from this tube. These branch-tubes are arranged in a spiral line. Some of them are distinctly widened distally, funnel-shaped. The basal part of the main-tube, and the lowest branch-tubes have walls about 2 mm. thick. Distally the walls become thinner, the uppermost being about 1 mm. thick. In the smaller specimens the main-tube is shorter and a little wider.

The beams composing these skeleton-nets are, in the middle-part of the length of the main-tube of the largest specimen, mostly 40–80 μ thick. The meshes of the network are, in the inner, gastral parts of the tube-walls, 100–300 μ wide and square with strongly rounded corners (Plate **106**, fig. 1). In the outer, dermal parts of this portion of the skeleton-net the meshes are mostly 80–350 μ wide and more frequently triangular with rounded corners (Plate **106**, fig. 2). The axes of the rays of the spicules, through the concrescence of which these

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 297.
[2] *F. E. Schulze.* *Loc. cit.*, pl. 79, fig. 13.
[3] *F. E. Schulze.* *Loc. cit.*, pl. 79, fig. 3.

skeleton-nets have been produced, are very distinct. In many places small hexactines, attached by the tip on one of their rays, arise vertically from the beams of the skeleton-net.

I think there can be no doubt that these skeleton-nets belong to a euretid sponge, but since no loose spicules were found in them, I am unable to say to which genus they should be assigned.

Euretid (?) from Station 4651.

Plate 32, figs. 4–6.

There are in the collection a fairly complete skeleton-net and three lamellar fragments of this sponge, all trawled off the coast of northern Peru, at Station 4651 on 11 November, 1904; 5° 41.7′ S., 82° 59.7′ W.; depth 4064 m. (2222 f.); they grew on sticky, fine, gray sand; the bottom-temperature was 35.4°.

The fairly complete skeleton-net (Plate **32**, fig. 4) consists of a dense basal mass with digitate processes, some of which are 10 mm. long and 6 mm. thick, from which arises a broad and low calyculate, funnel-shaped lamella. The marginal parts of the funnel are, for the most part, broken off. What remains of it is 65 mm. in maximum transverse diameter. Proximally, where it arises from the basal mass, the lamella forming the funnel is about 1.5 mm. thick. Towards the margin it thins out to 1 mm.

The *skeleton-net* of the basal mass is very dense and irregular. Its beams are mostly 15–100 μ thick, and its meshes 15–220 μ wide. The small meshes are round, the large ones triangular or irregularly square. The outer (dermal) zone of the skeleton-net of the funnel (Plate **32**, fig. 6) is irregular, composed of beams 20–180 μ thick, which enclose mostly triangular meshes up to 700 μ wide. The inner, gastral zone (Plate **32**, fig. 5) is more regular, but does not attain such a degree of regularity as is often observed in the corresponding zone of the skeleton-nets of the Euretidae. It is chiefly composed of smooth longitudinal and transverse beams, but a fair number of usually spined, oblique beams also occur in it. The longitudinal beams are 50–100 μ thick, the transverse beams are sometimes 160 μ thick. The oblique beams are much thinner, usually only 15–30 μ thick. The meshes are square or, less frequently, triangular. The square ones are usually somewhat irregular, not rectangular, 600–900 μ long, and 190–550 μ broad.

These skeleton-nets, which are similar to the ones from Station 4695, probably belonged to a euretid.

Euretid (?) from Station 4685.

There are in the collection three small, flat, lamellar fragments about 1 mm. thick, the largest of which is 16 mm. long, trawled in the southeastern Pacific at Station 4685 on 10 December, 1904; 21° 36.2′ S., 94° 56′ W.; depth 4033 m. (2205 f.); they grew on dark brown clay; the bottom-temperature was 35.3°.

These lamellae are *skeleton-nets* composed on one face of longitudinal and transverse beams, mostly 40–50 μ thick, which enclose square, rectangular meshes, generally 300–500 μ long and 200–250 μ broad; on the other face of considerably thinner beams, which enclose smaller, irregularly triangular meshes. The beams are mostly spined. The spinulation is more developed in the irregular than in the regular part of the network. Numerous hexactines, 100–150 μ or more in diameter, are attached by one ray to the beams of this network.

These skeleton-nets probably belonged to a euretid.

Euretid (?) from Station 4695.

There are in the collection four fragments of skeleton-nets of this sponge trawled northeast of Eastern Island, at Station 4695 on 23 December, 1904; 25° 22.4′ S., 107° 45′ W.; depth 3694 m. (2020 f.); they grew on fine, light brown ooze.

The largest and least incomplete is 32 mm. high, and appears as a tubular stalk, extending above to a thin-walled funnel 22 mm. in diameter. The stalk is about 10 mm. long, and in the middle, where it is somewhat attenuated, of oval, transverse section, 6.5 mm. broad and 4.5 mm. thick.

The *skeleton-net* of the stalk is irregular, composed of longitudinal and oblique spined beams, the former about 90 μ thick, the latter 15–50 μ. In places the stout longitudinal beams of this part of the net bear numerous, vertically arising thorns, 6–10 μ thick at the base, and of varying length. The meshes of this network are irregular, generally 50–200 μ wide. The skeleton-net of the funnel is more regular, chiefly composed of longitudinal and transverse beams. Oblique beams, however, also occur in it, particularly in its outer zone. The beams of this network are smooth and 50–130 μ thick, the meshes in the inner zone square, rectangular, in the outer zone more frequently triangular. The rectangular meshes of the inner zone are mostly about 600 μ long and 300–400 μ broad. Verticil thorns, directed towards the funnel-cavity, arise from the nodes of the inner part of this network.

These skeleton-nets may have belonged to a euretid sponge. They are similar to those described above from Station 4651.

COSCINOPORIDAE Zittel.

Lamellar, calyculate, or more complicated Hexasterophora consisting, if lamellar, of a simple plate; if calyculate or more complicated, of a rather thin wall enclosing a wide cavity. This plate or wall is traversed by straight, conical, blindly ending, sac-shaped afferent and efferent canals. With a firm supporting reticulate skeleton and uncinates and scopules.

The collection contains one specimen of this family, which belongs to a species of Chonelasma.

CHONELASMA F. E. Schulze.

Funnel-shaped or lamellar Coscinoporidae.

Chonelasma sp.

Plate 32, figs. 7–9.

There is in the collection a rather large skeleton-net of this sponge, collected in the Paumotu Islands at Station 3689 (A. A. 134) on 28 October, 1899; 18° 06′ S., 142° 24′ W.; depth 1476 m. (807 f.); they grew on a bottom of fine coral-sand and manganese nodules; the bottom-temperature was 37.6°.

This skeleton-net (Plate **32**, fig. 7) is a curved plate, 92 mm. long, 51 mm. broad, and 9–11 mm. thick. The sponge to which it belonged may have been tubular or calyculate; probably it was of large size. The convex, probably outer (dermal) zone of the skeleton-net (Plate **32**, fig. 8) is on the whole smooth. It is composed of skeleton-net lamellae vertical to the surface, extending indiscriminately in all directions and crossing each other irregularly. These lamellae form a network, the meshes of which are represented by short vertical canals round or polygonal in transverse section and 0.5–2 mm. wide. The concave, probably inner (gastral) zone of the skeleton-net (Plate **32**, figs. 7, 9) has some outgrowths. Most of these are quite small. One is 8 mm. high. Apart from a curved, obliquely transverse band 3–5 mm. broad, where the network is so dense as to appear nearly solid to the naked eye, the zone of the skeleton-net bordering on this inner concave, probably gastral surface is composed of skeleton-net lamellae, vertical to the surface and extending longitudinally. These lamellae are about 0.7 mm. apart and connected by numerous transverse beams, which, to a certain extent, also form skeleton-net lamellae. These transverse lamellae are, however, not nearly so compact and so regularly arranged as the longitudinal ones. Together the longitudinal and the transverse skeleton-net lamellae form a network with meshes about 0.7 mm. broad and 0.7–1.5 mm. long.

The *skeleton-net lamellae* of the outer zone, that is the one bordering on the convex side (Plate **32**, fig. 8), are composed of a network of beams mostly 450–650 μ thick, which enclose roundish irregular meshes, usually 1.5–2.5 mm. wide. The beams of this network are covered with large, rounded protuberances. Its meshes are either quite empty or contain only slight traces of a fine secondary network, similar to that in the inner zone, described below. The skeleton-net lamellae of the inner zone, that is those bordering on the concave side (Plate **32**, fig. 9), are composed of a primary network in the meshes of which a fine secondary network is spread out. The primary network consists of smooth, longitudinal, transverse, and oblique beams. The longitudinal beams are situated either singly or in bundles of two or three. Those of the same bundle are connected at frequent intervals by short transverse beams. Here and there they even coalesce to form irregular stems sometimes 350 μ thick. The individual longitudinal beams are usually about 130 μ thick, the transverse and oblique 60–110 μ. The meshes are very irregular and are sometimes more than 1 mm. long. Thorns about 200 μ long, 40 μ thick at the base, and provided with low, rounded protuberances arise from some of the nodes of this network. The secondary network extends in the meshes of the primary and in the transverse band above referred to, and also occupies the interstices between the lamellae. It is composed of beams, 5–10 μ thick, which enclose square, rectangular, or, more rarely, irregular meshes 50–130 μ wide.

TRETOCALYCIDAE F. E. Schulze.

Hexasterophora with ramified afferent and efferent canals. With a firm reticulate supporting skeleton and uncinates and generally also scopules.

The collection contains one specimen and three fragments of this family, which belong to Hexactinella.

HEXACTINELLA Carter.

Tretocalycidae which are calyculate or composed of simple, ramified, or anastomosing tubes; with firm reticulate supporting skeleton, uncinates, scopules, and discohexasters or oxyhexasters or tylehexasters or two of these forms. Without microonychhexactines and tylostyles with slender branch-rays, bearing end-discs, on the tyle.

The collection contains one specimen and three fragments of this genus. The specimen is insufficiently preserved for specific distinction. The three fragments all belong to a new species.

Hexactinella monticularis, sp. nov.

Plate 28, figs. 1–28.

Three fragments of the skeleton of this sponge were trawled south of Chatham Island, Galapagos, at Station 4642 on 7 November, 1904; 1° 30.5′ S., 89° 35′ W.; depth 549 m. (300 f.); they grew on broken Globigerina shells; the bottom-temperature was 48.6°.

From the surface broad and truncate conic protuberances arise and to these the name refers.

Shape and size. The three fragments measure 16, 17, and 20 mm. in maximum diameter respectively. All appear to be parts of an irregular massive sponge with stout, truncate, conic protuberances. One of these protuberances, which is about 4 mm. high and 8 mm. broad at the base, is represented (Plate 28, figs. 23, 28).

The *colour* in spirit is brown.

The *skeleton* consists of an internal and superficial network and loose hexactines, pentactines, uncinates, discohexasters, and scopules.

The *internal skeleton-net* (Plate 28, figs. 23, 24, 26, 28) forms meandric lamellae, mostly nearly 0.5 mm. thick, which appear as the walls of tubes, with lumina more or less circular in transverse section and about 1 mm. wide. In the interior of the sponge these tubes are variously curved and irregular in their course. On approaching the surface they straighten out. On the whole they extend chiefly radially and longitudinally from the base to the upper and lateral parts of the surface, where they open out. The openings are fairly equidistant and uniformly distributed, as numerous on the summits and the sides of the monticular processes as on the other parts of the surface. Since most of the tubes reach the surface obliquely their superficial openings are more or less oval (Plate 28, figs. 23, 28). It is to be presumed that the tubes form two systems, one afferent, vestibular ("Epirhysen"); the other efferent, preoscular ("Aporhysen").

The lamellae separating these tubes consist of a network of beams, mostly 40–100 μ thick, with meshes 100–200 μ wide. Some parts of this network are quite irregular, others more regular, with more or less quadratic meshes. The beams generally bear small, broad, sharp-pointed, conic spines (Plate 28, fig. 22). Large, freely terminating, conic protuberances, which are hexactine rays and may be designated as thorns, arise from the beams in many places. In the inner part of the lamellae these thorns are not numerous; they are small, usually 90–200 μ long (Plate 28, fig. 22). In their superficial part they are more numerous, more or less vertical to the surface of the lamella, and larger, 120–360 μ long, and about 60 μ thick at the base. These superficial thorns are covered with spines similar to those on the beams, but on the whole larger and more densely crowded.

The *superficial skeleton-net* (Plate 28, figs. 21, 27), remnants of which have been found in several places, extends paratangentially on the surface. It is rather loose and irregular, and consists of pentactines the lateral rays of which have been more or less soldered together.

The *loose hexactines* (Plate 28, figs. 17, 18) found in the interior are probably destined to be soldered together to form the internal skeleton-net. The small, probably young forms have straight, or slightly curved, nearly smooth rays, 70–100 μ long and 3 μ thick at the base. In the larger, probably older ones (Plate 28, figs. 17, 18) the rays are 100–260 μ and more long, nearly cylindrical, and 10–14 μ thick. They are, in the same spicule, often unequal and always covered with spines. Most of these spines are small, whilst some, which lie irregularly scattered between the small ones, attain a very large size and measure 10–50 μ in length. These large spines, of which each ray bears from five to ten or more, increase in size towards the distal end of the ray. The largest of them bear small secondary spines. Several, usually three, are situated terminally. These are always the largest. The large spines along the length of the rays arise nearly vertically, the terminal ones usually point obliquely outward.

The *pentactines* (Plate 28, figs. 19, 21, 27) are situated superficially. Their lateral rays, which form the superficial net, are 120–200 μ long, 4–10 μ thick at the base, and slightly attenuated towards the end. They are covered throughout with vertically arising spines. Young, still free, superficial pentactines (Plate 28, fig. 19) have slender rays and very small spines. Older ones, already incorporated in the superficial net (Plate 28, figs. 21, 27), have stouter rays and longer spines.

Of *uncinates* two kinds, a smaller and a larger, can be distinguished.

The *smaller uncinates* (Plate 28, fig. 10), which are very numerous and doubtlessly proper to the sponge, attain a length of 225–420 μ. They are centrotyle and anisoactine, the tyle, which marks the morphological centre, being situated much nearer the end from which the spines diverge than the other. The proportion between the length of the two actines is 2 : 3 to 1 : 3. Close to the tyle these uncinates are usually 2–3 μ thick, the tyle itself being about 0.7 more in transverse diameter than the adjacent parts of the spicule. The spines are numerous, very oblique, and so thin that it is impossible to see them with ordinary light. The u. v. photographs, however, show them clearly enough (Plate 28, fig. 10). I should say that these spines are scarcely thicker than 0.1 μ.

The *large uncinates* are rare and may be foreign to the sponge. All those observed were broken. The largest fragments were 600–800 μ long and about 5 μ thick. Their spines are strongly inclined, nearly parallel to the shaft, and exceedingly thin.

Two kinds of *discohexasters*, a larger and a smaller, can be distinguished. These are, it is true, connected by intermediate forms, but the latter are so rare that the distinction between them is quite clearly pronounced.

The *large discohexasters* (Plate 28, figs. 12, 15, 16, 25) measure 52–62 μ in total diameter, usually about 60 μ, and have equal and regularly arranged, fairly smooth main-rays, 5–6 μ long and about 1.8 μ thick. Each main-ray bears four rather strongly divergent end-rays. The end-rays are curved, concave to the continuation of the main-ray at the base, and straight or slightly curved in an irregular manner farther on. The end-rays are about 23 μ long, 1.2–1.3 μ thick at the base, and attenuated distally to 0.7–1 μ. They bear along their whole length numerous minute, backwardly directed spines and at the end a verticil of larger, recurved spines, which together form a kind of convex terminal disc with strongly serrated margin, 1.5–2.2 μ in transverse diameter (Plate 28, fig. 12).

The *small discohexasters* (Plate 28, figs. 11, 20) measure 30–47 μ in total diameter, and have equal, regularly arranged, fairly smooth main-rays, 4.5–6.5 μ long and 1–1.6 μ thick. Each main-ray bears four, exceptionally five, end-rays. These are curved at the base, concave to the continuation of the main-ray, and nearly straight farther on. In these small discohexasters the basal curvature usually extends farther than in the large discohexasters. The end-rays are 9–18 μ long, 0.5–1 μ thick at the base, and attenuated distally to 0.4–0.7 μ. They are covered along their whole length with numerous minute, backwardly directed spines, and usually bear at the end a verticil of four or more larger recurved spines, which, when seen in profile, together appear as a convex terminal disc, 1–2.5 μ in transverse diameter (Plate 28, figs. 11, 20). Sometimes these spines are so small that the end-rays appear terminally rounded and destitute of terminal discs.

The *scopules* (Plate 28, figs. 1–9, 13, 14) are 220–400 μ long. They consist, of a stout centrum, from one side of which arises a simple shaft, and from the opposite a verticil of end-rays. Sometimes one or two end-rays are also attached to the sides of the centrum.

The centrum is 6.2–9.6 μ broad, 4–9 μ long, and has four lateral protuberances arranged regularly crossways. When small these protuberances appear as slight rounded elevations (Plate 28, figs. 7–9), when large as short, cylindrical, terminally rounded ray-rudiments, equaling the shaft in thickness (Plate 28, figs. 5, 6). The centrum and its protuberances are uniformly and densely covered with minute spines.

The shaft is 200–345 μ long, straight or, rarely, curved. It is nearly cylindrical for the greater part of its length, and rather abruptly attenuated to a sharp point. It is 3–4.5 μ thick at the base, where it rises from the centrum; in the middle of its length it is slightly thinner, or, not so frequently, as thick or slightly thicker than basally. The middle-part of the shaft is nearly smooth. The proximal part, for a distance of about 30 μ from the centrum, is, like the centrum, densely covered with minute spines. In a belt which is 10–20 μ broad and situated a short distance from the distal end, larger, particularly broader sparsely scattered spines occur.

Of end-rays there are from five to nine, most frequently seven. As mentioned above, these generally all rise from the apex of the centrum, that is the face opposite the shaft. These terminal end-rays are slightly curved, concave to the continuation of the axis of the shaft for a short distance, and, for the remainder of their length, straight or curved slightly in the opposite direction (outwards). They diverge above more or less and together form a stouter or more slender, brush-like or calyculate verticil, 9–22 μ broad at the distal end. These end-rays are 11–65 μ long, most frequently 11–30 μ. Of 33 measured: —

0	was under	10 μ	long.	1	was	36–40 μ	long
5	were	11–15 μ	"	0	"	41–45 μ	"
9	"	16–20 μ	"	1	"	46–50 μ	"
7	"	21–25 μ	"	0	"	51–55 μ	"
7	"	26–30 μ	"	0	"	56–60 μ	"
2	"	31–35 μ	"	1	"	61–65 μ	"

0 was over 66 μ long

These end-rays are, at the base, 1–2 μ thick, very rarely 2.6 μ, and attenuated towards the distal end to 0.6–1 μ, rarely 1.4 μ. They are densely covered with minute, backwardly directed spines, and usually bear a terminal verticil of larger, recurved spines which together form a kind of convex terminal disc with deeply serrated margin, 1.2–2.5 μ in transverse diameter. Sometimes the terminal spines are so small that no disc-shaped terminal thickening at all can be detected.

The exceptionally occurring lateral end-rays are more divergent, more curved, and shorter than the terminal ones above described, which they resemble in all other respects.

From a point in the middle of the centrum six axial threads extend in three straight lines vertical to each other. One of these is long and well-developed. This one is continued in the axis of the shaft, which can be traced quite to the end of the latter. The other five axial threads are short, rudimentary, and terminate within the centrum. The one in line with and opposite the axis of the shaft is directed towards the terminal end-ray verticil, and ends before reaching it without giving off branches. The end-rays are destitute of axial threads. The other four axial threads terminate in the four lateral protuberances of the centrum.

The shape of the scopules and the arrangement of their axial threads indicate: — that the upper part of the centrum, from which the end-ray verticil arises, is, as far as it is traversed by the axial thread, an end-ray bearing main-ray; that the shaft is a well-developed, simple ray; that the four lateral protuberances of the centrum are rudimentary simple rays, and that the end-rays are homologous to hexaster end-rays. Thus the whole scopule appears as a hemihexaster. Since its end-rays bear the terminal verticils of recurved spines characteristic of the discohexasters and hemidiscohexasters, these scopule-hemihexasters are discohemihexasters.

In view of this I think it not unlikely that the scopules of the Hexactinellida generally are to be considered as apically highly differentiated hemihexasters, the scopules of the sponge here described being not quite so far advanced in this development and not so far removed from the ancestral form as the scopules destitute of lateral protuberances of the centrum of other hexactinellids.

The comparability of the scopules with hexasters was first noticed by F. E. Schulze who says[1] concerning their end-rays, "I should be more inclined to compare them with the terminal rays of the rosettes." But this author does not

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 34.

draw the same conclusion as I should concerning their origin from this comparability and their general structure, and expresses [1] his inclination to consider them "as diacts or monacts."

In spite of the fragmentary condition of the specimens they can, with a sufficient degree of certainty, be assigned to Hexactinella. Of all the known species only two, *H. ventilabrum* Carter and *H. labyrinthica* Wilson, have, like them, discohexastrose microscleres. From both of these species the sponge above described differs by the scopules, which have four end-rays in the former, and usually seven end-rays in the latter.

Hexactinella sp. indet.

Plate 32, figs. 13–15.

A skeleton-net probably a species of Hexactinella was trawled off the southern coast of western Panama at Station 4631, on 3 November, 1904; 6° 26′ N., 81° 49′ W.; depth 1415 m. (774 f.); they grew on a bottom of green sand; the bottom-temperature was 38°.

This skeleton-net (Plate 32, fig. 13) has the shape of a funnel 30 mm. high and 52 mm. in maximum breadth above. The funnel-wall is 4 mm. thick. Both the upper marginal part and the lower end, which latter may have been attached to a stalk, are broken off. The funnel-wall consists of skeleton-net lamellae extending radially and longitudinally from the base towards the margin. These lamellae are mostly a little over 1 mm. apart and joined to each other by groups of oblique beams, which, on the inner side of the funnel, form a honeycomb-like net (Plate 32, fig. 15) composed of lamellae vertical to the surface and enclosing short, likewise vertical canals, round or polygonal in transverse section, and mostly 1.5–2.5 mm. wide.

The *skeleton-net* of these lamellae consists of smooth beams, on an average about 100 μ thick, which in some places extend longitudinally and transversely with rather large square, rectangular meshes, but which are generally, particularly in the inner honeycomb zone, so variable in their direction, so crowded, and joined at so frequent intervals, that they form a quite irregular and very dense network.

[1] *F. E. Schulze. Loc. cit.*, p. 35.

Amphidiscophora F. E. Schulze.

Hexactinellida the spicules of which are always isolated; with amphidiscs; without hexasters.

Of the two families into which F. E. Schulze[1] divides this suborder, one, the Hyalonematidae, is represented in the collection.

HYALONEMATIDAE (Gray) F. E. Schulze.

Amphidiscophora in which the afferent apertures all lie in one area, the gastral face.

The collection contains fifty-seven more or less complete specimens and six fragments of this family. All belong to the genus Hyalonema.

HYALONEMA Gray.

Hyalonematidae with gastral cone, without conuli-like protuberances on the dermal face; with one or, exceptionally, several stalks composed of long intertwined anchoring spicules; with acanthophores in the lower end-part of the body.

Two specimens cannot be specifically determined. The other fifty-five, and the six fragments, belong to twenty-four species, twenty-two of which are new.

Hitherto fifty well-defined species of Hyalonema have been described. To these twenty-two are added in this Report, so that there are now seventy-two valid species of Hyalonema. The number of species being so great I endeavoured to arrange them in subgenera. In attempting to do this I first thought it might be possible to fall back on F. E. Schulze's[2] original division of the genus into the subgenera Hyalonema (with a special gastral sieve-membrane) and Stylocalyx without such a structure. I found, however, as Schulze himself did on reconsideration,[3] that this could hardly be done with advantage. Then I tried to attain my object with the help of the key given in Schulze's Valdivia report,[4] but this also helped me only to a small extent. I therefore

[1] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 181.

[2] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 189.

[3] *F. E. Schulze.* Revision des systemes der Hyalonematiden. Sitzungsb. Akad. Berlin, 1893, no. 30, p. 554.

[4] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 163.

propose a new arrangement, based on the results of my examination of the twenty-four Pacific species.

These results have led me to think that certain characters of the amphidiscs could be utilised for this purpose. It is true that the numerous very different forms of these spicules are to a great extent connected by transitions; there are, however, in spite of this, some amphidisc-forms not so connected.

The anchor-teeth of the amphidiscs of most of the Pacific Hexactinellida have smooth margins. In five of them, however, there occurs a particular kind of amphidiscs with serrated anchor-teeth. For these I establish the subgenus Prionema. Of the fifty species previously known there are, I believe, only two, *H. poculum* F. E. Schulze [1] and *H. validum* F. E. Schulze,[2] in which amphidiscs with serrated teeth have been noticed and described. I think it highly probable, however, that such amphidiscs occur in others also, as for instance in *H. lusitanicum* Bocage, and *H. cupressiferum* F. E. Schulze, where they have not been mentioned either because they were overlooked — they are generally small and clearly visible only with high powers — or because the authors who studied these sponges did not consider them of importance.

Most of the species of Hyalonema examined by me in which the anchor-teeth of all the amphidisc forms are smooth-margined, generally have hyperbolic, semispherical, or bell-shaped anchors and measure from about a quarter to a third of the whole spicule in length. In some of them, however, the amphidisc-anchors are of other relative dimensions and often also of another shape. In five of the Pacific species examined, one of which had been previously described, the anchors of a certain kind of amphidiscs are more or less semispherical and about half as long as the whole spicule, so that the two anchors of the same spicule nearly or quite meet in the middle. For these species I establish the subgenus Oonema. Of the species previously described there are, besides the one in the A. Agassiz Pacific collection above referred to, four (*H. tenerum* F. E. Schulze, *H. robustum* F. E. Schulze, *H. globiferum* F. E. Schulze, and *H. pedunculatum* Wilson) which can certainly, and one (*H. ovuliferum* F. E. Schulze) which can perhaps, be assigned to this subgenus.

In two of the Pacific species examined by me, one of which had been previously described, the anchors of the largest amphidiscs are small and relatively very short and broad. For these species I establish the subgenus Phialonema.

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 208. (This serration is not shown in the figure of a macramphidisc of this species. *Loc. cit.*, plate **33**, fig. 4).

[2] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 82, taf. 34, fig. 8.

Of the species hitherto described there is, besides the one reëxamined by me which is referred to above, one (*H. pellucidum* Ijima) at least, probably several, which can be referred to this subgenus.

In two of the Pacific species examined one kind of amphidisc has broad and rather low, umbrella-like amphidisc-anchors. For these I establish the subgenus Skianema.

In one of the Pacific species examined I found a peculiar kind of amphidisc with from one to three branches on the convex side of some or most of its anchor-teeth, which give to the anchors the appearance of being doubled. For this species I establish the subgenus Thallonema.

The remaining species of Hyalonema, in which none of the different kinds of peculiar amphidiscs referred to above occurs, can be divided, in accordance with the primary division used in F. E. Schulze's key, into those in which the largest amphidiscs are stout and have a thick shaft; subgenus Hyalonema, and into those in which these amphidiscs are slender and have a thin shaft; subgenus Leptonema.

Nine of the Pacific species examined by me, two of which were insufficient for exact description and for naming, and the great majority of the species of Hyalonema previously described, belong to the subgenus Hyalonema.

One of the Pacific species examined by me, and at least five previously described species (*H. poculum* F. E. Schulze, *H. solutum* F. E. Schulze, *H. urna* F. E. Schulze, *H. divergens* F. E. Schulze, *H. depressum* F. E. Schulze) belong to the subgenus Leptonema.

Possibly *H. lusitanicum* Bocage and *H. cupressiferum* F. E. Schulze mentioned above as probably belonging to the subgenus Prionema, and *H. ovuliferum* F. E. Schulze assigned to the subgenus Oonema may also belong to the subgenus Leptonema.

HYALONEMA (Gray) Lendenfeld.

Species, the amphidiscs of which have hyperbolical, semispherical, or bell-shaped terminal anchors from about one fourth to one third of the whole spicule in length; without amphidiscs of any other kind. The largest amphidiscs are stout and have a thick shaft.

The collection contains twenty-three more or less complete specimens and three fragments of this subgenus. Two of the specimens, apparently representing two distinct forms, could not be specifically determined; the twenty-one others and the three fragments belong to seven different species, all of which are new.

Hyalonema (Hyalonema) obtusum, sp. nov.

gracilis, var. nov.

Plate 33, figs. 1–24; Plate 34, figs. 1–19; Plate 35, figs. 1–37; Plate 36, figs. 1–45; Plate 37, figs. 1–22; Plate 38, figs. 1–8; Plate 39, figs. 1–10.

robusta, var. nov.

Plate 39, figs. 11–41; Plate 40, figs. 1–22.

Two specimens were trawled at two stations in the Tropical Pacific: — *Hyalonema* (*H.*) *obtusum* var. *robusta* at Station 3681 (A. A. 2) on 27 August, 1899; 28° 23′ N., 126° 57′ W.; depth 4330 m. (2368 f.); it grew on light brown volcanic ooze; the bottom-temperature was 34.6°. *H.* (*H.*) *o.* var. *gracilis* at Station 3684 (A. A. 17) on 10 September, 1899; 0.50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); it grew on light yellow-gray Globigerina ooze. These sponges are distinguished from their nearest allies by the stout truncate or terminally rounded spines on their macramphidisc-shafts. To these the name refers.

Although on the whole very similar in their spiculation, these two sponges differ in respect to their external appearance and certain characters of their skeletal element so that I consider them distinct varieties. The spicules of the specimen from Station 3681 (A. A. 2) are generally speaking stouter, those from Station 3684 more slender. I therefore name the former *H.* (*H.*) *o.* var. *robusta*, and the latter *H.* (*H.*) *o.* var. *gracilis*.

Shape and size. The specimen of var. *robusta* is rather fragmentary, its superficial parts having to a great extent been lost. It consists (Plate **39**, fig. 33) of a flattened body, 65 mm. long, 12 mm. thick, and 42 mm. broad above. Below it becomes narrower, and there protrudes from its rounded lower end a bundle of stalk-spicules. This bundle, where it arises from the sponge-body, is about 2.6 mm. thick. The stalk-spicules forming it are broken off at a distance of 35 mm. from the lower end of the sponge.

The specimen of var. *gracilis* is well-preserved, but destitute of the stalk; the sponge-body having apparently been pulled off the stalk-spicules by the trawl. It has the shape of a short and broad spindle or top (Plate **33**, fig. 15), is 47 mm. long (high), and has a maximum transverse diameter of 30 mm. The lower end, from which in life the large stalk-spicules arose, is now simply rounded off. The upper end consists of a gastral cone closely enveloped by the thin, frill-like margin of the wall surrounding the gastral cavity. The cone (Plate **33**, fig. 16a) is 9 mm. high, nearly cylindrical, circular in transverse section, terminally rounded, 6 mm. thick at the base, and 4 mm. at the end. Its end is slightly bent to one side (Plate **34**, fig. 3c). The frill surrounding it terminates with a fairly circular margin which lies in the level of the summit of the cone. The gastral cavity appears as a narrow fissure 5–12 mm. deep but only 0.4–1 mm. wide (Plate **33**, fig. 16; Plate **34**, fig. 3b) separating the gastral cone from the marginal part of the sponge-body.

The surface of the cone, and the inner face of the upper tubular marginal part of the wall surrounding the gastral cavity are smooth and destitute of apertures of any kind, the efferent openings being restricted to the bottom of the fissure-like gastral cavity. The intact parts of the outer surface exhibit a fine reticulate structure with meshes about 0.7 mm. wide (Plate **33**, fig. 15).

The *colour* of the specimen of var. *robusta* in spirit is rather dark reddish brown, that of var. *gracilis* light greenish brown.

Canal-system. The state of preservation of the specimen of var. *robusta* renders it impossible to say anything about the canal-system. In the specimen of var. *gracilis* subdermal cavities (Plate **34**, figs. 1b, 3, 4, 19c), mostly 0.3–0.7 mm. high and 0.2–0.5 mm. broad, are spread out below the dermal membrane (the outer surface). These cavities are generally separated from each other by thin partitions. From most of them small afferent canals take their origin; some are directly continued in large afferent canal-stems, 0.3–0.7 mm. wide, which extend somewhat tortuously towards the interior, and ramify in the central part of the sponge. Occasionally junctions of two such afferent canal-stems have been observed. The choanosome, that is the region occupied by the flagellate chambers, does not extend, for the most part, beyond the level of the floors of the subdermal cavities. In a few places only broad, conical groups of flagellate chambers rise between adjacent subdermal cavities, up to a distance of only 0.1 mm. from the outer surface.

The individual flagellate chambers appear to be broad oval or nearly spherical, and attain a maximum diameter of 60–100 μ (Plate **34**, fig. 2). The efferent canals join to form canal-stems up to 1.2 mm. wide, which, as above mentioned, open out into the bottom of the narrow, fissure-like gastral cavity. The larger of these canals are considerably contracted at the mouth.

The *skeleton* of var. *gracilis.* The outer surface is covered with dermal pinules, micramphidiscs, and small macramphidiscs. Most of the pinules are pentactine, some hexactine. Their paratangentially extending lateral rays lie in the dermal membrane; their radially extending and freely protruding distal rays form a fur about 150 μ high (Plate **35**, fig. 24). The micramphidiscs are, in some places at least, exceedingly numerous. They seem to be quite irregularly situated. The small macramphidiscs are also numerous and often arranged in groups (Plate **34**, figs. 1, 19b; Plate **35**, fig. 24b). Their shafts extend radially or obliquely and their distal parts protrude freely beyond the surface.

The dermal membrane is supported by hypodermal pentactines very variable in size. In the upper parts of the sponge the large pentactines greatly predominate, at the base the small ones are more numerous. The centres of the large hypodermal pentactines are about 0.7 mm. apart. The apical rays of these spicules are directed radially inward (Plate **34**, fig. 1c); their lateral rays, which are markedly inclined towards the apical ray, extend nearly paratangentially in the beams of the superficial network above referred to. Uncinate amphioxes, situated for the most part radially or obliquely, are met with in the subdermal region. The superficial part of the choanosome underlying the dermal surface is occupied, down to a depth of about 2.5 mm., by hexactine megascleres, rather regularly arranged in several paratangentially extending layers. These hexactines are situated so that two of their rays extend radially (inwards and outwards), two longitudinally (upwards and downwards), and two transversely (to the right and left). The distance between the centres of these spicules is less than the length of their rays, and the opposite rays of adjacent ones usually extend for some distance side by side and close together (Plate **34**, fig. 19d). These hexactine megascleres, therefore, form a three-dimensional network with fairly regular, somewhat cubic meshes. These spicules vary greatly in size; the larger are situated proximally, the smaller distally.

Numerous rhabd-megascleres and a few angularly bent diactines of similar dimensions occur in the choanosome. Most of the rhabds are blunt amphioxes or amphistrongyles, but styles and tylostyles also occur. Some of these rhabds are isolated; most of them, however, form loose strands. In the central (axial) part of the choanosome, the rhabds extend for the most part longitudinally; in the other parts of the choanosome they are mostly directed obliquely upwards and outwards, and generally lie in the walls of the canals. The styles and tylostyles are situated so that their rounded (thickened) end points downward and inward, their pointed end upward and outward. The choanosome is rich in microscleres. Large numbers of micramphidiscs are imbedded in the canal-walls and throughout it are scattered some macramphidiscs, masses of microhexactines (Plate **34**, fig. 2), and a few microhexactine-derivates, chiefly with only two opposite rays fully developed and the others more or less, sometimes entirely reduced.

As above stated the sponge-body was in life obviously attached to a bundle of stalk-spicules, which have, however, been pulled out of it. Empty tubular spaces, sometimes 0.9 mm. wide (Plate 36, fig. 26a), the walls of which are formed by fine, highly stainable membranes, mark the places where the upper ends of the largest of these stalk-spicules were situated. These spaces lie in the axial part of the sponge-body. They are conical, attenuated above, and extend upwards to within a distance of 2 mm. from the summit of the gastral cone. In the lower part of the sponge-body these spaces are surrounded by a kind of cement, composed of dense masses of stout, one- to five-rayed, most frequently tetractine or diactine acanthophores (Plate 36, fig. 26). In this cement a few microhexactine-derivate pachymicrohexactines also occur. Quite at the bottom, a short distance below the dermal membrane, numerous slender-rayed spicules with long spines, which I consider as slender acanthophores, form a kind of felt. These spicules are mostly tetractines, but a good many triactines and a few diactines, pentactines, and hexactines also occur among them. Transitional forms, connecting these spicules on the one hand with the stout acanthophores above referred to, and on the other with the dermal pinules, are also found in this part of the sponge.

The thin marginal part of the circular wall which surrounds the gastral cavity, and forms the boundary between the dermal and the gastral parts of the surface, contains numerous, longitudinally situated, diactine pinules, the distal rays of which protrude freely beyond the surface.

The gastral surface, that is the surface of the gastral cone, and the inner surface of the wall surrounding the fissure-like gastral cavity are covered with micramphidiscs and gastral pinules. The micramphidiscs are situated irregularly, and in some places are so numerous as to form dense masses. The gastral micramphidisc-layer does not terminate at the openings of the efferent canal-stems into the gastral cavity, but is continued in the walls of these canals and their branches quite down into the innermost parts of the choanosome. The gastral pinules are mostly pentactine, but hexactine forms also occur. Their centres are 30–100 μ apart. Their lateral rays extend paratangentially in the gastral membrane; their distal apical rays arise vertically from the surface, and protrude freely beyond it, forming a dense fur about 125 μ high (Plate 35, figs. 1, 3, 16). This pinule-fur is not, like the micramphidisc-layer, continued down the efferent canals, but terminates at their mouths.

Small hypogastral pentactines, similar in position to the hypodermal pentactines above referred to, occur below the surface of the cone.

Strands of longitudinal rhabds enter the wall of the gastral cavity and the gastral cone from below. The rhabds of the gastral wall for the most part follow the gastral membrane, and here form a dense and distinct subgastral layer. The rhabds of the cone lie partly superficially, partly axially. The superficial rhabds of the cone are more slender than the axial ones. The axial rhabds are congregated in strands which together form a loose column extending quite to the summit of the cone (Plate **34**, fig. 3). A few hexactine megascleres apparently with long longitudinal and shorter transverse rays also take part in the formation of this column. The micramphidiscs not only form a dense layer on the outer surface of the gastral cone, but also extend for some distance into its interior. Farther down, at a level about 0.3 mm. below the surface, microhexactines and microhexactine-derivates, similar to those of the choanosome, make their appearance in the cone. These spicules extend down to a depth of about 0.8 mm., thus occupying a zone about 0.5 mm. thick. The microhexactines are very numerous in this zone, the microhexactine-derivates rare. The central part of the cone, in which the axial column of longitudinal rhabds extends, is destitute of microscleres.

The *skeleton* of var. *robusta* appears to be on the whole similar. The microhexactine-derivates are more various; the uncinates attain a larger size, and reach down to greater depths of the sponge. The upper ends of the large stalk-spicules are still present, and the felt formed by the slender acanthophores in the basal part of the sponge-body is denser and more extensive (Plate **39**, figs. 22–24).

The *dermal pinules* (Plate **35**, figs. 23, 24a, 25, 29–37; Plate **40**, figs. 4, 5) are mostly pentactine, but hexactine forms also occur, differing from the pentactine ones only by possessing a sixth, proximal, apical ray. The distal apical ray is generally straight, rarely angularly bent below the middle of its length (Plate **35**, fig. 25). In the dermal pinules of var. *gracilis* 137–165 μ, the ray is usually 143–154 μ long and 4–5 μ thick at the base. Farther up it thickens and it generally terminates with a stout, broad, and blunt cone 8–11 μ thick. Rarely it is terminally rounded, dome-shaped, and has a maximum thickness of 12 μ (Plate **35**, fig. 31). The proximal part and the terminal cone (or dome) of the distal ray are smooth, its middle-part bears sharp, conic spines. The lowest of these spines are sparse, short, and strongly divergent. Farther up they become more numerous. The size of the spines increases up to the middle of the length of the distal ray and then again decreases; the inclination of the spines towards the tip of the ray increases continuously quite to the end. The largest spines attain a length of 13–19 μ, and are 2–4 μ thick at the base, usually about 3.5 μ. The maximum transverse diameter of the distal ray, together with the spines is 18–32 μ. The distal ray of the dermal pinules of var. *robusta* is 140–172 μ long and 5–8 μ thick at the base. The maximum transverse diameter of this ray, together with its spines, is 25–40 μ.

The proximal apical ray, of the hexactine forms of var. *gracilis*, (Plate **35**, figs. 29, 30) is straight, 10–42 μ long, and 3.7–4.5 μ thick at the base. It is cylindroconic, generally abruptly and sharply pointed, and covered with minute spines.

The four lateral rays of the same spicule are usually fairly equal, the greatest difference of length observed not exceeding 4 μ. The lateral rays are straight; in the dermal spinules of var. *gracilis* they are 20–40 μ long, rarely up to 50 μ, and 3–5 μ thick at the base; in those of var. *robusta* they are sometimes (Plate **40**, fig. 4) much shorter, 10–36 μ long. They are cylindroconic, rounded or, more rarely, abruptly pointed, and covered with minute spines.

The *gastral pinules* (Plate **35**, figs. 1a, 2, 3a, 4–9, 16; Plate **40**, fig. 3) are, like the dermal pinules, mostly pentactine; hexactine forms, however, also occur differing from the pentactine only by possessing a sixth apical proximal ray. The distal ray is straight; in the gastral pinules of var. *gracilis*, it is 73–145 μ long, usually 77–135 μ, and 4.5–5.5 μ thick at the base, in the gastral pinules of var. *robusta* 94–140 μ long and 5–7 μ thick at the base. It is thickened above, and attains its greatest thickness a little way beyond the middle of its length; then it again becomes thinner, and it ends in a usually sharp-pointed, rather slender, terminal cone, which does not exceed the proximal end of the ray in thickness. The proximal end-part and the distal cone of the ray are smooth; its middle-part bears spines. The spines on the proximal half of the distal ray are very sparse, point obliquely upward, and are strongly divergent, the angles enclosed between them and the ray being 40°–55°. The spines on the distal half of the ray are smaller, more crowded, and less divergent, their size decreasing and their inclination increasing towards the end of the ray. They attain a length of 15–25 μ and a basal thickness of 3–4.5 μ. The maximum transverse diameter of the distal ray, together with the spines, is in both varieties 26–45 μ.

The proximal ray (of the hexactine forms) (Plate **35**, fig. 4; Plate **40**, fig. 3) is straight, 43–74 μ long, 4.5–5.5 μ thick at the base, conical, pointed, and spiny.

The four lateral rays of the same spicule are fairly equal or rather unequal in size; the maximum difference observed in their length was 15 μ. The lateral rays are straight or, more rarely, slightly curved. Their length is subject to considerable variation. They are in the gastral pinules of var. *gracilis* 35–90 μ long, usually 45–70 μ, at the base 4.5–5.5 μ thick, rarely as much as 6 μ, conic, pointed or, more rarely, rounded at the end, and covered with spines, which are more conspicuous in the distal than in the proximal portion of the rays. In the gastral pinules of var. *robusta* the lateral rays are on an average somewhat longer, they measure here 47–75 μ in length.

The *marginal pinules* (Plate **35**, figs. 10–13, 26–28) have been found only in var. *gracilis;* in the specimen of var. *robusta* they appear to have been lost. In these pinules only the distal and proximal rays are properly developed, the lateral rays being altogether rudimentary, and together forming merely a tyle. These spicules consequently appear as centrotyle diactines. The outer, distal one of their two properly developed rays, which corresponds to the distal apical ray of the hexactine and pentactine pinules, is 304–360 μ long, rarely as much as 450 μ, fairly straight, and 5–10 μ thick at the base. Its proximal part, and its distal, conic, sharp-pointed end-part, are smooth. Its middle-part bears spines, which are rather strongly inclined towards the end of the ray, attain 6–10 μ in length, and are 1.5–2 μ thick at the base. The maximum transverse diameter of this ray, together with the spines, is 17–20 μ.

The opposite, inner, proximal one of their two properly developed rays, which corresponds to the proximal apical ray of the hexactine pinules, is usually 490–665 μ long, fairly straight, at the base about as thick as the distal ray, and attenuated towards the end. Sometimes it is greatly reduced in length, only 50 μ long, cylindrical, and thickened at the end to a terminal tyle 13 μ in diameter.

The central tyle, which is all there is left of the reduced lateral rays, is 3–7 μ thicker than the adjacent parts of the spicules, and measures 8–15 μ in transverse diameter.

The *hypodermal pentactines* of the outer surface (Plate **33**, figs. 5–14, 17, 24; Plate **34**, fig. 1c; Plate **39**, figs. 31, 32, 40, 41). The proximal apical ray is straight or, rarely, slightly curved, and usually properly developed, conic, and blunt-pointed, occasionally reduced, cylindrical, and terminally thickened (Plate **34**, fig. 1c). It is in the large hypodermal pentactines, which greatly predominate in the upper parts of the specimen of var. *gracilis*, when properly developed, 0.7–1.86 mm. long and, at the base, 30–75 μ thick, rarely 90 μ. When reduced it retains its thickness throughout, but is less than half as long. In the small hypodermal pentactines, which occur chiefly in the lower part of this sponge, the proximal ray measures 0.27–0.6 mm. by 10–23 μ. The lateral rays are inclined towards the proximal ray, and enclose with it angles of 73°–84°. The four lateral rays of the same spicule are usually very unequal in length; the longest is sometimes more than twice as long as the shortest. The greatest difference in length between the lateral rays of the same hypodermal pentactine observed was 310 μ. The lateral rays are straight, conic, and blunt. They are, in the large hypodermal pentactines of var. *gracilis*, 240–730 μ long and 32–60 μ thick at the base. In the small ones they measure 135–440 μ in length. The small hypodermal pentactines accordingly have, relative to the proximal ray, considerably longer lateral rays than the large ones. At the end the lateral rays are usually from one fifth to one third as thick as at the base, and here measure 5–22 μ in transverse diameter. The hypodermal pentactines of var. *robusta* have a proximal ray 0.47–1.3 mm. long, and 40–80 μ thick at the base. The lateral rays are on the whole attenuated towards the distal end less than in the hypodermal pentactines of var. *gracilis*. They are, when not reduced, 250–750 μ long and, at the base, about as thick as the proximal ray.

The end-parts of the lateral rays of these spicules exhibit remarkable irregularities of external shape and internal structure. These irregularities are the more conspicuous the thicker (the more blunt) the rays. Such an irregular lateral ray-end of a hypodermal pentactine of var. *gracilis* is represented (Plate **33**, fig. 17). A rudiment of a branch-ray, arising a short distance from the tip of the main-ray, and a marked irregularity in the axial thread and the stratification of the siliceous body of the latter are noticeable in this spicule. I am inclined to ascribe these irregularities to the influence of the obstacles — other spicules — met by these rays during their longitudinal growth. The cells building the tips of these rays were forced to act in an abnormal manner; being prevented by other spicules from adding to the length of the axial thread and from depositing silica around it in a normal and regular manner, they produced the irregular structures observed. The obstacles (other spicules) which thus cause these irregularities are probably the stout proximal rays of adjacent hypodermal pentactines.

The *hypogastral pentactines* of the gastral cone of var. *gracilis* have straight proximal apical rays, usually 240–400 μ long, and about 12–20 μ thick at the base. The lateral rays are slightly inclined towards the proximal ray, straight, and generally 180–250 μ long. In the specimen of var. *robusta* the parts containing these spicules appear to have been lost.

The *hexactine megascleres* of the distal part of the choanosome (Plate **34**, figs. 5–18, 19d) are in both varieties very variable in size and have a maximum diameter of 350 μ – 2 mm. The rays of the same spicule are often unequal. The greatest difference of length observed in them was 400 μ. The rays are 130–950 μ

long, straight, conic, rather blunt-pointed, and 7–35 μ thick at the base. Their basal thickness is roughly speaking in proportion to their length.

Very young stages of these hexactines appear as spheres, 20 μ in diameter, perforated by six axial cylinder threads, 5 μ thick, which are joined at right angles in the centre. Where these axial cylinder threads reach the surface of the sphere this is elevated in the shape of very thin-walled tubes rising about 10 μ over the surface of the sphere (Plate **39**, fig. 5).

The *hexactine megascleres of the loose axial spicular column*, which were found only in var. *gracilis*, appear to be larger than the more superficially situated, but since I have not been able to find any intact ones, I can only say that their longitudinally extending rays appear to be much longer than their transverse rays, and that their rays are, at the base, about 40 μ thick.

The *stout acanthophores* (Plate **36**, figs. 1–25, 27–45; Plate **39**, figs. 17–21, 34–38) of the basal part of the sponge-body range from pentactine to monactine.

The pentactines are rare. The few observed in var. *gracilis* were 225–530 μ in diameter, and had rays, at the base, 12–29 μ thick.

The tetractines (Plate **36**, figs. 1–25, 27, 28; Plate **39**, figs. 18–20) generally have more or less unequal rays. The inequality of the rays is often very considerable. The rays are exceedingly variable in size, curvature, shape, and spinulation, but constant and uniform in so far as their basal parts always form a fairly regular, rectangular cross, and as the rays themselves always appear to extend nearly in one plane. The tips of the rays are nearly always more or less spiny, only quite exceptionally (Plate **39**, fig. 20) entirely smooth. In both varieties these spicules measure 180–840 μ in total diameter. Among the irregular ones all sizes between these limits are met. The regular ones never appear to exceed 500 μ in diameter. The rays are generally wavy in outline, cylindro-conical or cylindrical, and distally thickened, or, more rarely, without a thickening at or near the end (Plate **36**, fig. 1; Plate **39**, fig. 20). The ray either terminates with the distal thickening and then appears simply rounded off at the end (Plate **36**, figs. 22, 23, 25; Plate **39**, fig. 18), or it is continued beyond the distal thickening in the shape of a terminal cone (Plate **36**, fig. 7). The rays of these spicules are in var. *gracilis* 35–380 μ long and 12–35 μ thick at the base; in var. *robusta*, where they are more irregular and stouter, 40–500 μ long and, at the base, 20–50 μ thick. The distal thickening is in the tetractines of var. *gracilis* 10–40 μ in diameter, in those of var. *robusta* 10–60 μ.

The thickness of the rays is not in proportion to their length, and varies in the rays of all lengths between similar limits. We consequently find among the short rays relatively much stouter ones than among the long rays. The rays most strongly reduced, that is those under 55 μ in length, are by far the relatively stoutest. None of the rays as short as this was in *gracilis* under 25 μ, several of them were here 35 μ thick.

In both varieties the tips of the rays bear broad, conic, vertical spines with a maximum length of 4 μ (Plate **36**, figs. 27, 28). On the distal thickening these spines are usually densely crowded (Plate **36**, figs. 6, 7, 9), more rarely sparsely scattered (Plate **36**, fig. 4, fig. 18, the upper and lower ray, fig. 23, the upper and left ray). They are usually confined to the distal thickening, the proximal part of the ray and the conic tip (when present) protruding beyond it being quite smooth (Plate **36**, figs. 1, 2, 4–25, 27, 28). Sometimes, however, the spines cover the whole ray (Plate **36**, fig. 3) in greater or smaller numbers.

It is to be noted that the axial thread is in many of these tetractines, particularly in the slender-rayed (perhaps young) ones, remarkably wide (Plate **36**, fig. 27), sometimes as much as half as thick as the ray itself.

The triactines (Plate **39**, fig. 21) are obviously tetractine-derivates, in which one of the rays has quite disappeared. They are more frequent in var. *robusta* than in var. *gracilis*, measure in both 330–760 μ in total length, and have rays about 37–42 μ thick in the former, and about 20 μ thick in the latter.

The diactine and monactine rhabds are of two kinds: — shorter and stouter tetractine-derivates, and longer and more slender derivates of the ordinary rhabds of the choanosome.

The tetractine-derivate rhabds of the cement-mantles (Plate **36**, figs. 31, 40–45; Plate **39**, figs. 17, 34–38) are generally diactine and slightly and irregularly curved, rarely (Plate **39**, fig. 17) strongly angularly bent. Such strongly bent, compass-like spicules have only been found in var. *robusta*. In var. *gracilis* some small spicules, also apparently belonging to this group, have been observed, in which the curvature is so great that one half of the spicule forms a complete circle (Plate **36**, fig. 45). The tetractine-derivate rhabds in var. *gracilis* are 170–950 μ long and 11–39 μ thick near the middle; in var. *robusta* 450 μ–1.42 mm. long and 6–50 μ thick near the middle. In the shorter spicules of this kind a central tyle is usually present, but the longer ones are often without it (Plate **39**, figs. 34, 35, 37). When present the central tyle is, in var. *gracilis*, as much as 10 μ, and, in var. *robusta*, as much as 20 μ, thicker than the adjacent parts of the spicule; in transverse diameter they measure in the former 13–39 μ, and in the latter 25–70 μ. It either passes gradually into the body of the spicule (Plate **36**, figs. 40, 44; Plate **39**, figs. 36, 38) or it is set off from it more or less distinctly (Plate **36**, figs. 31, 41–43). Most of these spicules are fairly isoactine, some distinctly anisoactine (Plate **36**, fig. 31; Plate **39**, fig. 38). Their end-parts are thickened more or less to spherical tyles (Plate **36**, figs. 31, the left one, 41, 44; Plate **39**, figs. 34, 35, 36, the right one, 37) or spindle-shaped tyles (Plate **36**, figs. 40, 42, 43). These distal thickenings are in var. *gracilis* usually smaller, rarely (Plate **36**, fig. 44, the right one) stouter, than the central tyle. In var. *robusta* they attain much larger dimensions and have a maximum diameter of 90 μ. The middle-part of the spicule is smooth. The two ends are generally covered with spines, for a shorter or longer distance (Plate **39**, fig. 38, the left one); they are rarely smooth (Plate **36**, fig. 41; Plate **39**, fig. 37).

Although doubtless derived from the tetractines (triactines) among which they occur, these rhabds are hardly at all connected with them by transitional forms, and therefore readily distinguishable from them.

The acanthophore rhabds, which are to be considered as derivates of the ordinary rhabds of the choanosome, are in var. *gracilis* (Plate **36**, figs. 29, 30, 32–39), where they appear to be more numerous than in the other variety, 0.6–2 mm. long and 10–18 μ thick in the middle. Most of them are rather uniformly curved throughout (Plate **36**, figs. 29, 30, 32, 34–36), some are irregularly curved (Plate **36**, fig. 33), and a few strongly angularly bent near the middle (Plate **36**, fig. 39). Some of them are fairly isoactine (Plate **36**, figs. 30, 37–39), others distinctly anisoactine (Plate **36**, figs. 29, 32–36). All these spicules are more or less thickened at both ends. In the isoactine forms both terminal thickenings are slight, spindle-shaped, and situated a short distance below the end (Plate **36**, figs. 30, 37, 38). In the anisoactine only one of the distal thickenings is of this nature, the other being stouter, 25–45 μ in diameter, spherical or oval, and situated terminally (Plate **36**, figs. 29, 32–36). The spindle-shaped thickening usually passes gradually into the body of the spicule; sometimes it is distinctly set off from it (Plate **36**, fig. 32). The shaft or body of the spicule is smooth. The ends are sometimes also smooth (Plate **36**, fig. 33); usually, however, one (Plate **36**, figs. 29, 36) or both (Plate **36**, figs. 30, 32, 34, 35) of them bear spines. The axial thread is widened in the spindle-shaped distal thickenings (Plate **36**, figs. 37, 38) and extends quite to their end. In the ray-ends thickened to a stouter, spherical or oval terminal tyle, the axial thread does not extend quite to the end. The silica-layers of the isoactine forms therefore appear as tubes open at both ends, those of the anisoactine forms as tubes open at one end only.

An *abnormal stout acanthophore* 220 μ in diameter was found in var. *gracilis*. Its rays are straight, cylindrical, terminally rounded, and very unequal in length, but all about 10 μ thick.

The *intermediate transitional acanthophores* (Plate **39**, figs. 1, 6, 11, 12) have rays which are in both varieties 4–6 μ thick and covered with stout, blunt (Plate **39**, fig. 1) or pointed (Plate **39**, figs. 11, 12), usually curved, oblique spines 2–4 μ long.

The *slender acanthophores* (Plate **39**, figs. 2–4, 13–16, 22–24) are mostly tetractine, triactine or diactine tetractine-derivates; a few hexactine and pentactine forms appear to be pinule-derivates. In both varieties the rays of these spicules are sometimes 200 μ long and, at the base, in var. *gracilis* 1.3–1.5 μ, in var. *robusta* 1.5–3.5 μ thick. They are usually curved more or less in an irregular manner and bear sparse, irregularly distributed spines. In both varieties these spines reach 6 μ in length and are usually more or less curved. The spines arising from the end-parts of the rays are usually directed backwards and recurved; the others are either also recurved, or vertical, or directed outwards. The basal parts of the rays appear always to retain their original, regular, relative position. In the tetractines these parts of the rays form regular rectangular crosses, in the triactines a T, and in the diactines usually a right angle. When a ray entirely disappears, a large spine usually takes its place (Plate **39**, fig. 16).

The *rhabds of the choanosome and gastral cone* are for the most part blunt amphioxes or amphistrongyles, but a few styles and tylostyles are also found among them.

The *blunt amphioxes and amphistrongyles of the choanosome and cone* (Plate **33**, figs. 1, 2, 18, 19, 21–23; Plate **39**, fig. 39) are in both varieties nearly straight, slightly curved, or angularly bent, and usually provided with a more or less prominent central tyle. They are perfectly smooth. Their end-parts are generally somewhat wavy in outline. The amphioxes (amphistrongyles) of the upper part of the choanosome and the wall of the gastral cavity are 0.5–1.55 mm. long and 4–20 μ thick near the central tyle. The tyle is 2–8 μ thicker than the adjacent parts of the spicule, and measures 11–28 μ in transverse diameter. When there is an angular bend the apex of the angle invariably lies in the central tyle (Plate **33**, fig. 2). In the basal and the axial parts of the sponge these amphioxes (amphistrongyles) attain a larger size. They are here 1–3.5 mm. and more long and 8–50 μ thick.

The *styles and tylostyles of the choanosome and gastral cone* (Plate **33**, fig. 20) are in both varieties shorter than the isoactine rhabds above described, usually only 0.9–1.6 mm. long. The largest terminal tyles of the tylostyles observed were 30 μ in diameter.

The *uncinate amphioxes of the superficial parts of the sponge* (Plate **33**, figs. 3, 4; Plate **39**, figs. 25–30) are straight, or slightly curved, and sharp-pointed at both ends. They are in var. *gracilis* 580 μ long, and 4.5–9 μ thick in the middle.

In var. *robusta* they are larger, sometimes 1.1 mm. long and 20 μ thick. A slight central thickening (tyle) with an axial cross in the interior can usually be made out, particularly in the smaller uncinates. This is generally about 0.5, rarely as much as 1 μ thicker than the adjacent parts of the spicule. The spicule is covered with slender spines, all strongly inclined in the same direction. Near the end from which these spines diverge, they are rather numerous, towards the other end they become very scarce. So far as I could make out these spines consist of a rather broad conic basal part and a fine, exceedingly slender, needle-like end-part. The basal conic part arises steeply from the shaft and bends round above, where it passes into the fine end-part, so that the latter comes to lie nearly parallel to the shaft.

The *large stalk-spicules* (Plate **40**, figs. 21, 22), in var. *robusta* 8 mm. below their upper ends, where they are all broken off, are 40–720 μ thick. The empty spaces previously occupied by them in var. *gracilis* have a maximum width of 900 μ. The upper ends of these spicules of var. *robusta* are curved, the curvature increasing towards the (upper) end. The axial thread is for the most part 3–4 μ thick. It does not lie centrally, but describes a spiral line around the mathematical axis of the nearly cylindrical spicule. It is by no means a simple cylindrical thread. Some parts of it (Plate **40**, fig. 21) are uncinate-like, covered with strongly inclined spine-like processes directed upwards, others (Plate **40**, fig. 22) are thickened, quite irregular, and attain 20 μ in transverse diameter.

In both varieties the *regular microhexactines* (Plate **35**, figs. 14, 15, 17a, 18, 19; Plate **40**, figs. 6, 7, 20b) measure 42–80 μ in diameter. The six rays of the same spicule are fairly equal, and regularly arranged. The chords of the rays are 20–43 μ long. The rays themselves are 1.5–2.2 μ thick at the base, gradually and uniformly attenuated distally to a fine point, and covered with very minute, vertically arising spines. The basal parts of the rays are nearly straight, the distal parts strongly curved through an angle usually a little over 90°. The direction of curvature of the end-part of each individual ray is generally opposite to that of the end-part of the ray opposite it in the same axis.

The *microhexactine-derivates* (Plate **35**, figs. 20–22; Plate **40**, figs. 8–15, 20c) represent two series of forms. One begins with microhexactines in which the two rays lying opposite in the same axis are longer than the other four, and ends with centrotyle diactines. The other begins with micropentactines with equal rays, and ends with style monactines. In var. *robusta* forms of both series are rather frequent; in var. *gracilis* hardly any but diactine forms, with the two fully developed rays opposite in the same axis, have been observed.

First series of microhexactine-derivates. One of the microhexactines, with two opposite longer, and four shorter rays, with which the first series commences, is represented in Plate **40**, fig. 9. This spicule is 117 μ in length. Forms still farther removed from the regular microhexactine are produced by a further reduction of the four shorter rays of such a spicule. The reduction of the four shorter rays is either unequal or more or less equal. In the first case pentactines, tetractines, and triactines (Plate **40**, fig. 11) with two opposite longer rays, and three, two or only one shorter, are produced; in the second case forms like those represented on Plate **35**, figs. 20–22, and Plate **40**, figs. 12, 13, and 20e. In the extreme forms of this series all that remains of the shorter rays is a slight tyle (Plate **35**, fig. 22; Plate **40**, fig. 12). It is to be noted that a distinct increase in size of the two opposite, developed rays is, in these spicules, associated with the reduction of the four other rays. Such diactine microhexactine-derivates are, particularly in var. *gracilis*, more numerous than any of the others. They are in both varieties 156–204 μ long, but in var. *robusta* considerably stouter than in var. *gracilis*, the basal parts of their properly developed rays being in the former 1.5–4 μ, while in the latter only 1.5–2.5 μ thick. The fully developed rays of these spicules are gradually attenuated to fine points, straight in their basal part and curved at the end. The reduced ones are straight throughout, cylindrical or cylindroconic, terminally rounded, and reach 6 μ in length. The terminal curvature of the fully developed rays is not so great as in the rays of the regular microhexactines, nor is its direction generally opposite.

To the *second series of microhexactine-derivates* belong the spicules represented on Plate **40**, figs. 8, 10, 14, and 15. The first (fig. 8) of these is a pentactine with equal rays, 100 μ in diameter. The second (fig. 10) is a compass-shaped diactine. It consists of two fully developed rays, 47 μ long, the basal parts of which enclose a right angle; and the insignificant rudiments of two other rays opposite to the two fully developed ones. The third and fourth (figs. 14, 15) are monactines. Such monactines are more frequent than the other forms of this series. They are 73–86 μ long. Their single fully developed ray is 2.5–4 μ thick at the base and tapers gradually to a fine point. It is straight in its basal part but strongly curved, through an angle of about 120°, in its distal part.

These spicules are, like the regular microhexactines, covered with minute spines. In the larger ones the spines are more conspicuous than in the smaller ones, the size of the spines being, generally speaking, proportional to the thickness of the ray from which they arise.

The *pachymicrohexactines* (Plate **39**, figs. 7–10) are rather rare, and have only been found in the basal part of var. *gracilis*. I consider them as hypertrophic microhexactines. They consist of six fairly equal rays joined at right angles, and measure 52–80 μ in total diameter. Their rays are cylindrical, of nearly uniform stoutness throughout, and rounded at the end. They are 26–42 μ long, 5–15 μ thick, and generally quite smooth. Their basal part is straight, their end-part either straight (Plate **39**, fig. 7) or more or less curved (Plate **39**, figs. 8–10). Axial threads, terminating however a considerable distance below their ends, can be easily made out in the rays of these spicules.

Among the *amphidiscs* of var. *gracilis* two main groups can be distinguished morphologically: — large forms, the largest of which have broad and rather short terminal anchors and a stout, spiny shaft; and small forms the largest of which have long and very slender terminal anchors and a slender shaft with very small spines. In each of these main groups, which I name macramphidiscs and micramphidiscs respectively, two subgroups can be distinguished: — in the macramphidiscs larger forms with relatively shorter, and smaller forms with relatively longer, terminal anchors; in the micramphidiscs larger forms with long and slender anchors, and smaller forms with shorter and broader anchors.

The biological length frequency-curve of these amphidiscs exhibits (Fig. 4) a gap between the lengths 54.76 μ and 66.26 μ. The amphidiscs, to which the part of the curve to the right of the gap pertains, are the amphidiscs referred to above as macramphidiscs; those to the left of the gap as micramphidiscs. Each of these two parts of the curve exhibits a conspicuous depression dividing it into two distinct elevations. These elevations correspond to the smaller and larger kinds of the macramphidiscs and the micramphidiscs, which are, as above stated, also distinguished from each other morphologically by the shape of their terminal anchors.

Thus both the morphological and the biometrical qualities of these amphidiscs show that *four* kinds of these spicules are to be distinguished in var. *gracilis*: — large macramphidiscs, small macramphidiscs, large micramphidiscs, and small micramphidiscs.

The amphidiscs of var. *robusta* also fall into these four groups.

The large *macramphidiscs* of var. *gracilis* (Plate **37**, figs. 20–22) are somewhat infrequent. They are 250–356 μ long, most frequently about [1] 264 μ, and have a straight shaft 8–14 μ thick. This is thickened slightly and gradually to 14–22 μ at the ends, and abruptly in its middle-part to a central tyle 15–18 μ in diameter. The tyle never appears to lie quite in the middle; the difference

[1] This phrase "most frequently about" refers, throughout the descriptions, to the summit of that part of the length frequency-curve of the graph which pertains to the amphidiscs in question.

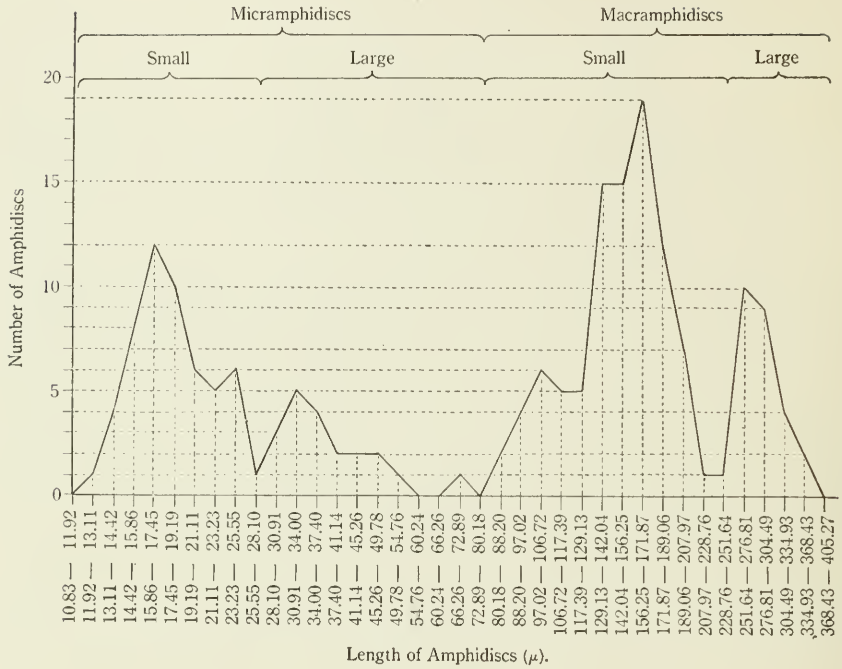

Fig. 4.— Length frequency-curve.

between its distances from the two ends is 7–37 μ, 3%–15% of the length of the whole spicule. In the shaft an axial thread is distinctly visible (Plate **37**, fig. 21). This thread appears to be quite simple and it certainly does not give off branches in the central tyle. From the central tyle, and also from other parts of the shaft, spines arise. The spines of the central tyle are generally five to eight in number and arranged in a more or less regular verticil. They are conical, blunt-pointed, or truncate, 9–14 μ long, exceptionally 18 μ, and 5–7 μ thick at the base; the truncate ones bear minute secondary spinelets on their ends. The other spines are irregularly scattered over the middle-part of the shaft. The thickened conical end-parts of the shaft are free from spines. These spines are not very numerous; often there are a good many more spines on one side of the central tyle than on the other. Most of these spines are vertical to the axis of the shaft; a few of them are, however, oblique, inclined toward the centre of the spicule. These scattered spines are similar in shape and about as stout, but, as a rule, are shorter than the spines of the central tyle. The spines are destitute of axial threads.

The two anchors of the same spicule are equal or slightly unequal in size. The greatest differences between them in length and breadth observed were 12 and 8 μ respectively. The anchors are 70–100 μ, that is generally a little less than a third of the whole spicule in length, and 70–95 μ broad. The proportion of length to breadth in these anchors is 100 to 60–108, on an average 100 : 93.2.

Each anchor consists of eight recurved teeth. The teeth of the same anchor are fairly equal and regularly arranged. Their axes extend in planes passing through the axis of the shaft and enclosing angles of 45° with their neighbours. The individual teeth arise nearly vertically from the shaft, and then curve concave towards it. This curvature in the basal part of the tooth is for some distance fairly uniform, but it decreases distally. Towards its end the tooth is hardly at all concave to the shaft, or straight, or even slightly convex to the shaft. The whole curvature amounts to about 90°, the end-parts of the teeth being nearly parallel. Seen *en face* (from above) the individual teeth are elongate oval in appearance, 10–16 μ broad in the middle, and rounded or pointed at the end. Seen in profile they appear stoutest at the base and are at first gradually, and near the end abruptly, attenuated to a sharp point. Each anchor-tooth somewhat resembles a T-iron. It consists of an outer band-shaped part, and an inner keel. The outer band-shaped part is broadest in the middle, attenuated towards both ends, and bent, concave to the shaft, both transversely and longitudinally. Its transverse convexity increases, and its longitudinal convexity decreases, towards the distal end. The inner keel is highest at the base of the tooth; towards its distal end it becomes lower, at first gradually, then more abruptly.

The large macramphidiscs of var. *robusta* (Plate **40**, figs. 1, 2, 19) are similar to those of var. *gracilis*, but larger and provided with somewhat thicker shafts and broader anchors. They are 235–335 μ long, most frequently about 297 μ. The shaft is 10–17 μ thick. Its central tyle measures 15–18 μ in diameter. The anchors are 70–100 μ in length, that is about a third of the whole spicule, and 90–110 μ broad. The proportion of the length to the breadth of these anchors is 100 to 95–150, on an average 100 : 117.6.

The *small macramphidiscs* of var. *gracilis* (Plate **34**, fig. 19b; Plate **35**, fig. 24b; Plate **37**, figs. 12–19; Plate **38**, figs. 4–8) are 86–212 μ long, most frequently about 164 μ. The shaft is 2.5–9 μ thick, and thickened in or near the middle to a central tyle 4–12 μ in diameter. The shaft bears spines similar to those on the shafts of the large macramphidiscs. These spines are 5–12 μ long and 2–3.5 μ thick. The terminal anchors are 32–72 μ in length, usually a little more than a third of the whole spicule, and 16–69 μ broad. The proportion of the length to the breadth of the anchors is 100 to 56–96, on an average 100 : 81.2. The individual anchor-teeth are strongly curved in their basal part. Distally their curvature decreases and their end-parts, a third to a half of their total length, are nearly straight and parallel.

The small macramphidiscs of var. *robusta* are similar but stouter and provided with broader terminal anchors. Their measurements are: — length, 146–205 μ, most frequently about 176 μ; thickness of shaft 4–11 μ; anchor-length 45–80 μ, usually a little over a third of the length of the whole spicule; proportion of anchor-length to anchor-breadth, 100 to 72–112, on an average 100 : 81.2.

The *large micramphidiscs* of var. *gracilis* (Plate **37**, figs. 6–11) are 28.5–68 μ long, most frequently about 32.4 μ. The shaft is 0.8–1.5 μ thick. It always bears a few spines in or near the middle, and usually some also elsewhere. The central spines do not form verticils. The spines are 0.4–1 μ long, about as thick, and usually cylindrical and terminally rounded, or truncate.

The two anchors of the same spicule are very similar, the greatest difference observed in their lengths and breadths being 2 μ and 1 μ respectively. The anchors are 11–24 μ in length, that is a little over a third of the whole spicule, and 6–10 μ broad. The proportion of the length to the breadth of the anchors is 100 to 44–64, on an average 100 : 52.6. The individual anchor-teeth of the smaller forms of these spicules are strongly curved in their basal parts and fairly straight in their distal parts, their total curvature being such that their tips are nearly parallel (Plate **37**, figs. 6, 7). In the larger forms the teeth are relatively longer, and the curvature of their basal part stronger, whilst their end-parts are slightly curved in the opposite direction, convex to the shaft. The tips of the teeth of these amphidiscs are parallel or convergent, and the anchors themselves at the end sometimes as much as 3 μ narrower than in their broadest, more proximal part. This gives to these spicules quite a peculiar appearance (Plate **37**, figs. 8–11).

In var. *robusta* no amphidiscs have been observed similar to the larger forms of the large micramphidiscs with distally attenuated anchors; all the large micramphidiscs of var. *robusta* are similar in shape to the smaller forms of the large micramphidiscs of var. *gracilis*. The dimensions of the large micramphidiscs of var. *robusta* are: — length 27–64 μ, most frequently about 45.5 μ; anchor-length 11–25 μ, about two fifths of the length of the whole spicule; anchor-breadth 7–26 μ; proportion of anchor-length to anchor-breadth 100 to 64–104, on an average 100: 84.

The *small micramphidiscs* of var. *gracilis* (Plate **35**, fig. 17b; Plate **37**, figs. 1–5; Plate **38**, figs. 1–3) are 13–26 μ long, most frequently about 16.7 μ. The shaft is straight and 0.5–1.2 μ thick. It bears in its central part a few short and broad, terminally rounded protuberances. The terminal anchors are 5–9 μ in length, that is a third to two fifths of the whole spicule, and 4.2–8 μ broad. The proportion of the length to the breadth of the anchors is 100 to 55–120, on an average 100 : 90.

The small micramphidiscs of var. *robusta* (Plate **40**, figs. 16–18, 20a) are similar but somewhat smaller. Their measurements are: — length 12–23 μ, most frequently about 16.2 μ; anchor-length 3.8–7 μ, that is about a third of the length of the whole spicule; anchor-breadth 4–5 μ; proportion of anchor-length to anchor-breadth 100 to 72–125, on an average 100 : 90.

A few young forms of micramphidiscs were observed in var. *robusta*. These spicules (Plate **40**, fig. 18) have a centrotyle and spiny shaft thickened at both ends. Their anchors appear as terminal verticils of small vertically arising and slightly recurved teeth.

The two specimens described are in respect to their spiculation similar enough to be considered the same species. Their skeletal elements, however, differ in detail, the spicules generally, and particularly both the stout and the slender tetractine and tetractine-derivate acanthophores, having much stouter rays. The uncinates are larger and the anchors of both kinds of macramphidiscs and of the large micramphidiscs are relatively considerably broader in the specimen from Station 3681 (A. A. 2) than in the specimen from Station 3684 (A. A. 17). For this reason and because the two specimens differ considerably in outer appearance and come from localities a good distance (over 3000 km.) apart, I think it advisable to consider them as two distinct varieties.

The only species of Hyalonema which appears to be at all closely allied to these sponges is the one described in this report as *Hyalonema* (*H.*) *agassizi*. From this they differ chiefly by their macramphidiscs and large micramphidiscs having more strongly curved and less divergent teeth, by their microhexactines being smaller and having more strongly curved rays, by the spicules of their acanthophores being larger, and by the rays of the slender acanthophores having longer spines.

Hyalonema (Hyalonema) agassizi, sp. nov.

Plate 41, figs. 1–14; Plate 42, figs. 1–59; Plate 43, figs. 1–7; Plate 44, figs. 1–30; Plate 45, figs. 1–64; Plate 46, figs. 1–16; Plate 47, figs. 1–13.

Eleven more or less complete specimens and three fragments of this species were trawled in the Tropical Pacific at five stations. One of these sponges is a very fine specimen, the best in the collection. It is therefore appropriate to name this new species after the leader of the several Albatross expeditions which brought home the material here reported on.

Two of the five specimens from Station 4742 are cake-shaped, the three others more elongate, pear- or top-shaped. The general appearance and the spiculation of the fragments indicate that they are parts of similar pear- or top-shaped sponges. The two cake-shaped specimens from Station 4742 appear to be identical in structure among themselves, but to differ from all the rest. The same is to be said of the three pear- or top-shaped specimens and the fragments from the same station, and of the three specimens from Station 4740. The specimens from the three other stations all differ from each other and from the rest. I shall, for the reasons given below, describe these six different kinds as distinct "forms":—

A, the one taken at Station 4656 on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4063 m. (2222 f.); bottom composed of fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°.

B, the one taken at Station 4651 on 11 November, 1904; 5° 41.7′ S., 82° 59.7′ W.; depth 4063 m. (2222 f.); bottom a sticky, fine gray sand; bottom-temperature 35.4°.

C, the three from Station 4740 taken on 11 February, 1905; 9° 2.1′ S., 123° 20.1′ W.; depth 4429 m. (2422 f.); bottom composed of dark gray Globigerina ooze; bottom-temperature 34.2°.

D, the one taken at Station 3684 (A. A. 17) on 10 September, 1899; 0° 50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); bottom light yellow-gray Globigerina ooze.

E, the two caked-shaped specimens, and

F, the three pear- or top-shaped specimens and the fragments, all from Station 4742, on 15 February, 1905; 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); bottom composed of very light, fine Globigerina ooze; bottom-temperature 34.3°.

Shape and size. The single specimen of form A (Plate **41**, fig. 2) is well-preserved. Its body is broad top- or spindle-shaped, has at every level a nearly circular transverse section, and measures 66 mm. in length and 48 mm. in maximum transverse diameter. At its apex the rounded summit of the nearly cylindrical gastral cone is visible. The cone is surrounded by a circular wall which terminates in a narrow frill, the margin of which appears as a circle 8 mm. in diameter. The circular wall is separated from the cone by a circular fissure about 1 mm. wide. This fissure is the gastral cavity. The outer surface of the sponge-body is quite smooth and continuous; apertures, visible to the naked eye, do not occur in it. From the lower, rounded end of the body the stalk arises. At its origin this is about 5 mm. thick, thickens slightly below, and measures a little over 40 cm. in length. The spicules composing it are all broken off at the lower end; in life the stalk was probably considerably longer. Its lower and central parts are quite straight. Its upper part is strongly and uniformly bent through an angle of about 60°.

The single specimen of form B (Plate 41, fig. 1) is not so well-preserved. Of its dermal membrane only a few patches are left and the upper part is much torn. It is massive, pear- or club-shaped, 81 mm. long and 61 mm. broad. The stalk is straight, 7 mm. thick at the point of origin and broken off at a distance of 9 cm. from the sponge-body. Although, as above stated, the upper part of the sponge is much torn, one can make out in the middle of it a nearly cylindrical, terminally rounded gastral cone about 10 mm. thick, connected by four radial, vertical, membraneous plates joining it with the gastral wall. The surface appears very rough and uneven. This is doubtlessly due to the loss of the dermal membrane.

The three specimens of form C are cake-shaped. Of their dermal membranes and the stalks only slight remnants remain. The best preserved one (Plate 41, figs. 13, 14) is a stout, marginally rounded disc, broad-oval, nearly circular in outline. It measures 66 mm. in length, 60 mm. in breadth, and 27 mm. in thickness (height). The lower face is nearly flat, the upper convex. The centre of the latter is occupied by a gastral depression 20 mm. in diameter, nearly circular in outline, and surrounded by a circular wall on the margin of which remnants of a thin frill can be made out. Where this frill is best preserved it appears to be turned outward. A low, dome-shaped, gastral cone about 6 mm. thick arises from the centre of the depression. This cone is connected with the gastral wall by four vertical, radial membraneous plates. The wide spaces between these radial plates appear as diverticular parts of the gastral cavity, which are continued down into the interior of the sponge. A few stalk-spicules, broken off 1–3 cm. from the sponge, arise from the centre of the flat lower face. Many parts of the surface, particularly of the upper side, exhibit a reticulate appearance, caused by the presence of a superficial network with irregularly square meshes, the centres of which are about 1 mm. apart (Plate **41**, fig. 14). The centre of each mesh is occupied by the circular entrance to an afferent canal. The other two specimens of this form are similar. One of them is about as long and broad as the one above described, but thicker (higher); the distance between the summit of its gastral cone and the slight protuberance on its lower face, from which the (absent) stalk arose, being 40 mm. The other is smaller, has no trace of a stalk, and measures 45 by 37 by 12 mm.

The single specimen of form D is also indifferently preserved. A few small remnants of the dermal membrane and some stalk-spicules, broken off short, are, however, still present. This sponge (Plate **41**, fig. 12) is also cake-shaped. It measures 51 mm. in length, 46 mm. in breadth, and 17 mm. in thickness (height).

The larger and more complete of the two specimens of form E is cake-shaped, 36 mm. long, 28 mm. broad, and 25 mm. thick (high). In the middle of its flattened upper face there is a gastral depression, surrounded by a thin circular wall with sharp margin. This margin is nearly circular and measures 13 mm. in diameter. In the centre of the depression a low gastral cone is situated, from which radiate several somewhat irregularly disposed vertical plates. Between these plates wide diverticula of the gastral cavity extend downwards to a distance of about 14 mm. A protuberance 5 mm. high is observed in the middle of the lower, more convex face of the sponge. The holes in it indicate that, in life, the spicules forming the stalk arose from this protuberance. The other specimen of this form is very similar. It measures 34 by 28 by 21 mm.

The most complete specimen of form F is laterally compressed and appears as an irregularly triangular plate about 5 mm. thick. The plate is 30 mm. broad above and narrows below to 5 mm. A bundle of stalk-spicules arises from the lower end. The other two specimens of this form are more fragmentary and consist only of the central and the attenuated basal part of the sponge-body, and the upper part of the stalk. One is (without the stalk) 37 mm. long, the other 35 mm. The largest of the fragments of this form is 28 mm. long.

The *colour* of the specimen of form A in spirit is a rather rich coffee-brown, of form B a dirty light greenish gray, of form C a light reddish brown, of form D a light dirty brown, and forms E and F are whitish.

Canal-system. The canal-system of form A (Plate **45**, figs. 18, 23) seems to be similar to that of *Hyalonema* (*Hyalonema*) *obtusum* var. *gracilis;* the chief difference apparently being that the former is more dense and has narrower subdermal cavities and canals. The flagellate chambers are elongate and 50–80 μ broad. In one of the specimens of form C the afferent canals are very clearly visible. They here appear as tubes, about 0.5 mm. wide, which lie parallel side by side and extend vertically down into the interior of the choanosome. In this form, and in the forms B, D, and E, the gastral cavity is divided by radial vertical plates into diverticula. The plates are, in several of these specimens, four in number and regularly arranged in a cruciate manner. The diverticula extend downward, are tubular, very wide above, attenuated below, and nearly circular in transverse section. Their walls are perforated by numerous efferent apertures, many of which attain considerable dimensions.

Skeleton. The whole of the outer surface of form A, and the (small) parts of it, in the other forms where the dermal membrane is still present, are covered by a dense pinule-fur (Plate **42**, fig. 36; Plate **45**, fig. 23a). Certainly in form A and probably also in the other forms, the pinules of all parts of the outer surface are similar, with the exception of the part close to the origin of the stalk. They are in all forms for the most part pentactines; a few, however, possess a more or less developed sixth, proximal ray, and appear as hexactines. Between the lateral rays of these dermal pinules a few micramphidiscs lie scattered on the outer surface. From the thin, upper, free margin of the wall surrounding the gastral cavity (fissure or depression) the distal rays of diactine pinules protrude. The gastral surface, that is the inner surface of the wall surrounding the gastral cavity, and the surface of the gastral cone are likewise covered by a pinule-fur. The pinules composing it are chiefly pentactines, more rarely hexactines, exceptionally diactines. A few minute spiny pentactines have also been observed here. On these gastral surfaces also micramphidiscs occur. These spicules are here, however, much more abundant than on the outer surface, and in places form dense masses. Below, where the gastral cavity passes into the large efferent canal-stems, the pinule-fur ends; the coating of micramphidiscs, however, is continued along the walls of these canals quite down to the innermost parts of the choanosome. The micramphidiscs of the outer, dermal surface and of the surfaces bordering on the upper part of the gastral cavity and enclosing the inner, proximal parts of the efferent canals, are all or nearly all small ones. Those on the surfaces surrounding the lower proximal part of the gastral cavity and the mouths of the large efferent canals on the other hand are, certainly in form A, and probably also in the other forms, in great part large macramphidiscs.

Just below the level in which the lateral rays of the dermal pinules of the outer surface extend, the paratangentially situated lateral rays of hypodermal pentactines are met (Plate **42**, fig. 37a; Plate **45**, fig. 23). In form C these lateral pentactine rays extend in the beams of the superficial network above described. The apical rays of the hypodermal pentactines extend radially inward. In form A a superficial zone about 0.6 mm. thick, underlying the dermal membrane, is occupied by dense masses of more or less radially arranged uncinates and irregularly scattered microhexactines and microhexactine-derivates (Plate **45**, fig. 23). This zone contains no spicules besides these and the proximal rays of the hypodermal pentactines, which traverse it. Below this zone hexactine megascleres begin to make their appearance. Those lying nearest the surface are quite small, towards the interior they increase in size. Though often irregularly disposed in the sections, these spicules are, in the living sponge, in all probability regularly arranged in such a manner that two opposite rays extend longitudinally upward and downward, two radially outward and inward, and two paratangentially and laterally to the right and left. In most of the large and in a good many of the smaller hexactines the two opposite longitudinally extending rays are longer than the other four. Masses of large macramphidiscs are met with a little below the level where the hexactines begin to make their appearance. In some places these form but a thin layer, in others they extend a considerable distance, 2 mm. or more, into the interior of the choanosome.

The inner parts of the sponge are occupied by the large hexactine megascleres referred to above, and also by rhabd-megascleres, uncinates, microhexactines, microhexactine-derivates, amphidiscs, and spheres.

The large inner hexactines usually have two opposite, longitudinally extending, greatly elongated rays and four shorter transverse rays. The rhabds of the axial part of the sponge are situated longitudinally and form a kind of axial column, which extends upwards to the summit of the gastral cone. Loose strands of rhabds diverge from this axial column and extend upwards and outward. Below, in the interior of the choanosome, these diverging rhabd-strands dissolve into scattered, obliquely situated, isolated rhabds; above they join to form distinct layers lying below the dermal and the gastral surfaces of the thin frill-like marginal part of the gastral wall. In the forms B, C, and D masses of longitudinal rhabds also occupy the vertical radial plates connecting the gastral cone with the gastral wall. Most of these rhabds are very blunt amphioxes or amphistrongyles; but sharp-pointed amphioxes, amphityles, styles, and tylostyles also occur among them. In the axial column of form A both large and small rhabds are met. Outside the axial column, however, only the smaller ones have been observed.

In the interior the uncinates are not very numerous and are irregularly scattered. Of amphidiscs both macramphidiscs and micramphidiscs occur in the interior. The former are very scarce, the latter, which appear chiefly to occupy the walls of the efferent canals, exceedingly numerous. The micro-hexactines and their derivates are, in the interior, rather frequent, but not nearly so abundant as in the superficial region. The spheres appear to be restricted to the axial column, where they occur singly or, more rarely, in clusters. They are rather numerous in form A and have also been found in form D.

In the specimens of form A, B, and in two of the specimens of form F the stalk is more or less intact. It is in these forms composed of stouter and more slender rods, broken off at the lower, distal end. In the specimen of form A the stalk is over 40 cm. long and now consists of twenty spicules; in life there may have been more. The spicules composing it are very distinctly spirally twisted, like the strands of a rope and also similarly entwined. The twist has the same direction in all. Progressing from the proximal to the distal end the spiral curvature is in the direction of the movement of the hands of a watch.

The stalk-spicules extend for some distance upwards into the sponge-body, and they are, in the basal part of the latter, surrounded by masses of acanthophores. These are stout-rayed, usually terminally spined tetractines (stauractines), derivates of these spicules, more or less spiny pentactines, modified pinules, and modified rhabds with spiny ends. In the basal part of some of the specimens spheres also occur. In the specimens of all the forms with the exception of those of forms E and F, slender-rayed, long-spined spicules with four to six rays also occur just below the surface of that part of the body from which the stalk arises. Their absence in forms E and F is probably due to the fragmentary nature of the specimens of these forms.

The *dermal pinules* (Plate 42, figs. 20–23, 25–36, 37b, 42b) are nearly all pentactine; only a few are hexactine. Their distal ray, in form A (Plate 42, figs. 25–28, 35, 36), is straight, 93–110 μ long, usually 94–107 μ, on an average 100.4 μ; and, at the base, 4.4–7 μ thick, usually 4.5–6.7 μ. Above it thickens, and it ends with a well-developed, smooth, terminal cone 6.5–11 μ thick, usually 8.5–9 μ. The proximal, basal part of the ray and its terminal cone are free from spines; the rest of it, usually about 60% of its length, is covered with spines. The most proximal spines diverge strongly, and are often nearly vertical to the ray. Distally they become more inclined towards the tip, and the uppermost spines, which surround the terminal cone, are nearly parallel to the ray-axis. The lowest spines are straight and quite short. Distally they become slightly curved, concave towards the tip of the ray. Up to the middle of the length of the ray they increase in size; beyond they again become smaller. The largest spines on the middle-part of the ray are 10–20 μ long and 2–4 μ thick at the base. The maximum transverse diameter of the distal ray, together with its spines, is 18–32 μ, usually 20–30 μ, on an average 23.6 μ. The lateral rays of the same spicule are usually fairly equal (Plate **42**, fig. 35), sometimes considerably unequal (Plate **42**, fig. 36). They are 21–32 μ long, straight, nearly cylindrical in their basal part, attenuated toward the end in their distal part, and blunt-pointed or terminally rounded. The proximal parts of the lateral rays are usually rather smooth; their distal parts bear sparse small spines. A sixth proximal ray is observed very rarely and, when present, is short and rudimentary.

The dermal pinules of form B (Plate **42**, fig. 29) are very similar but have a shorter and more bushy distal rays and longer lateral rays. The distal ray is 85–97 μ long, on an average 93 μ, and 3.5–6 μ thick at the base. Its maximum transverse diameter, together with the spines, is 28–34 μ, on an average 29.2 μ. The lateral rays are 25–30 μ long.

The dermal pinules of form C (Plate **42**, figs. 20–23) are even more similar to those of form A, but have a slightly more bushy distal ray and longer lateral rays. The distal ray is 95–114 μ long, on an average 104.9 μ, and 4–6 μ thick at the base. Its maximum transverse diameter, together with the spines, is 22–32 μ, on an average 27 μ. The lateral rays are 25–35 μ long.

The dermal pinules of form D (Plate **42**, figs. 30–34, 42) differ from those of the other forms by the distal ray being not so long, having a shorter and stouter terminal cone, and being covered with more numerous and crowded spines. The distal rays of the dermal pinules of this form therefore appear, when compared with those of the other forms, more stunted, stout, and dense. The distal ray is 82–101 μ long, usually 87–95 μ, on an average 89.1 μ, and at the base 4.5–8 μ thick, usually 4.5–6 μ. Its maximum transverse diameter, together with the spines, is 23–32 μ, on an average 26.2 μ. The terminal cone is 8–11 μ thick. The lateral rays are 17–30 μ long, exceptionally up to 38 μ.

The dermal pinules of form E have a distal ray 70–94 μ long, on an average 86.7 μ. Its maximum thickness, together with the spines, is 22–32 μ. The lateral rays are usually 18–23 μ long.

The dermal pinules of form F have a distal ray 85–97 μ long, on an average 90 μ. Its maximum thickness, together with the spines, is 23–25 μ. The lateral rays are usually 23–43 μ long.

Peculiar, very variable, *modified pinules* (Plate 42, figs. 38–41, 43–45, 47, 48) occur in the basal region, where the large stalk-spicules enter the sponge-body. These spicules appear to be dermal pinules changed in shape and in part pushed into the interior by the stresses arising in this region from the resistance of the embedded upper ends of the stalk-spicules to the weight of the sponge-body, and to such passive movements of it as may be caused by the impact of moving deep-sea animals. Transitional forms appear to connect these modified pinules with the slender-rayed, long-spined basal tetractines and other spicules described below.

The modified basal pinules of form A (Plate 42, figs. 38–41) are pentactine or hexactine. The distal ray is straight, 78–120 μ long, and 2.5–6 μ thick at the base. It bears, in its middle- and end-parts, sparse, strongly divergent spines, which are sometimes irregularly distributed, and are more numerous on one side than on the other (Plate 42, fig. 40). These spines are slender, conic, pointed, straight or slightly curved, simply or in an S-shaped manner; they are 15–29 μ long and 1.3–3 μ thick at the base. The maximum transverse diameter of the distal ray, together with the spines, is 18–42 μ. The lateral rays of the same spicule are equal or unequal. They are straight, 30–57 μ long, conic, usually pointed, and covered with spines directed obliquely outward. The largest of these spines are 1.5–2 μ long. The proximal ray (of the hexactine forms) is 42–55 μ long; in shape and spinulation it resembles the lateral rays.

The modified basal pinules of form B (Plate 42, figs. 47, 48) are similar but have shorter and stouter rays. The distal ray is 83–94 μ long and 4–6 μ thick at the base. Its maximum diameter, together with the spines, is 28–35 μ. The spines of the distal ray are 18–24 μ long and 2.5–2.7 μ thick at the base. The lateral rays are 25–32 μ long.

Some of the modified basal pinules of form C (Plate 42, figs. 43, 44) are considerably larger than those of the other forms. The distal ray is 101–135 μ long and 4.5–5 μ thick at the base. Its maximum transverse diameter, together with the spines, is 13–33 μ. Its spines are 14–15 μ long and about 2.3 μ thick at the base. The lateral rays are 20–80 μ long.

In form D, E, and F, I found only few modified basal pinules (Plate 42, fig. 45). One of form D which I measured had a distal ray 82 μ in length and, together with the spines, 28 μ in maximum thickness. Its largest spines measured 18 by 2.5 μ.

The frill on the margin of the gastral wall, containing the *diactine pinules,* is preserved in a satisfactory manner only in the specimen of form A. The diactine marginal pinules of this form (Plate 44, figs. 1–5) have a total length of 350–640 μ. The distal ray is 148–245 μ long, fairly straight, 6–9 μ thick at the base, and thickened above. It ends with a smooth, rather slender, sharp-pointed terminal cone. All parts of it, with the exception of its basal portion and its terminal cone, are covered with spines strongly inclined towards the tip. The largest spines are situated about a third of the length of the distal ray from the tip. From here they decrease in size both distally and proximally. The largest spines are 6–7 μ long and 2–3 μ thick at the base. The maximum transverse diameter of the distal ray, together with the spines, is 15–26 μ. The lateral rays are generally reduced to mere rounded protuberances, only exceptionally as much as 9 μ high (Plate **44**, fig. 2, the left one). Together they form a central tyle 11–21 μ in diameter. The proximal ray is straight or slightly curved, 175–400 μ long, and, at the base, as thick as the distal ray. It usually bears a few spines and a number of very low and broad rounded protuberances which render the appearance of its outline somewhat wavy.

I have observed a few transitional forms which appear to connect these diactine pinules with ordinary, centrotyle, amphiox megascleres. The ray corresponding to the distal ray of the diactine pinules of one of these spicules, which I measured, was perfectly smooth, 680 μ long, and 22 μ thick at the base, and thickened above the middle of its length to 26 μ. Its central tyle measured 30 μ in transverse diameter.

The *gastral pinules* (Plate **42**, figs. 1–8, 10–19, 24). In form A, where the gastral pinules both on the cone and on the inner face of the gastral wall could be conveniently measured, I found the distal rays of the former markedly longer than the distal rays of the latter, and also noticed that the distal rays of the pinules of the gastral wall decreased in length towards the upper, free margin.

The gastral pinules of the cone of form A (Plate **42**, figs. 1–8, 10–13) are for the most part pentactine; a few, however, are hexactine (Plate **42**, figs. 1, 2) and one that I observed was diactine (Plate **42**, fig. 13). The distal ray in these pinules, when normally developed, is 97–135 μ long, usually 100–134 μ, on an average 118.2 μ, and 3.5–9.5 μ thick at the base. One (Plate **42**, fig. 8) that had apparently been broken off during growth and then partly regenerated was only 65 μ long. The distal ray-ends with a smooth, blunt, terminal cone 4.5–9 μ thick. This and the basal part of the ray are destitute of spines. The remaining parts of it bear somewhat sparse spines. The proximal spines are strongly divergent, only slightly inclined, and curved towards the tip of the ray. Distally they become more inclined in this direction, but are, on the whole, much more divergent than those of the dermal pinules. The spines attain their greatest length near the middle of the ray and from here decrease in size both proximally and distally. The largest spines are 10–21 μ long and 2.5 μ thick at the base. The maximum transverse diameter of the distal ray, together with the spines, is 21–41 μ, usually 30–40 μ, on an average 34.1 μ. The lateral rays of the pentactine and hexactine gastral cone-pinules are, in the same spicule, fairly equal (Plate **42**, figs. 1, 10, 11) or more or less unequal (Plate **42**, figs. 3, 5, 12), some of the lateral rays of the same spicule often being short, cylindrical, and terminally rounded, the others long, conic, and pointed. The individual lateral rays are 20–85 μ long, straight, cylindrical, and terminally rounded, or conic and pointed at the end. Their basal part is usually quite smooth, their distal part for two thirds or more of their length is covered with more or less conspicuous spines. The proximal ray in the hexactine forms is 17–76 μ long, gradually attenuated towards the end, or abruptly pointed. It is smooth throughout, or covered with spines in its distal part. The proximal ray of the diactine cone-pinule (Plate **42**, fig. 13) is 95 μ long.

The gastral pinules of the inner surface of the gastral wall of form A are similar to those of the cone, but have distal rays only 91–112 μ long.

The gastral cone-pinules of form B (Plate **42**, figs. 14, 15) are pentactine or, more rarely, hexactine and similar to those of form A. They have, however, shorter distal rays with more divergent and longer spines. The distal ray is in these spicules 83–109 μ long, on an average 98.2 μ, and 5–7 μ thick at the base. Its maximum transverse diameter, together with the spines, is 27–45 μ, on an average 34.4 μ. Its largest spines attain a length of 25 μ. The lateral rays are 30–48 μ long, the proximal ray (of the hexactine forms) is 12–27 μ long.

The gastral cone-pinules of form C (Plate **42**, figs. 16, 17) have a longer distal ray than those of form B and resemble those of form A very closely. The distal ray in these spicules is 110–127 μ long, on an average 118.5 μ, and 4.5–5.5 μ thick at the base. Its maximum transverse diameter, together with the spines, is 24–29 μ. The lateral rays are 35–50 μ long.

The distal rays of the gastral pinules of the inner surface of the gastral wall of form C (Plate **42**, figs. 18, 19) are similar in size but have more divergent spines and consequently, together with the spines, a greater maximum transverse diameter. The divergence of the proximal spines from the tip of the ray is so great that some of them stand vertical, and some even point the opposite way. The distal ray is 103–126 μ long, on an average 115 μ, and 5–6 μ thick at the base. Its maximum transverse diameter, together with the spines, is 28–35 μ. The lateral rays are 36–50 μ long.

The gastral pinules of the cone of form D (Plate **42**, fig. 24) resemble those of form A rather closely. They have a distal ray 98–113 μ long, on an average 106.7 μ, and 6.5–8.5 μ thick at the base. Its maximum transverse diameter, together with the spines, is 25–38 μ. The lateral rays are 26–64 μ; the proximal ray (of the hexactine forms) is 38–50 μ long.

The gastral pinules of form E have a distal ray 69–103 μ long, usually 83–99 μ, on an average 90.5 μ, and 4.5–7 μ thick at the base. Its maximum thickness, together with the spines, is 21–37 μ. The lateral rays are 21–57 μ long. In two hexactine gastral pinules of this form measured, the proximal ray was 42 and 44 μ long respectively.

The gastral pinules of form F have a distal ray 100–153 μ long, on an average 129 μ, and 5–6 μ thick at the base. Its maximum thickness, together with the spines, is 25–40 μ. The lateral rays are 50–62 μ long.

Minute pentactines with spiny rays (Plate **42**, figs. 9, 50) were found in small numbers in the spicule-preparation of the gastral cone of form A, and the basal part of forms A and B. These pentactines have straight, conic, blunt-pointed rays, smooth at the base, but covered with conspicuous spines in their distal part. Their apical ray in form A is 36–80 μ long, in form B 43–65 μ, and is in both 3–6 μ thick at the base. The lateral rays of the same spicule are equal. In form A they are 40–50 μ long, in form B 25–42 μ, and about as thick as the apical ray.

The *hypodermal pentactines* of form A (Plate **41**, figs. 3–11; Plate **45**, fig. 23) have a fairly straight, conic, and blunt apical (proximal) ray, which measures 0.3–1.5 mm. in length, and 18–90 μ in thickness at the base. The lateral rays of the same spicule are fairly equal or more or less unequal. Among the small hypodermal pentactines forms with equal lateral rays predominate, but among the large ones forms with unequal lateral rays are the more numerous. The lateral rays are more or less oblique and enclose angles of 80°–88° with the apical (proximal) ray. They are usually somewhat curved, conic, and rounded at the end. The longest lateral ray is 0.25–1.3 mm. long. The ends of the lateral rays (Plate **41**, fig. 9) are, as in *Hyalonema obtusum*, usually irregular, and probably for the same reason (*cf.* p. 160).

In the forms B, C, and D, in which the greater part of the dermal membrane is lost, only few hypodermal pentactines were found. All those observed in forms C and D were similar to those of form A. In form B spiny pentactines of similar dimensions were found, in addition to the ordinary smooth ones of the other forms. For the reasons given below (p. 183) I consider these spiny pentactines as foreign spicules.

The *hexactine megascleres* of form A (Plate **45**, figs. 6–13) measured were 0.4–6 mm. in maximum diameter. The rays of the same spicule are in the smaller ones either equal or unequal, in the largest ones always unequal in length, two opposite ones being in these much longer than the other four. The four shorter rays are often also unequal among themselves. The rays arise from a central thickening 30–90 μ in diameter, are smooth, conic, 10–58 μ thick at the base, and blunt or rounded at the end. They are in the small hexactines straight, in the large usually slightly curved. The longest ray is 220 μ–3.2 mm. long.

The hexactines of forms C and D are similar. In form B I found, besides hexactines similar to those of form A, one 11 mm. in maximum diameter with rays 70 μ thick at the base, and only slightly attenuated to the rounded ends. In this form also spined hexactines, 2–5.5 mm. in diameter, occur. Although these are quite numerous and found in the depth of the choanosome, I do not believe that they really belong to the sponge. They are, like the large spined pentactines referred to above, identical with the spined hexactine and pentactine megascleres of *Calycosilva cantharellus* (Plate **1**, figs. 5–24; Plate **6**, figs. 1–12), a large number of specimens of which were trawled at the same station. Some of the spined hexactines and pentactines of these sponges may therefore have got accidentally into the sponge.

In the basal part of the body, from which the stalk arises, *slender acanthophores*, usually with four, more rarely with five or six rays (Plate **42**, figs. 49, 51–59), are met in all the forms except E and F. In form A these spicules (Plate **42**, figs. 49, 51, 52) are 95–170, usually 110–135 μ in diameter, and generally consist of four rays lying in the same plane and enclosing angles of 90° with their neighbours. Sometimes a fifth ray, vertical to the other four, is present. The rays of these spicules are fairly straight, at the base 2.5–4 μ thick, rarely 5 μ, conic, and sharp-pointed. They bear numerous slender oblique spines inclined towards the tip of the ray. The largest spines are 4–12 μ long.

In form B these spicules (Plate **42**, figs. 53, 54) are similar, measure 85–150 μ in diameter, and have rays 2–4.5 μ thick at the base. Here only tetractines were observed.

In form C these spicules (Plate **42**, figs. 55, 56, 58) are larger, 120–210 μ in diameter, and have four or, more rarely, five fairly straight or considerably curved rays, 3.5–5 μ thick at the base.

In form D some of these spicules (Plate **42**, figs. 46, 57, 59) attain a still larger size. They measure here 100–230 μ in diameter and have usually five, more rarely four or six rays 2.8–6 μ thick at the base.

Transitional forms were found quite frequently in the basal part of the sponge-body, particularly in form C, apparently connecting these slender-rayed acanthophores with the modified basal pinules described above on the one hand, and the stout acanthophores described below, on the other hand.

The *stout acanthophores* surrounding the proximal end-parts of the large stalk-spicules (Plate 45, figs. 1–4, 14–17, 24, 25, 35–39) are mostly tetractines and diactine tetractine-derivates. However, similar pentactines, triactines, and, exceptionally, also monactines occur among them. Occasionally one meets with tetractines and pentactines of this kind with all the rays greatly reduced in length. These spicules appear as transitions, leading to the spheres described below.

The rays of the same spicule are always more or less, and sometimes very unequal. They generally join at angles of about 90° or 180°, and are straight or curved, and cylindrical and terminally rounded, or conic and either blunt or pointed at the end. The diactine ones are either centrotyle or simply cylindrical in the centre, straight, slightly angularly bent in the middle, or, rarely, strongly curved. One 11 μ thick, which I observed in form A, formed a complete ring 65 μ in diameter. Sometimes the rays bear rudiments of branch-rays. The basal parts of the rays are usually smooth or only sparsely spined; their end-parts bear numerous, rather large, generally nearly vertical spines, which stand close together. The smooth proximal part is usually a little longer than the spined distal part.

In form A the larger, normal acanthophores are 200–690 μ in maximum diameter and have rays 14–40 μ thick at the base. The small ones transitional to the spheres (Plate 45, figs. 24, 25, 38) are 46–115 in diameter and have rays 9–14 μ thick.

In the other forms these spicules appear to be similar. Form D possesses mon- to pentactine spicules of this kind 195–550 μ in maximum diameter with rays 15–35 μ thick. The monactines are very rare. One that I measured was 195 μ long, and at the rounded, somewhat thickened end, 12 μ in transverse diameter.

In the preparations of one of the specimens of form F the stout acanthophores are particularly numerous. The triactine and tetractine forms here measure 120–640 μ in diameter, usually 420–590 μ, and have rays 20–40 μ thick at the base. The diactine forms are usually fairly straight, rarely strongly angularly bent in the middle so that the two rays enclose an angle of 90° or less. The fairly straight diactines are 120–550 μ long. Their rays have the same thickness as those of the triactines and tetractines.

In the spicule-preparations of the basal part of this form numerous small, hollow, cross-like siliceous bodies were observed. The smallest of these are about 20 μ in diameter, and consist of four somewhat conic rays, 10 μ long, about 16 μ thick at the base, and hollowed out by cylindrical axial canals about 8 μ wide. These smallest crosses are connected with the large normal stout-rayed tetractines above described by an uninterrupted series of spicules intermediate in size. The axial canals of these spicules are usually 5–9 μ wide. The axes of the rays of the full-sized, stout-rayed basal spicules are occupied either by a fine axial thread, or a more or less widened axial canal. The broadest axial canals in these spicules were about 9 μ in diameter. In cylindrical, terminally rounded rays these axial canals are closed at the end; in conical and pointed rays they usually open out freely.

The wide axial canals are regular or irregular. The regular ones are either cylindrical throughout or widened distally. Distal widenings occur both in the terminally open and in the terminally closed axial canals. The irregular ones are of two kinds. In some the axial canals bear short, irregular, branch-like diverticula, which usually arise near the distal end, and are vertical or oblique, directed outward or, more rarely, inward. Others possess backwardly directed diverticula, which arise from their basal part and occupy interstices between adjacent silica-layers.

It is obvious that the small forms of this series are to be considered either as the young of the full-sized ones, or as the last remnants of full-sized ones which have in great part been dissolved. The general appearance of the whole series seems to me to be in favour of the latter alternative. I accordingly assume that the stout acanthophores with wide axial canals are spicules in process of decay (solution), that this decay or solution is the further advanced the smaller the spicules are, and that the dissolving agency acts on the silica-layer both from the inner (the axial threads) and the outer side (the surface). No doubt the sea-water can and does dissolve the silica of the spicule in this way when the protecting organic or semiorganic sheath is lost, but it must not be overlooked that the living sponge-tissue of the sponge itself might possibly also attack and dissolve the silica in spicules which have become superfluous, and use the material thus obtained for building up other spicules.

The *spheres* of form A (Plate 45, figs. 26–34) are irregularly nodular or spherical and measure 18–57 μ in diameter. Most of them are smooth (Plate 45, figs. 26–29, 33, 34), some more or less spiny (Plate 45, figs. 30–32). They consist of concentric layers of silica. The centre around which these silica-layers are deposited may be a simple point, a short rod, or a cross. The spheres with a cross-shaped centre (Plate 45, fig. 29) lead to those short-rayed tetractines (Plate 45, figs. 24, 25) which have been referred to above as transitions between the normal long-rayed, stout, basal spicules and the spheres; I am inclined to consider the spheres as derivates of these spicules.

I have not seen any spheres in the preparations of form B and C, but I found some, similar to those of form A, in form D.

The *microhexactines and their derivates* form a series commencing with regular equal-rayed hexactines and ending with diactines and monactines. They fall into two groups: — 1, regular and irregular microhexactines proper, and 2, diactine and monactine microhexactine-derivates.

The *microhexactines proper* (Plate 44, figs. 15, 16, 17b, 18–23, 25–30) have regularly disposed rays which enclose angles of 90° with their neighbours. The rays are conic and pointed. Their basal part is straight, their distal part nearly straight or curved more or less, sometimes considerably. In the forms E and F, where the microhexactines with the most strongly curved rays are found intermingled with the other, more straight-rayed forms, the degree of curvature appears to be in inverse proportion to the size of the spicule. The end-parts of opposite rays are usually curved in opposite directions. The rays of these spicules are beset with small backwardly directed spines. These are largest and most numerous on the middle-part of the ray; proximally they decrease in number, distally in size. It is also to be noted that these spines are on the whole much larger in the large (and straight-rayed) than in the small (and more curved-rayed) microhexactines.

The microhexactines proper of form A (Plate 44, figs. 16, 17b, c, 18–20, 22, 23, 30) are 50–144 μ in diameter and have rays 1.7–4 μ thick at the base. The irregular forms are larger (longer) and have thicker rays than the regular. The difference in the length of the rays of the irregular forms is sometimes very considerable, the length of the shortest ray being occasionally only a ninth of that of the longest.

In the other forms the microhexactines proper are similar and also in these the irregular ones are larger than the regular. The maximum diameter of the microhexactines proper measured was in form B (Plate 44, figs. 21, 25, 27) 66–145 μ, in form C (Plate 44, fig. 26) 44–130 μ, in form D (Plate 44, figs. 28, 29) 48–114 μ, in form E 53–157 μ, and in form F 52–160 μ.

The *diactine and monactine microhexactine-derivates* are by no means frequent. The diactine microhexactine-derivates of form A (Plate 44, fig. 24) are more or less centrotyle spiny rods, pointed at both ends. Their middle-part is straight, their end-parts are slightly curved. These spicules are 84–240 μ long and 3.6–5 μ thick near the centre. The central tyle measures 5.8–15 μ in transverse diameter and, when large, clearly shows that it is composed of four ray-rudiments.

The monactine microhexactine-derivates are very rare. One of form A which I measured was 75 μ long, and 3.5 μ thick at the rounded end.

Apart from the diactine pinules and the diactine and monactine derivates of the stout-rayed basal tetractines and the microhexactines above described, three kinds of *rhabds* can be distinguished: — ordinary rhabds of the choanosome and axial column, modified rhabds of the basal part of the sponge-body, and uncinates.

The *ordinary rhabds* of the choanosome and axial column (Plate 45, figs. 19–22) are smooth, slightly curved or, rarely, angularly bent, 0.3–7 mm. and more long, as some long fragments observed indicate, and 7–50 μ thick, rarely 95 μ. Most of them are blunt amphioxes or amphistrongyles, but amphityles, styles, and tylostyles also occur among them. The smaller amphioxes, amphistrongyles, and amphityles are generally distinctly centrotyle. Remarkably regular cylindrical amphityles occur in the marginal part of the gastral wall of form A. These are mostly 0.7–1 mm. long and 26–30 μ thick; their spherical terminal tyles measure 40–50 μ in diameter. A short somewhat spindle-shaped style 75 μ thick at the rounded end and 95 μ at the stoutest point was observed in the axial column of this form. The axial canals (threads) of the small rhabds are usually quite fine, those of the large ones on the other hand generally wide, sometimes 5 μ or more in transverse diameter.

The *modified basal acanthophore rhabds* (Plate 45, fig. 5) are centrotyle, usually slightly curved, smooth in the middle, and strongly spined at the ends, which are generally somewhat thickened. The terminal thickenings are either spherical or spindle-shaped, and in the same may be either similar or dissimilar, one end-thickening frequently being spherical, the other spindle-shaped. These spicules are 0.8–2.6 mm. long, and 7–22 μ thick near the centre. The central tyle is 12.5–27 μ in transverse diameter, the terminal thickenings 12–30 μ. The spherical terminal thickenings are stouter than the spindle-shaped. The spiny end-parts are 80–260 μ long. The axial canals (threads) of these spicules are often very wide. They are usually closed in the rounded ends and open in the spindle-shaped.

The *uncinates* are mostly diactine, but monactines also occur.

The *diactine uncinates* (Plate **44**, figs. 6–14, 17a) are generally straight or slightly curved, simple amphioxes; considerably curved and centrotyle ones, however, also occur. The ordinary amphiox uncinates in form A are 330–800 μ long, 5.5–12 μ thick in the middle, and beset with spines. As far as I could make out these spines are 0.7–1.5 μ long, and about 1 μ thick at the base. Sometimes it appeared as if they were continued in a fine terminal filament which was, however, too thin to be distinctly projected even with the 280 μ light. At one end of the spicule these spines are numerous, rather close together, and strongly inclined toward the opposite end. Toward the other end they become much scarcer and less inclined. Some of the spines nearest the latter end are vertical or even inclined in the opposite direction. In the centrotyle uncinates the central tyle is 15% to 45% thicker than the adjacent parts of the spicule.

The *monactine uncinates* appear as tylostyles. In form A they are 260–293 μ long and 9–12 μ thick just below the rounded end. The rounded end itself is thickened to a more or less spherical tyle 14–16 μ in transverse diameter.

The *large stalk-spicules* of form A (Plate **41**, fig. 2; Plate **43**, figs. 1–7) have a maximum length of 42 cm. and all are broken off at the lower distal end. Where they arise from the sponge they are 0.05–0.95 mm. thick; 30 cm. lower, where most of them are stoutest, they are 0.5–1.3 mm. thick.

One (Plate **43**, fig. 1), which I studied in detail, is 160 μ thick at the upper end, and rapidly increases in thickness to 730 μ at 7 cm. from the end; it then gradually thickens down to 28 cm., where it attains its maximum thickness of 1050 μ. Farther on it again becomes thinner, and at the lower end, 42 cm. from the tip, is 760 μ thick. Its axial thread is for the most part thin. It is thickened, however, here and there in an irregular manner. The silica is very clearly stratified. The surface of the upper, proximal part of the spicule is quite smooth. Where the spicule attains its maximum thickness fine transverse lines (Plate **43**, fig. 7) make their appearance on its surface, and 1 cm. above the distal end its surface, for a short distance, has quite a peculiar structure (Plate **43**, fig. 4). Here a silica-layer is exposed which consists of lamellae overlapping like tyles, and composed of parallel rods about 10 μ thick and lying close together. These rods extend nearly but not quite paratangentially and longitudinally. They deviate slightly both radially and laterally from the direction of the axis of the spicule. The radial deviation is due to their forming the overlapping lamellae, and like the lamellae themselves they slightly diverge from the axis below. The lateral deviation is due to their lying somewhat obliquely in elongated spirals.

Most of the other stalk-spicules exhibit, in their lower portion, the same transverse lines as the one described above, and in six of them the same spiral rods, combined to form tyle-like lamellae, are visible on portions of the surface near the end.

The transverse lines may be considered as fissures in the superficial silica-layer. In the six spicules where it was observed, (and probably also in the others) the portions showing the superposed rows of spiral rods indicate that there are one or more silica-layers (composed of thin, spirally extending rods) quite different in structure from the rest. These layers are rendered visible where the disintegration (solution) of the spicule (which proceeds from the surface downwards) has just reached them; and their structure is probably brought out so clearly by the silica joining the rods having been partly dissolved.

Being composed of layers differing in structure, one or more of which consist of superimposed rows of spirally arranged rods or threads, the stalk-spicules may, in respect to their internal structure, be compared to cables.

No traces of backwardly directed spines or of terminal anchors could be found in any of the spicules.

The *amphidiscs* (Plate **44**, fig. 17d; Plate **45**, figs. 40–64; Plate **46**, figs. 1–16; Plate **47**, figs. 1–13). The biological length frequency-curve of the amphidiscs of *Hyalonema agassizi*, form A, shows (Fig. 5), that, as regards the frequency of those of different length, these spicules fall, like those of *Hyalonema obtusum*, into four groups: — large macramphidiscs, small macramphidiscs, large micramphidiscs, and small micramphidiscs. The second and third of these groups are, in respect to their length frequency, not as clearly distinguished from each other as from the first and fourth respectively. The parts of the curve pertaining to the large macramphidiscs and the small micramphidiscs each have two culminations, a principal, and a secondary. The measurements and examination of the amphidiscs of various length of the three other forms show that these also fall into the four groups mentioned, and that, at least in two of them (B and C), the gap between the small macramphidiscs and large micramphidiscs is not so distinct as in the others. In the forms B and C these two kinds of amphidiscs, which can be readily distinguished by differences in their shape, slightly overlap in respect to their length.

The *large macramphidiscs* of form A (Plate **46**, figs. 2–5, 9, 12, 13; Plate **47**, figs. 1, 2, 5, 6, 10) are 134–242 μ long, most frequently about 200 μ. The shaft is straight, cylindrical, 7–13.5 μ thick, and thickened abruptly at some point

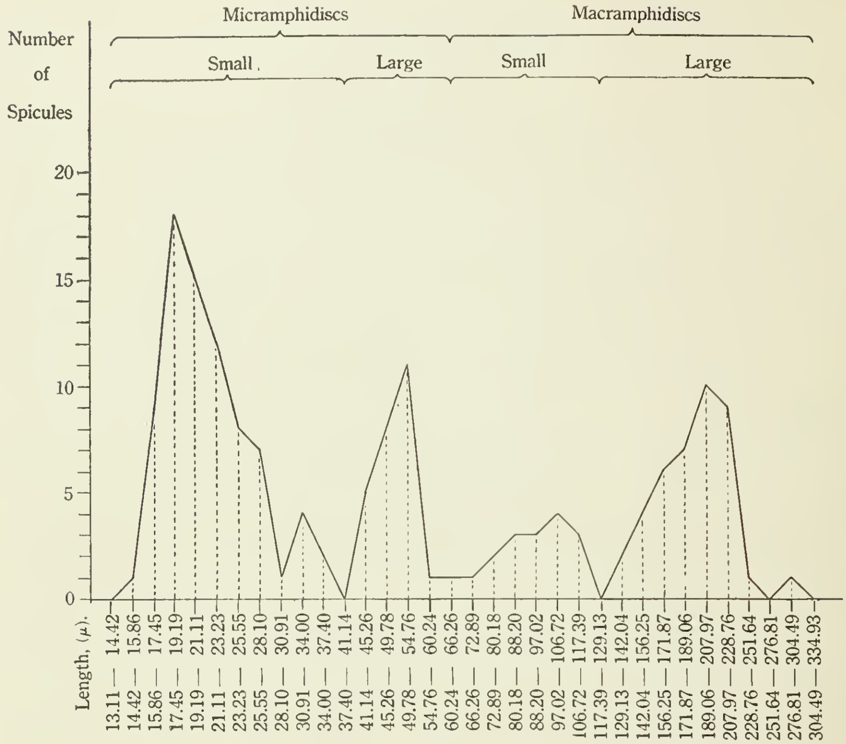

Fig. 5.— Form A. Amphidiscs.

near its centre to 8–20 μ, and gradually at both ends to 8–15 μ. From the central thickening arises a regular, or irregular, verticil of conic truncate spines which is 2–8 μ long, and 2–5 μ thick at the base. The ends (terminal faces) of these spines bear clusters of small secondary spinelets. The other parts of the shaft usually bear a few, rarely a good many, very low protuberances covered with clusters of secondary spinelets. These protuberances are circular in outline and agree in breadth and secondary spinulation with the spines on the central thickening. The shaft is traversed by a fine axial thread which, where it passes through the central thickening, is slightly thickened to a small but well-defined point. Traces of branch-rays of the axial thread (an axial cross) could be detected neither here nor elsewhere. The terminal anchors are composed of eight to twelve recurved teeth. They are 40–80 μ in length, that is about a third, generally a little less than a third, of the whole spicule, and 41–86 μ broad. The proportion of the length to the breadth of the anchors is 100 to 91–120, on an average 100 : 103. The anchor-teeth are T-shaped in transverse section. The upper part appears as a curved band, for the greater part of its length 8.7–11.5 μ broad, and attenuated to a point or, more rarely, rounded off at the end. The teeth arise steeply and are uniformly curved, concave to the shaft. The curvature is not very great and never suffices to give the end-parts of the teeth a direction parallel to the shaft. The tangents on these end-parts enclose, in the adult large amphidiscs, angles of about 5° with the axis of the shaft. In young spicules of this kind (Plate 46, fig. 9) this angle is, of course, much greater.

The large macramphidiscs of form B (Plate 46, fig. 15) are 126–310 μ long, most frequently about 240 μ. Their shafts are 8–14 μ thick, and their anchors are 46–67 μ long and 48–76 μ broad. These spicules are longer and have smaller anchors than those of form A.

The large macramphidiscs of form C (Plate 46, figs. 10, 11) are 110–290 μ long, most frequently about 240 μ. Their shafts are 6–10 μ thick, and their anchors 40–63 μ long and 35–75 μ broad. They are very similar to those of form B, and are like them longer and provided with smaller anchors than those of form A.

The large macramphidiscs of form D (Plate 46, figs. 6–8, 16) are mostly regular and similar to those of the other forms. They are 132–282 μ long, most frequently either about 240 or 180 μ, with shafts 9.5–12 μ thick, and with anchors 52–73 μ long and 48–66 μ broad. In respect to their length the regular large macramphidiscs of form D are intermediate between forms B and C on the one hand and form A on the other. Their anchors are similar in size to those of forms B and C. In the specimen of form D I found an irregular large macramphidisc (Plate 46, fig. 7) 192 μ long, with a shaft 4.4 μ thick. The two anchors of this spicule are both about 26 μ broad but very unequal in length, one being 44 μ long, the other considerably shorter. The shaft is beset with numerous large pointed spines, all strongly bent towards one end. These spines increase in size towards the end from which they diverge; the largest is 16 μ long.

The large macramphidiscs of form E are 150–280 μ long, usually 170–256 μ, most frequently about 200 μ. Their shaft is 6–12 μ thick. Their anchors are 51–67 μ long and 51–80 μ broad.

The large macramphidiscs of form F are 112–260 μ long, usually 150–232 μ, most frequently about 200 μ. Their anchors are 36–65 μ long and 34–70 μ broad. In a preparation of one of the specimens of this form I found an abnormal large macramphidisc, in which the central spine-verticil was replaced by an anchor similar to but slightly smaller than the terminal anchors.

To attain a clearer insight into the range and character of the variation of the length of the large macramphidiscs in the four forms of this sponge I drew the following graph, in which the frequency of the large macramphidiscs of various lengths of all the four forms is represented. To make the curves in it commensurate I calculated the relation of the number of large macramphidiscs actually measured to 100, that is its percentage in each form, and multiplied all the numbers of amphidiscs belonging to the same category, in respect to length, by this number. These percentages are represented by the curves in Fig. 6.

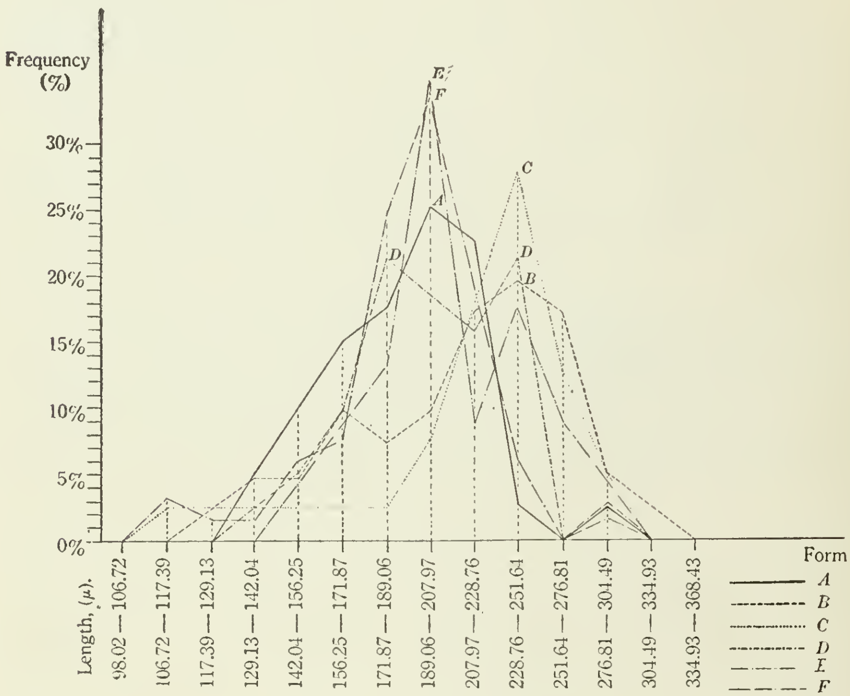

Fig. 6.— Large macramphidiscs.

The above curves, expressing the relative frequency of the large macramphidiscs of different lengths in the six forms, are based on 247 measurements. The curves pertaining to all the forms, except D, have one main elevation, the curve pertaining to form D has two. The second main elevation of this curve coincides with the main elevations of the curves of forms B and C, and with the considerable right secondary elevation of form E. All four lie at a point corresponding to amphidiscs about 240 μ long. The main elevations of the curves of forms A, E, and F lie at points representing spicules about 200 μ long. The first elevation of the curve of form D corresponds to still shorter amphidiscs, of about 180 μ in length. The curves of forms A, D, and F have a small secondary elevation at about 290 μ. The curve of form B has a secondary elevation at about 164 μ; the curve of form F has also an additional slight secondary elevation at about 112 μ.

These curves indicate that A, E, and F have, on the whole, smaller large macramphidiscs than the other forms; that D possesses two nearly equally numerous varieties of these spicules, a larger and a smaller one; and that in C the small forms of the large macramphidiscs are much rarer than in the others. They further show that the large macramphidiscs of all the six different forms differ in respect to the character and range of the variation of their length. It is also to be noted that none of the curves are similar to a mathematical probability curve; for these spicules do not, in respect to their length, vary uniformly round a mean.

The *small macramphidiscs* of form A (Plate **46**, fig. 1) are 62–115 μ long, most frequently about 93 μ, and have a cylindrical centrotyle shaft 3–8 μ thick. The central thickening bears a verticil of rather blunt spines 1.3–1.5 μ long and about 0.5 μ thick. Numerous similar spines are found on the other parts of the shaft. The anchors are 22–43 μ long, that is about a third, generally a little more than a third, of the whole spicule, and are 16–42 μ broad. The proportion of their length to their breadth, in the smaller forms under 80 μ in length is, 100 to 73–84, on an average 100 : 79; in the larger forms, over 80 μ in length, it is 100 to 76–105, on an average 100 : 90. The shape of the individual anchor-teeth is, on the whole, similar to that of those of the large macramphidiscs; but it is to be noted that their curvature, in the smaller forms of these spicules, is considerably greater.

In the specimen of this form (A) I found a remarkable hexactine spicule 116 μ in diameter, composed of four fully developed and two rudimentary rays. The four developed rays are cylindrical, 7.5 μ thick, and bear at their ends verticils of large recurved teeth which together form somewhat irregular anchors 36 μ long and about 64 μ broad. One of the rudimentary rays is a short, terminally rounded cylinder; the other is bifurcate and slightly longer at the end. The whole spicule appears as a cross formed by two small macramphidiscs joined in the middle, from the centre of which two protuberances arise.

Spicules of this kind have occasionally, but very rarely, been observed in other species of Hyalonema, as *H. tenerum*.[1] The only hyalonematid in which

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, pl. 31, fig. 18.

they are more abundant is *Monorhaphis dives*,[1] where they usually have six anchor-bearing rays. F. E. Schulze (*loc. cit.*) named these spicules hexadiscs. The spicule above described and others similar, like the one found in *Hyalonema tenerum* (*loc. cit.*), might, in an analogous manner, be called tetradiscs, or staurodiscs.

In the other forms of *Hyalonema agassizi* only a few small macramphidiscs have been observed. Those seen were similar but smaller than those of form A. The small macramphidiscs of form B (Plate **45**, fig. 53) are 53–101 μ long. Their shafts are 2–4 μ thick, and their anchors 18–27 μ long and 18–33 μ broad. Those of form C are 53–80 μ long. Their shafts are 2–3.3 μ thick, and their anchors 20–24 μ long and 16.5–20 μ broad. In form D only a single small macramphidisc was found. This was 84 μ long.

In form E the small macramphidiscs are 48–90 μ long, most frequently about 51 μ, and have anchors 10–33 μ long and 10–25 μ broad. In form F I found only two such spicules. These were 45 and 70 μ long respectively.

In form A the *large micramphidiscs* (Plate **45**, figs. 46–49; Plate **47**, figs. 11–13) are very numerous. They are here 42–60 μ long, most frequently about 52.3 μ. The shaft is 1.1–2 μ thick, cylindrical, or slightly and very gradually thickened, in a spindle-shaped manner, in or near the middle, but without a sharply defined central tyle. It is covered with numerous, slender, cylindrical, vertical or, more rarely, oblique spines, sometimes 2 μ long. The anchors are relatively slender. They are 14.4–22 μ long, that is a little more than a third of the whole spicule, and 8–14 μ broad. The proportion of their length to their breadth is 100 : 53 (in one of the smallest), 100 : 71 (in one of the largest), on an average 100: 65. The individual anchor-teeth are about 1.5 μ broad and strongly curved, so that their end-parts lie nearly parallel to the shaft or converge towards it.

In form B, where they are rather scarce, the large micramphidiscs appear to be similar to those of form A, and measure 41–59 μ in length, most frequently about 54.8 μ.

In form C (Plate **45**, figs. 59–61), where they are still more numerous than in form A, they measure 36–64 μ in length, most frequently, as those of form A, about 52.3 μ in length, and have spined shafts 1–1.7 μ thick. Their anchors are 17–23 μ long and 10–13 μ broad. One in which I was able to count the anchor-teeth had fourteen. The individual teeth in the larger forms are about 2.5 μ broad.

[1] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 124, taf. 43, figs. 1, 6, 7.

In form D, where they are also rather frequent, the large micramphidiscs (Plate **45**, figs. 63, 64) measure 35–55 μ in length, most frequently about 47.5 μ. Their shafts are spiny and 1.5–1.7 μ thick; their anchors are shorter than in the other forms, 15–17 μ long, and 10–11 μ broad.

In the specimens of form E the large micramphidiscs are exceedingly abundant. They are here 40–69 μ long, most frequently about 48 μ, and have anchors 13–21 μ long and 8–14 μ broad.

In the specimens of form F the large micramphidiscs are not nearly so numerous. They are here 37–57 μ long, most frequently about 52 μ, and have anchors 14–20 μ long and 9–14 μ broad.

According to the frequency of those of different length, three kinds of *small micramphidiscs* can be distinguished in form F, and two kinds in forms A, B, C, and E. The small micramphidiscs of form D are all of the same kind. The smaller (A, B, C, E) or smallest (F) kind is invariably the most abundant. The spicules belonging to the larger (A, B, C, E) or largest (F) kind have very slender anchors and appear as transitions between the (broad-anchored) small and the (slender-anchored) large micramphidiscs. Judged morphologically, by their shape alone, the larger (largest) kind of small micramphidiscs should, indeed, be considered as belonging to the large micramphidiscs. Since, however, in the smaller (A, B, C, E) or smallest and intermediate (F) kinds of small micramphidiscs the relative breadth of the anchors decreases with the increase in the size (length) of the spicules, since in a few exceptional spicules of this kind the anchors are quite as slender as in the larger (largest) kind, and since they are, in the forms where they occur, separated biometrically much more clearly from the larger micramphidiscs than from the smaller kind of the small micramphidiscs, I provisionally place them in the latter group.

The small micramphidiscs of form A (Plate **44**, fig. 17d; Plate **45**, figs. 40–45; Plate **47**, figs. 3, 4, 7–9) are 15–36 μ long, most frequently about 18.3 μ. The limit between the larger and the smaller kind lies at about 29 μ. The shaft is straight or rarely bent, 0.6–1.4 μ thick, cylindrical throughout, or slightly and gradually thickened in the middle. It is either quite smooth, or it bears near the centre an irregular cluster of a few spines, not over 0.5 μ long, or it is covered with sparse, vertical, more rarely oblique, spines throughout. The anchors are 4–13 μ long, that is a quarter to a third of the whole spicule, and 4.7–9 μ broad. They consist of fifteen or sixteen recurved teeth. In the larger kind of small micramphidiscs the proportion of the length to the breadth of the anchor is 100 to 58–75, on an average 100 : 64; in the smaller kind 100 to 75–135, on an average 100 : 93. It is to be noted that in the smaller small micramphidiscs the relative breadth of the anchor is, on the whole, in inverse proportion to their size (length). The curvature of the individual teeth is such that the anchors appear rather broad above and that the end-parts of the teeth come to lie parallel or nearly parallel to the shaft.

The small micramphidiscs of the other forms appear to be very similar to those of form A. Those of form B (Plate **45**, figs. 50–52) are 13.5–31.5 μ long, most frequently about 20.1 μ. The limit between the larger and smaller kinds lies, as in form A, at about 29 μ. Those of form C (Plate **45**, figs. 54–58) are 14–30 μ long, most frequently about 18.3 μ. The limit between the larger and the smaller kind lies here at about 25.5 μ. Those of form D (Plate **45**, fig. 62) are 13–28 μ long, most frequently about 20.1 μ. The small micramphidiscs of form E are 15–34 μ long, most frequently about 22.2 μ. The limit between the larger and smaller kind lies at about 24.4 μ. The small micramphidiscs of form F are 15–33 μ long, most frequently about 18.3 μ. The limits between the smallest, the intermediate, and the largest kind of small micramphidiscs of this form lie at about 20.2 μ and 25.4 μ.

To obtain a clearer insight into the range and character of the variation of the length of the small micramphidiscs in the four forms of this sponge I

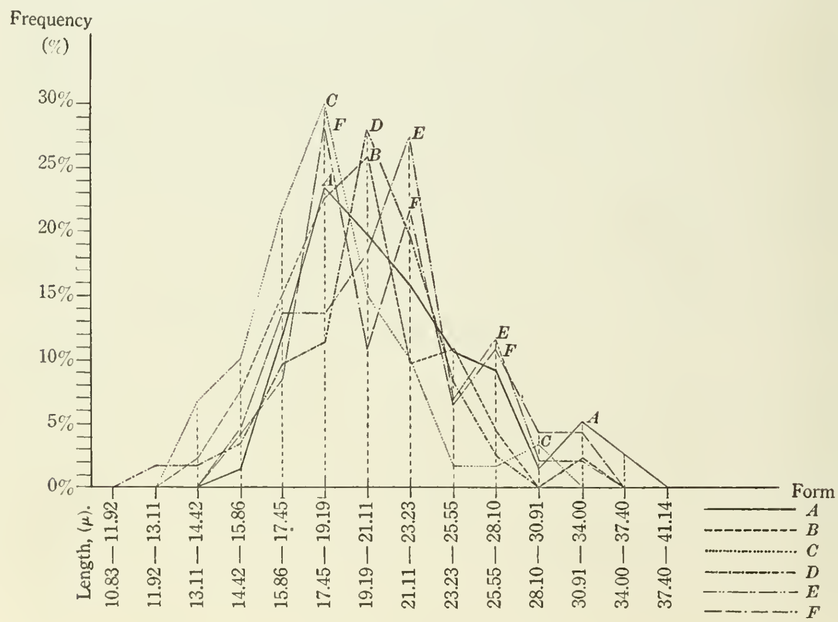

Fig. 7.— Small micramphidiscs.

drew (by the method already described) Figure 7, in which the relative frequency of the small micramphidiscs of various lengths of all the four forms is represented.

The above curves, expressing the relative frequency of the small micramphidiscs of different lengths in the six forms, are based on 381 measurements. All have one main elevation; those of forms A, C, and E have one secondary elevation, the curves of forms B and F have two. The main elevations of the forms A, C, and F correspond to amphidisc-lengths of about 18.4 μ, those of forms B and D to amphidisc-lengths of about 20.1 μ, those of form E to amphidisc-lengths of about 22.2 μ.

The first and principal secondary elevation of form F, which is very considerable, coincides with the main elevation of form E at about 22.2 μ. The first secondary elevation of form B, which is quite insignificant, lies at about 24.4 μ. The first secondary elevation of form E and the second secondary elevation of form F, which are both very well-pronounced, lie at about 26.8 μ. The single secondary elevation of form C, which is inconsiderable, is situated at about 29.5 μ. The second secondary elevation of form B and the single secondary elevation of form A both lie at about 32.5 μ. The former of these is very well-pronounced, the latter insignificant.

These curves clearly show that the small micramphidiscs of forms A, C, and F are on the whole relatively small, those of forms B and D intermediate, and those of form E relatively large, and further that all the six forms differ in respect to the range and character of the variation of the length of their small micramphidiscs.

The description given above shows these sponges to be so similar that there can be no doubt about their belonging to one and the same species. They differ, however, more or less by their external shape, the structure of their gastral cavity, and the shape and size of their spicules. The variable spicule-characters which could be accurately ascertained in a sufficient number of spicules in all the forms are: — the length and maximum thickness (together with the spines) of the distal ray of the dermal pinules and gastral cone-pinules, the nature of the spinulation of the former, the diameter of the microhexactines, and the length of the large macramphidiscs and small micramphidiscs. In the following discussion I have considered only these spicule-dimensions, the shape of the sponge, and its gastral cavity.

The specimens from Station 4651 and 4656 and some of the specimens from Station 4742 are massive, spindle-, pear-, top-, or club-shaped, the specimens from

Station 3684 (A.A. 17) and Station 4740 and the other specimens from Station 4742 are flattened, cake-shaped. In the specimen from Station 4656 the gastral cavity is a narrow fissure, uninterrupted by radial plates; in all the specimens from Stations 4651 and 4740, in the cake-shaped specimens from Station 4742, and probably also in the specimen from Station 3684 (A.A. 17), the gastral cavity is quite wide and divided into separate diverticula by radial plates. The dermal pinules of the specimens from Stations 4656 and 4740 have longer distal rays than the others. The dermal pinules of the specimen from Station 4656 and the pear-shaped specimens from Station 4742 have more slender distal rays (together with the spines) than the others. The spines of the distal rays of the dermal pinules of the specimen from Station 3684 (A.A. 17) are more crowded and form a more compact structure than those of the others. The distal rays of the gastral cone-pinules are of five sizes. Those of the cake-shaped specimens from Station 4742 are on an average only 90.5 μ long, those of the specimen from Station 4651 98.2 μ, those of the specimen from Station 3684 (A.A. 17) 106.7 μ, those of the specimens from Stations 4656 and 4740 128.2 μ–128.5 μ, and those of the pear-shaped specimens from Station 4742 129 μ long. Those of the specimens from Station 4740 are (together with the spines) narrower than the others. The microhexactines are relatively large in the specimens from Stations 4651, 4656, and 4742, smaller in the specimens from Station 4740, and still smaller in the specimen from Station 3684 (A.A. 17). In the specimens from Stations 4651 and 4740 the large macramphidiscs are of one kind and most frequently about 240 μ long. In the specimens from Stations 4656 and 4742 these spicules may also be said to be of one kind, and they are here most frequently about 200 μ long. In the specimen from Station 3684 (A.A. 17) a smaller kind, most frequently about 180 μ long and a larger kind most frequently about 240 μ are nearly equally abundant. The small micramphidiscs in the specimens from Stations 4656 and 4740 and the pear-shaped specimens from Station 4742 are most frequently about 18.3 μ long, those of the specimens from Stations 4651 and 3684 (A.A. 17) most frequently about 20.1 μ, and those of the cake-shaped specimens from Station 4742 most frequently about 22.2 μ.

This shows that the specimens of this species differ in respect to the following ten accurately determinable qualities: — *a*, the external shape, *b*, the nature of the gastral cavity, *c*, the length of the distal rays of the dermal pinules, *d*, the maximum thickness of the distal rays, together with the spines, of the dermal pinules, *e*, the density of the spinulation of the distal rays of the dermal pinules, *f*, the length of the distal rays of the gastral cone-pinules, *g*, the maximum thickness of the distal rays, together with the spines, of the gastral cone-pinules, *h*, the diameter of the microhexactines, *i*, the length of the large macramphidises, and *k*, the length of the small micramphidiscs. The following table, arranged in pairs, shows which of these qualities the forms A to F have in common.

The specimens from Station	agree in respect to the	qualities
4656 (A) and 4651 (B)	4	a c g h
" " 4740 (C)	4	c e f k
" " 3684 (A.A. 17) (D)	1	g
" " 4742 cake-sh. (E)	4	e g h i
" " 4742 pear-sh. (F)	7	a b d e g h k
4651 (B) and 4740 (C)	4	b d e i
" " 3684 (A.A. 17) (D)	5	b c d g k
" " 4742 cake-sh. (E)	6	b c d e g h
" " 4742 pear-sh. (F)	5	a c e g h
4740 (C) and 3684 (A.A. 17) (D)	3	a b d
" " 4742 cake-sh. (E)	4	a b d e
" " 4742 pear-sh. (F)	1	e
3684 (A.A. 17) (D) and 4742 cake-sh. (E)	5	a b c d g
" " 4742 pear-sh. (F)	4	c g i k
4742 cake-sh. (E) and 4742 pear-sh. (F)	4	c e g h

These affinities are shown in Figure 8.

Of the five stations where these sponges were trawled, two, Stations 4651 and 4656, lie near together off the Peruvian coast. The other three, Stations 4740, 4742, and 3684 (A.A. 17), are a considerable distance apart in the central Pacific and are far from the two Peruvian stations. The degree of similarity of the specimens separated as the six kinds of *Hyalonema agassizi* stands in no relation to the distances of their localities from each other. Thus the cake- and the pear-shaped specimens from Station 4742 agree only in respect to four of the ten qualities, and the pair from Stations 4651 and 4656, which lie very near each other, also agree only in respect to four qualities. The pairs which agree most are the pear-shaped specimens from Stations 4656 and 4742, which agree as to seven qualities, and the cake-shaped specimens from Stations 4651 and 4742, which agree in respect to six. The units of the pairs of stations from which these come are very far apart.

These and the other differences between the six kinds of *Hyalonema agassizi* are not systematically important *individually;* I believe, however, that several of them *together* demand recognition. Of the ten varying qualities here under discussion, nine are different only in two pairs from Stations 4656, 3684 (A.A. 17), and Stations 4740, 4742 pear-shaped. All the other pairs differ by from three to seven of these qualities. Since the units of the two mentioned strongly divergent pairs are connected in other ways, and since, as has been shown above, there appears to be no correlation between the degree of difference and the distance of the localities, I do not think that these differences warrant the

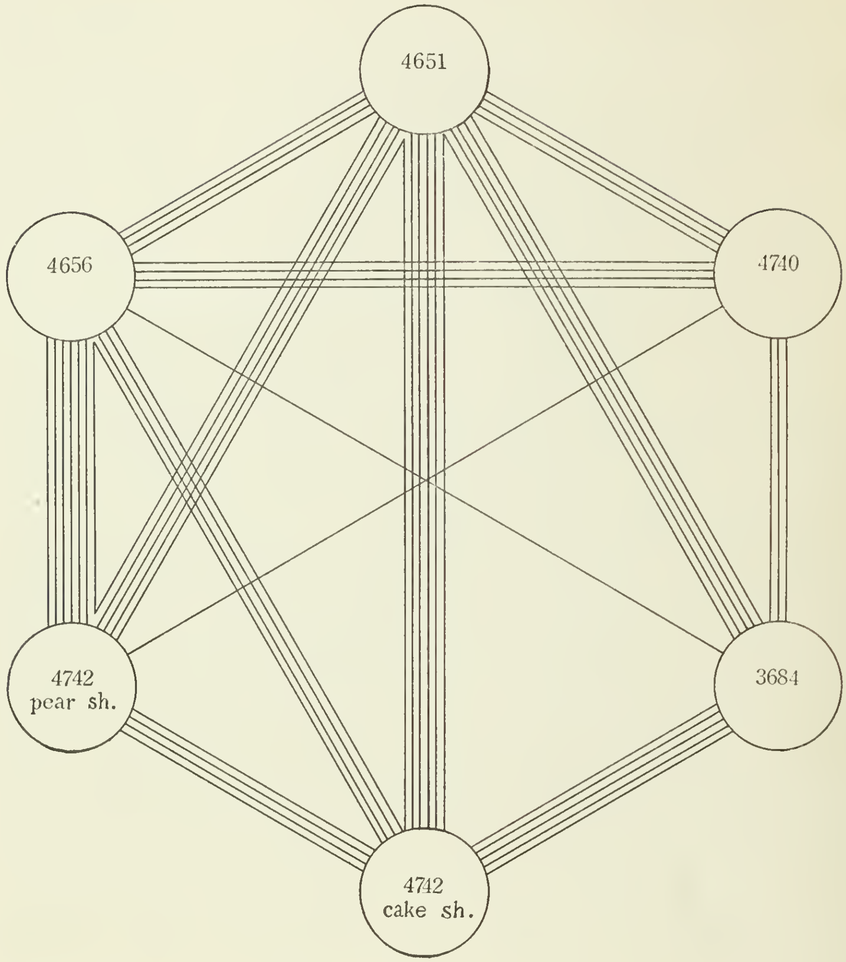

Fig. 8.

establishment of separate varieties. The distinction of different *forms* within the species, designated A, B, C, D, E, and F, is a sufficient division.

The species composed of these six forms is most closely allied to the *Hyalonema* (*Hyalonema*) *obtusum* and the *Hyalonema* (*Hyalonema*) *polycaulum*. The outer appearance of the variety *gracilis* of *H.* (*H.*) *obtusum* is indeed nearly the same as that of form A. These latter differ, however, from *H.* (*H.*) *obtusum* in the following respects:— the dermal pinules are considerably longer in both varieties of *H.* (*H.*) *obtusum* than in any of the forms described above; the slender-rayed basal spicules are about twice as large, and the microhexactines are smaller, and composed of more strongly curved rays in the former than in the latter; the large macramphidiscs of *H.* (*H.*) *obtusum* reach 356 μ in length, have shafts bearing large spines along their whole length and possess anchors the end-parts of whose teeth are parallel to the shaft; the large amphidiscs of *H.* (*H.*) *agassizi* are not over 310 μ long, have shafts destitute of large spines outside the centre, and possess anchors the end-parts of whose teeth diverge; the end-parts of the anchor-teeth of the large micramphidiscs are in the former far more curved than in the latter.

Hyalonema (*Hyalonema*) *polycaulum* is in outer appearance, apart from its polycaule nature, similar to the forms described as C, D, and E. It differs from this species, however, by its large macramphidiscs, its pinules, and its mode of attachment to the sea-bottom. The large macramphidiscs are in the sponges described above considerably shorter, have relatively narrower anchors and anchor-teeth much more strongly curved in their distal part and less divergent, than in *Hyalonema* (*Hyalonema*) *polycaulum*. The distal rays of the pinules of the former are considerably thickened above the middle and have a stout terminal cone. In those of the latter such a thickening above the middle is either absent or very insignificant, and the terminal cone is much more slender. It is also to be noted that the distal rays of the pinules of the sponges described above bear more numerous spines than those of *Hyalonema* (*Hyalonema*) *polycaulum*. The former is attached by a single stalk; the latter by several stalks.

Hyalonema (Hyalonema) polycaulum, sp. nov.

Plate 53, figs. 1–17; Plate 54, figs. 1–45.

One specimen of this species was trawled in the eastern part of the Tropical Pacific at Station 4721 on 15 January, 1905; 8° 7.5′ S., 104° 10.5′ W.; depth 3811 m. (2084 f.); bottom composed of light brown Globigerina ooze. It appears to have possessed four distinct stalks. To this the specific name refers.

Shape and size. The single, somewhat fragmentary specimen (Plate 53, fig. 4) is oval, 54 mm. long, 48 mm. broad, and somewhat flattened. Only slight remnants of the dermal membrane are left, the specimen appearing very porous in consequence. A group of large cavities, separated by thin plates, occupies one of the flat faces. A thickening at the joining line of these plates, which, however, does not project freely, is, as its internal structure shows, a gastral cone. The large cavities around it are parts (diverticula) of the gastral cavity. On the opposite flat face of the sponge the superficial tissue is, in four places, considerably harder than elsewhere. These harder patches protrude more or less and appear as superficial knobs. They are distant from each other and rather uniformly distributed over the face opposite the gastral. From two of these knobs a few broken stalk-spicules protrude.

The *colour* in spirit is brown.

Skeleton. Of the dermal pinule-fur only insignificant remnants are left; the gastral pinule-fur, however, is preserved in places. The dermal pinules have much shorter lateral rays than the gastral. Here and there, where the superficial parts of the sponge are still present, pentactine megascleres occur. The hard superficial knobs contain dense masses of tetractine (tetractine-derivate) stout, and diactine (diactine-derivate) more slender acanthophores. Here also slender-rayed, long-spined acanthophores are met. Large quantities of microhexactines, some microhexactine-derivates with fewer than six rays, and a good number of more or less pinule-like pentactines, which may be tubular pinules, and amphidiscs occur in the choanosome rhabd and hexactine megascleres. Certainly from two, probably from all the four hard superficial knobs bundles of rather large spicules, broken off at the surface of the sponge, extend towards the interior. One of these bundles leads up to the gastral cone above referred to. The spiculation of these knobs indicates that certainly from two and probably from all four there arise in life stalks composed of bundles of spicules.

A good many anatriaenes with long and slender anchors, very large dichotriaenes, and large spiny metasters, all foreign, and apparently belonging to some species of Thenea, are found in the sponge. A few hexactinellid anchor-spicules, similar to those of the holascids, were observed in the hard superficial knobs. These spicules are 9–14 μ thick, and have terminal tyles about 30 μ in diameter, beset with short anchor-teeth. I consider these spicules as foreign.

The *dermal pinules* (Plate **54**, figs. 35, 38–40) are generally pentactine, very rarely hexactine. The distal ray is 110–130 μ long, and 4.5–9 μ thick at the base. It is straight, thickened above only very slightly or not at all, and ends with a slender and sharp-pointed terminal cone, only about 4 μ thick at the base, that is at the point of insertion of the uppermost spines. The basal part and the terminal cone of the distal ray are smooth, its middle-part bears sparse spines. The lowest spines are short, arise steeply, and are usually slightly inclined towards the tip of the ray. Sometimes they are more strongly inclined in this direction, sometimes vertical, and sometimes even inclined towards the base. Distally the spines at first increase in size, and then again become smaller.

Their inclination towards the tip generally increases uniformly towards the end of the ray. The individual spines are conic, pointed, and curved more or less, generally concave towards the tip (Plate 54, figs. 35, 40), sometimes in the opposite direction (Plate 54, fig. 38, the lowest) and occasionally in an S-shaped manner (Plate 54, fig. 39). The largest spines are 15–24 μ long and 2.5–4 μ thick at the base. The maximum thickness of the distal ray, together with the spines, is 24–40 μ. The lateral rays are blunt-pointed or terminally rounded and 24–40 μ long. They bear rather sparse, conspicuous spines. The proximal ray does not, when present, exceed the lateral rays in length.

The *gastral pinules* (Plate 54, figs. 41–45) are also usually pentactine; hexactine forms are, however, not so rare among them as among the dermal pinules. The distal ray is 110–133 μ long and 6–9 μ thick at the base. It is straight, simply conic throughout, or cylindrical basally and conic distally, or very slightly thickened below the middle of its length. It ends with a slender and very sharp-pointed terminal cone, 20–35 μ long, and 3–5 μ thick at the base, that is at the point of insertion of the uppermost spine. Nearly the whole of the distal ray, with the exception of the terminal cone, is spined; a spineless basal region being absent altogether, or quite insignificant. The spines are sparse. The largest arise from the middle-part of the ray. From here they decrease in size both distally and proximally. The basal spines are vertical or slightly inclined, either towards the tip or the base of the ray. Distally they become more and more inclined towards the tip of the ray. The individual spines are conic, sharp-pointed, straight or slightly curved, either uniformly concave towards the tip of the ray, or, more rarely, uniformly concave in the opposite direction, or in an S-shaped manner. The largest spines are 12–16 μ long and 3–4 μ thick at the base. The maximum thickness of the distal ray, together with the spines, is 25–40 μ. The lateral rays are 40–60 μ long, usually conic, sharp-pointed, and in their distal two thirds or to a farther extent, often quite down to their base, they are covered with somewhat sparse, conspicuous spines. The proximal ray is, when present, similar to the lateral rays in shape and spinulation and has a maximum length of 50 μ.

The *pinule-like pentactines*, which may be canalaria (Plate 54, figs. 34, 37), have straight, conic, sharp-pointed rays, rather densely covered throughout with small spines. Their apical ray is 110–135 μ long, their lateral rays about 65 μ. The rays are 5–6 μ thick at the base.

The (hypodermal and ? hypogastral) *pentactine megascleres* have fairly straight rays. The rays of the smaller forms are conic, very blunt-pointed, smooth in their basal and spined in their distal part. Those of the large forms are often nearly cylindrical, rounded at the end, and entirely destitute of spines. In the smaller forms the apical (proximal) ray is usually about 300 μ long, the longest lateral ray being 220–340 μ. In the large forms the longest lateral ray attains a length of 650–1050 μ. The basal thickness of the rays is 20–32 μ in the former, and 40–80 μ in the latter.

The *hexactine megascleres* (Plate **53**, fig. 8) have conic and blunt, usually fairly straight rays. In many, two opposite rays are longer than the other four. The intact hexactines observed were 0.6–1.6 mm. in maximum diameter, and had rays 15–35 μ thick at the base. Some fragmentary ones had rays as much as 40 μ thick.

Among the *stout-rayed tetractine and tetractine-derivate acanthophores* (Plate **54**, figs. 1–15), which form the principal part of the skeleton of the hard superficial knobs, forms occur with four, three, two, and one ray. Those with four rays, that is the tetractines (or stauractines), are the most frequent. The rays of these spicules are on the whole cylindrical or cylindroconic, and rounded or, more rarely, abruptly pointed at the end. They are straight or slightly curved, and generally somewhat irregular in outline. The end-part of the ray is always densely spined, the proximal part, usually one half to two thirds of it, is smooth. Sometimes the spines extend farther proximally, occasionally quite down to the centre of the spicule. The tetractines (stauractines) and triactines (tauactines) (Plate **54**, figs. 1–10) are 150–650 μ in diameter, and have rays 10–37 μ thick at the base. The diactines (Plate **54**, figs. 11, 12) are usually straight (Plate **54**, fig. 12) or more rarely abruptly rectangularly bent at the morphological centre (Plate **54**, fig. 11). The morphological centre is always thickened to a central tyle, which is generally smooth, or more rarely spined. These spicules are usually 0.4–1 mm. long, and 20–25 μ thick near the middle. The central tyle measures 30–50 μ in diameter. The monactines (Plate **54**, figs. 13–15) are usually 250–450 μ long, more or less cylindrical, 10–20 μ thick, and closely resemble single rays of the other forms. The end corresponding to the morphological centre is thickened to a more or less spherical terminal tyle 18–40 μ in diameter.

The *slender-rayed, long-spined acanthophores* of the hard superficial knobs (Plate **54**, figs. 30–33, 36) are usually hexactine, pentactine, or more rarely tetractine. The hexactines and pentactines form a series extending from regular hexactines (Plate **54**, fig. 32) to pinule-like pentactines (Plates **54**, fig. 35). The tetractines are to be considered as pentactine-derivates. These slender-rayed spicules measure 80–180 μ in diameter. Their rays are straight, joined at right angles, 3–8 μ thick at the proximal end, conic, pointed, and covered with somewhat sparse spines quite or nearly down to the base. The largest spines are 5–15 μ long and 2–3 μ thick at the base. The basal spines arise vertically; the distal ones are inclined towards the tip of the ray.

The *microhexactines* (Plate 53, figs. 9–12, 14–16) measure 80–142 μ in diameter, and have fairly equal, straight, or only very slightly curved, conic, and pointed rays, which are joined at right angles in the centre of the spicule. The rays are 2.5–4 μ thick at the base and covered along their whole length with spines sometimes 0.4 μ long. The basal spines are sparse and vertical, the distal more crowded and oblique, inclined backwards, towards the centre of the spicule.

The rare *microhexactine-derivates* appear as spined amphioxes, from the centres of which arise terminally rounded rudiments of the four reduced rays. In respect to size and spinulation they agree with the largest regular microhexactines.

The *choanosomal rhabds* are mostly centrotyle amphioxes, more rarely styles (tylostyles). They are mostly 1–2 mm. long and 10–20 μ thick. The central tyle is relatively much larger in the thin than in the stout amphioxes, and measures 15–35 μ in transverse diameter. The proportion of the thickness of the parts of the spicule adjacent to the tyle and of the tyle itself is 100:110–100:250. It is to be noted that the tyle, particularly in the slender rhabd, is often very eccentric, the four rays, the remnants of which it represents, being not all reduced to the same extent.

The *diactine* (*diactine-derivate*) *rhabd acanthophores* of the hard superficial knobs (Plate 53, fig. 17; Plate 54, figs. 16–20) are simple or centrotyle cylindrical rods, often thickened, and usually densely spined, rarely smooth at the rounded or spindle-shaped ends. They are straight or irregularly, sometimes (Plate 53, fig. 17) very strongly curved. These spicules are usually 0.6–1.4 mm. long and 4–20 μ thick. The central tyle has a maximum in transverse diameter of 35 μ. The smooth, strongly curved form (Plate 53, fig. 17) is only 5.5 μ thick, and about 180 μ long measured along the curve.

The upper ends of the *stalk-spicules* found in the parts of the body underlying the hard superficial knobs attain 15 μ in length, and are 50–110 μ thick at the lower, broken ends and attenuated above. In places these rods are irregular and knotty. Their axial threads at these points exhibit remarkable irregularities, from which I inferred that the spicules had here been broken and then again joined by freshly apposed silica-layers.

Of *amphidiscs* three kinds (which correspond to the large macramphidiscs and the large and small micramphidiscs of *Hyalonema* (*Hyalonema*) *obtusum*) can be distinguished: — macramphidiscs, large micramphidiscs, and small micramphidiscs.

The *macramphidiscs* (Plate **53**, figs. 1–3, 13; Plate **54**, figs. 28, 29) are 200–365 μ long, most frequently about 293 μ. The shaft is cylindrical, straight, 6.5–12 μ thick, and abruptly thickened in or near the middle to a central tyle 12–18 μ in diameter. The proportion of the thickness of the adjacent parts of the shaft to the thickness of the tyle is 100 μ to 115–170. A verticil of truncate or blunt-pointed, often irregularly curved spines 3.5–7 μ long and 2.5–4 μ thick arises from this tyle. Spines similar in shape but smaller (particularly shorter, only 1.5–3 μ long and 2–3 μ thick) are scattered in larger or smaller numbers over the other parts of the shaft. The tips of the spines are smooth or slightly roughened. The terminal anchors are 60–100 μ long, usually considerably less than a quarter of the whole spicule, and 67–107 μ broad. The proportion of their length to their breadth is 100 to 103.8–125.7, on an average 100: 115.5. They consist of ten to twelve teeth. The individual teeth are curved in their (shorter) proximal part and generally nearly straight in their (longer) distal part. The latter usually diverges considerably and encloses an angle of about 20° with the shaft. The teeth are T-shaped in transverse section. Their upper part appears as a band about 10 μ broad and is abruptly attenuated to a point at the end.

The *large micramphidiscs* (Plate **53**, figs. 5, 6; Plate **54**, figs. 26, 27) are 30–56 μ long. The shaft is straight, 1.2–1.7 μ thick, and gradually thickened in a spindle-shaped manner in or near the middle. It bears a few small cylindrical spines. Some of these always arise from the central thickening. The anchors are usually 13.5–17 μ long, generally considerably more than one third of the whole spicule, and 8–10 μ broad. The distal parts of the individual teeth are fairly straight and generally nearly parallel to the shaft.

The *small micramphidiscs* (Plate **53**, fig. 7; Plate **54**, figs. 21–25) are 13–27 μ long, most frequently about 19.5 μ. The shaft is straight, cylindrical, and 0.7–1.5 μ thick. Its central part usually bears a few spines. The anchors are 4.5–7.5 μ long, usually a quarter to a third of the whole spicule, and 5–8 μ broad. The individual anchor-teeth, of which there are about eighteen in one anchor, are more strongly curved some distance from the base than elsewhere. The end-part is nearly straight, and diverges very slightly or not at all from the shaft.

The spiculation of the four hard superficial knobs indicates that the sponge above described had at least two, probably four, distinct and distant stalks, each composed of a separate bundle of spicules.

Authors attach considerable systematic importance to the structure of the organs of attachment in the hyalonematids, and have established genera (Pheronema, Poliopogon) for sponges in which this attachment is effected by a broad spicule-brush or a number of separate spicule-bundles, and not, as in Lophophysema, etc., and the species of the genus Hyalonema, by a simple slender stalk.

Under these circumstances, and in view of the fact that the genus Hyalonema is characterized by the possession of a single slender stalk-spicule bundle, it at first sight seemed advisable to consider the sponge above described not as belonging to Hyalonema, and either to place it in one of the old polycaule genera (Pheronema or Poliopogon), or to establish a new genus for it. Since it has a rudiment at least of a gastral cone, which excludes it from Pheronema or Poliopogon; since it is very similar in habit and spiculation to the forms C, D, and E of *Hyalonema* (*Hyalonema*) *agassizi;* and since it seems to me very doubtful whether the difference between a monocaule and polycaule attachment is, by itself, sufficient for generic distinction, I place it in the subgenus Hyalonema.

The nearest ally to it is *H.* (*H.*) *agassizi.* From this it differs by the large macramphidiscs, the pinules, and the mode of attachment. The large macramphidiscs are considerably longer, their anchors relatively much broader, and the distal parts of their anchor-teeth more straight and divergent in the sponge above described than in *H.* (*H.*) *agassizi.* The distal rays of the pinules of the former are more conic than those of the latter, and not distally thickened as in *H.* (*H.*) *agassizi*, the terminal cone consequently being much more slender than in *H.* (*H.*) *agassizi.* These pinule-rays differ also in respect to their spinulation, their spines being more numerous in *H.* (*H.*) *agassizi* than in *H.* (*H.*) *polycaulum. H.* (*H.*) *agassizi* has a single stalk, *H.* (*H.*) *polycaulum* has several. These, and other minor differences, render it advisable to separate these sponges specifically.

Hyalonema (Hyalonema) placuna, sp. nov.

Plate 63, figs. 29–51; Plate 64, figs. 1–19; Plate 65, figs. 1–23; Plate 66, figs. 1–5.

Two specimens of this species were trawled in the Central Tropical Pacific at Station 3684 (A.A. 17) on 10 September, 1899; 0° 50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); they grew on a bottom of light yellow-gray Globigerina ooze.

In their outer appearance they to a certain extent resemble Placuna shells and to this resemblance the name refers.

Although similar and doubtlessly referable to the same species, the two specimens differ in detail to such an extent that I have established two distinct forms, A and B.

Shape and size. The specimen of form A is the better preserved. This sponge (Plate 64, fig. 11) appears as a thin, irregularly oval lamella with a slight marginal protuberance at one of the narrow ends. Part of its margin is torn off. The sponge is 65 mm. broad and, together with the protuberance, 80 mm. long. A number of transverse folds slightly protrude from its surface. These folds are strongly inclined towards what appears to be the upper end of the sponge, and are here more numerous and crowded than below. Their margins form more or less concentric curves, which are convex towards the upper end of the sponge and extend across the whole lamella. These folds, which are much more clearly marked on one face of the lamella than on the other, give to the sponge its Placuna-like appearance.

The sponge is not, as at first sight appears, a simple plate, but is composed of two lamellae, 1.5–3 mm. thick, closely pressed together and joined along one side. In life it was probably a thin-walled sac, and I am inclined to ascribe its present lamellar shape to a compression and complete flattening after capture. The intact parts of the free margin of this sac bear a frill of freely projecting spicules. The protuberance (Plate 64, fig. 11) is part of this marginal frill. The outer surface appears rough and exhibits the folds mentioned above. Apertures (pores) were not found in it. The inner surface is smooth, and also bears a few strongly inclined projecting folds.

The specimen of form B is similar (Plate 64, fig. 12), but more fragmentary. It appears as a lamella, about 3 mm. thick, with somewhat irregular outline, and is 65 mm. long and 42 mm. broad.

The *colour* of both specimens in spirit is dirty white.

Skeleton. The outer surface is covered with a dense fur of large dermal pinules (Plate 64, fig. 13a; Plate 65, figs. 22, 23). Diactine pinules and centrotyle amphioxes protrude from the sharp margin of the probably sac-shaped body. These pinules form the marginal frill referred to. The inner surface like the outer bears pinules. These gastral pinules are smaller, scarcer, and not nearly so densely crowded as the dermal. In form B two kinds of internal pinules can be distinguished, a larger with long lateral rays, and a smaller with apparently rudimentary lateral rays. The former are certainly gastral, the latter may be canaliculate. Megascleres are very abundant just below the surface and in the interior rhabds. Most of them are centrotyle amphioxes of moderate thickness; some are short spindle-shaped centrotyle amphioxes with remarkably large tyle; a few are diactine centrotyle styles and tylostyles. Hypodermal and hypogastral pentactines occur below the outer and inner surface, and hexactine megascleres in the interior. Numerous microhexactines and a few diactine microhexactine-derivates are found in all parts of the sponge. Seven forms of amphidiscs can be distinguished: — 1, large macramphidiscs with apically broad anchors; 2, small macramphidiscs with apically narrow anchors; 3, large, 4, medium, and 5, small mesamphidiscs; 6, large micramphidiscs with narrow anchors; and 7, small micramphidiscs with broad anchors. In form B all the seven kinds of amphidiscs occur. In form A No. 1 (the large macramphidiscs) and No. 3 (the large mesamphidiscs) are very rare, and No. 5 (the small mesamphidiscs) are apparently altogether absent. In form B I found a tetradisc.

The *dermal pinules* (Plate **64**, figs. 8–10, 13a, 14–19; Plate **65**, figs. 22, 23) are nearly always pentactine, very rarely hexactine, and have a large, bushy distal ray and short lateral rays. Those observed of form A (Plate **64**, figs. 8, 14–16) were all pentactine. They have a straight distal ray, 414–475 μ long, most frequently about 425–440 μ, and 7.5–10.5 μ thick at the base. This ray ends with a stout terminal cone protruding about 20 μ beyond the tips of the uppermost spines. Apart from this terminal cone and the basal end-part, the whole of the distal ray is covered with spines. The lowest spines are strongly divergent and rather far apart. Distally the spines become more and more inclined towards the tip of the ray, and much more crowded. The uppermost spines are nearly parallel to the axis of the distal ray. The lowest spines are quite short. Distally they increase in dimension, and attain their maximum size at from two thirds to three quarters of the length of the distal ray from the centre of the spicule. Beyond this point they again become smaller. The largest spines are about 40 μ long and 2–3 μ thick at the base. It seems that the basal parts of these spines are somewhat flattened, their diameter in a direction radial to the distal ray being smaller than their diameter in a direction vertical to this. These distal pinule-rays have the appearance of wheat-ears; this is due to a slight, just perceptible curvature of the spines towards the tip of the ray, to the increase in their size towards a point in the distal half of the ray, and to their density. The maximum thickness of the distal ray, together with the spines, is 32–50 μ, most frequently 38–47 μ. This maximum thickness lies near the distal end of the ray. The proportion of the total length of the distal ray to the distance between the point of its maximum thickness, together with the spines, and the centre of the spicule (the base end of the distal ray) is 100 to 65.1–83.3, most frequently 100 to 70–78, on an average 100 : 73.8.

The lateral rays of the same spicule are usually all alike. They are 25–42 μ long, attenuated distally, in their basal part very gradually, in their distal part abruptly, and pointed at the end. Sometimes one (Plate **64**, fig. 8, to the left) or more (Plate **64**, fig. 8, to the right) of them are reduced in length, only 20–24 μ long, nearly cylindrical, and rounded at the end. The lateral rays are smooth, or provided with a few small spines.

The dermal pinules of form B (Plate **64**, figs. 9, 10, 17–19) differ from those of form A chiefly in the maximum thickness of their distal ray, together with the spines, which is situated farther up, nearer to the tip of the ray. These pinules are not, as those of form A appear to be, all pentactine, but some hexactines occur among them. The distal ray of these spicules is 385–458 μ long, most frequently 399–445 μ, and 7–11 μ thick at the base. The terminal cone is usually 18–27 μ long. The maximum thickness of the distal ray, together with the spines, is 35–62 μ, most frequently 40–60 μ. The proportion of the length of the distal ray to the distance between the point of maximum thickness (together with the spines) and the centre of the spicule (the base of the distal ray) is 100 to 71–86, most frequently 100 to 76–84, on an average 100 : 79.6. The lateral rays are 28–44 μ long. The proximal ray of one of the hexactine forms is 34 μ long.

The *ordinary gastral pinules* of form A are nearly always pentactine, very rarely hexactine. In form B pentactine forms only were observed. The distal ray of the ordinary gastral pinules of form A (Plate **65**, figs. 19–21) is straight or, rarely, angularly bent and 153–390 μ long, usually 200–360 μ. It is somewhat spindle-shaped, thickest at a point about one third of its length from the base. At the base it measures 7–12 μ, at the thickest point 10–16 μ, in thickness, and it ends in a rather long and slender terminal cone. Its distal and its proximal end-parts are spineless. The remainder of it bears rather sparse and distant spines. The lower spines arise steeply or vertically from the ray and then curve upwards, often very markedly, towards its tip (Plate **65**, fig. 21). The upper spines for their whole length are strongly inclined and slightly curved towards the tip of the ray. They decrease in size distally, the uppermost ones being very small. The maximum thickness of the distal ray, together with the spines, is usually 30–38 μ, rarely less, down to 22 μ. The lateral rays are 37–85 μ long, usually 40–70 μ, conic, and pointed. They are in the distal half, or two thirds of their length, beset with somewhat sparse, conspicuous, vertical or outwardly directed spines. A good many of the pentactine forms of these spicules possess a large spine opposite the distal ray. This spine may be a rudiment of the proximal ray. In the rare cases where the sixth (proximal) ray is properly developed, it attains a length of 27–73 μ.

The ordinary gastral pinules of form B (Plate **65**, figs. 16–18) are similar. All those observed were pentactine. Their distal ray is 164–286 μ long, rarely 330 μ, 8–11.5 μ thick at the base, and at the point of maximum thickness 11–17.5 μ thick. Everywhere, except at the base and at the tip, it bears spines, which are larger (17–25 μ long) and, particularly the upper, more divergent than in form A. In many of these spicules the lower spines are irregular and branched (Plate **65**, fig. 17). The maximum thickness of the distal ray, together with the spines, is 28–52 μ. The lateral rays are conic, pointed or blunt, 40–73 μ long, and either quite smooth or provided with a few very minute spines.

Besides the pinules described above, other much *smaller pinules with apparently rudimentary lateral rays* (Plate **65**, figs. 9–12) have been found in the spicule-preparations of the interior of form B. As I have not seen them *in situ* in the sections, I cannot say with certainty whether they are gastral or canalar. The probability is that they are canalar. These pinules are pentactine. Their distal ray is straight and 172–200 μ long, 7.5–9 μ thick at the base. It is somewhat spindle-shaped and measures in thickness 11–13 μ at the point of maximum thickness, which is about a third of the length of the distal ray distant from the base. The distal ray ends with a terminal cone. Everywhere, except at its base and at its tip, it bears large and sparse, more or less irregularly arranged spines. The lower spines arise steeply or vertically from the ray and are often branched; the upper are inclined towards the tip and simple; the latter decrease in size distally. The lateral rays appear as short stumps only 10–14 μ long. Sometimes it seemed to me that their shortness was due to their being broken; in other cases they appeared to be quite intact. Occasionally one or a few large and slender spines arise from the lower side of the laterals. Sometimes a large spine of this kind projects downward from the centre of the spicule (Plate **65**, fig. 11). Such a spine appears as a rudiment of a sixth proximal ray.

The *diactine marginal pinules*. In the somewhat fragmentary specimen of form B the margin is torn off and these spicules are missing. In form A they are abundant. In this form they are slightly curved or nearly straight, and 0.9–1.5 mm. long. The distal ray may be longer or shorter than the proximal. The former measures 520–700 μ in length, the latter 360–760 μ. At their base both rays are 9–11 μ thick. The centrum is thickened to a tyle 11–20 μ in transverse diameter. The distal part of the distal ray bears spines strongly inclined towards the tip. This spiny part, which is usually 350–400 μ long, has, together with the spines, a maximum diameter of 26–30 μ.

Of *rhabds* three kinds can be distinguished:— ordinary, isoactine, and centrotyle amphioxes; anisoactine centrotyle rhabds with one longer and pointed and one shorter and terminally rounded and usually thickened ray; and short and stout centrotyle amphioxes.

The *ordinary centrotyle amphioxes* (Plate **63**, fig. 46) are in both forms usually 0.8–2 μ long and 9–21 μ thick near the centre. The central tyle is 14–22.5 μ in diameter. The ends are blunt and usually irregular, with widened axial thread-ends. In these spicules the proportion of thickness (close to the tyle) to length is 1:50–72, on an average 1:63.3.

The *anisoactine centrotyle rhabds* appear as centrotyle tylostyles or, more rarely, styles. They are shorter than the isoactines, and 11–23 μ thick near the terminal tyle (rounded end). The terminal tyle is often irregular, and measures in transverse diameter 13.5–37 μ, sometimes 14 μ more than the adjacent part of the spicule.

The *short and stout centrotyle amphioxes* (Plate **63**, fig. 47) are 0.6–1.6 mm. long, and 13–38 μ thick near the middle. The central tyle is 23–45 μ in diameter. The proportion of the thickness (close to the tyle) to the length is 1:37–52, on an average 1:44.

The *hypodermal pentactines* (Plate **63**, figs. 48–50) appear to be about the same in both forms. It is to be noted, however, that forms with lateral rays over 480 μ in length were found only in form A. The proximal ray is usually slightly curved, conic, blunt, 470–800 μ long, and 9–55 μ thick at the base. The lateral rays may be fairly equal, or unequal in size. Sometimes their inequality is very great (Plate **63**, fig. 48), the longest being nearly twice as long as the shortest. They are conic, very blunt, straight, or curved concave to the proximal ray, and usually also inclined in this direction. The longest lateral ray of the spicule is 220 μ–1.1 mm. long.

Hypogastral pentactines were found only in the preparations of form B, and here also they are very scarce. Those observed had lateral rays 360–670 μ long and 18–35 μ thick at the base.

The *hexactine megascleres* are scarce, but have been found in both forms. In both they measure 0.8–1.2 mm. in diameter and have blunt conic rays 16–34 μ thick at the base.

The *microhexactines and microhexactine-derivates* form a series beginning with spicules composed of six fairly equal rays and ending with centrotyle diactines from the central tyle of which arise one to four ray-rudiments. The most frequent are the intermediate forms, representing the middle-part of this series, with two opposite rays longer than the other four.

The *regular microhexactines* in both forms (Plate **64**, figs. 4, 6, 7; Plate **65**, figs. 3–8) measure 60–140 μ in diameter. Their rays are straight throughout or slightly bent in their middle-part, but never markedly curved in their end-part. They are 1.4–2.9 μ thick at the base, conic, sharp-pointed, and covered with minute and slender, backwardly directed spines, only 0.3 μ long. In the middle-part of the ray these spines are much more numerous than in the basal and end-parts.

The *irregular microhexactines* have two opposite longer rays, and four shorter rays (Plate **64**, figs. 2, 3, 5) vertical to the axis of the two longer. The two longer rays are usually fairly equal, the four shorter rays often very unequal. These spicules are in form A 120–195 μ long and 90–130 μ broad; in form B 110–170 μ long and 80–135 μ broad. Their rays are similar to the rays of the regular microhexactines above described, and are 1.8–2.5 μ thick at the base. Transitional forms connect these spicules on the one hand with the regular microhexactines and on the other with the diactine microhexactine-derivates.

The *diactine microhexactine-derivates* (Plate **64**, fig. 1) are 220–330 μ long. Their central tyle measures 4–5 μ in diameter. Their two properly developed rays are similar to those of the microhexactines and are 2.5–3 μ thick at the base. The four other rays are reduced, often to quite insignificant protuberances of the central tyle. The degree of reduction of these four rays is, in the same spicule, usually different, some being generally 5–10 μ and more long, while others are represented only by slight protuberances of the central tyle.

The regular microhexactines are 60–140 μ long, the ordinary irregular microhexactines 110–195 μ long, a transitional form with reduced rays 13–25 long is 225 μ long, one 10–22 long is 270 μ long, and one 2–5 long is 330 μ long.

A comparison of these dimensions shows that the total length of these spicules, that is to say the length of their two properly developed rays, is in proportion to the degree of reduction of their four other rays.

This correlation is obviously comparable to that found by me[1] in the microscleres of the Tetraxonia, where the number of rays is usually in inverse proportion to their size. I am inclined to ascribe this in the case of *Hyalonema* (*Hyalonema*) *placuna* to the same cause as in the case of the tetractinellids. I believe that the cells or assemblages of cells building spicules like the asters of the tetractinellids and the microhexactines and microhexactine-derivates here under discussion contain a certain and definite amount of potential energy available for spicule-building and that this definite amount of energy is expended by the spicule-builders in *H.* (*H.*) *placuna* either in producing six smaller more or

[1] *R. v. Lendenfeld.* Die Tetraxonia. Ergeb. Deutsch. tiefsee-exped., 1907, **11**, p. 64.

less equal, or two larger and four more or less rudimentary rays. If this assumption is correct, and if the energy saved in the building of the smaller rays is utilised in increasing the size of the larger, the latter must be hypertrophic to a degree in proportion to the degree of reduction of the former as, in fact, they are.

The *amphidiscs*. As these spicules are more numerous in form B than in form A, I shall commence the description of them with an examination of the amphidiscs of the former.

The amphidiscs of form B are 18.5–367 μ long. The frequency of those of different length is shown in Figure 9.

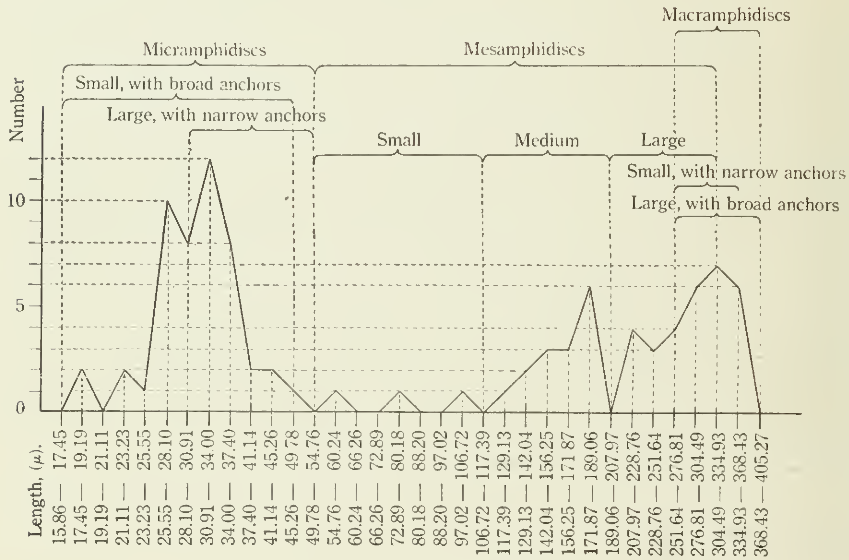

Fig. 9.— Form B. Amphidiscs.

The figure shows that, apart from minor depressions of the frequency-curve, the amphidiscs can, biometrically (according to the frequency of those of different lengths), be divided into two main-groups, one comprising amphidiscs 18.5–48 μ long, the other amphidiscs 124–367 μ. These groups dimensionally so very different are connected only by three of the 96 amphidiscs measured, which are 55, 72, and 100 μ long respectively. The part of the curve pertaining to the small amphidiscs exhibits three not very deep depressions, the part of it pertaining to the large amphidiscs one small and one considerable depression. The latter lies between amphidiscs 187 and 214 μ long.

All the amphidiscs under 30.5 μ and the majority of those 30.5–42 μ long have broad anchors (proportion of anchor-length to anchor-breadth 100 to 58–92). Some of the amphidiscs 30.5–43 μ long, and all 43–48 μ long, have more slender anchors (proportion of anchor-length to anchor-breadth 100 to 50–56). The few dimensionally intermediate forms 55–100 μ long, and the smaller of the forms belonging to the second main elevation of the curve (that is those 124–286 μ in length), have slender anchors (proportion of anchor-length to anchor-breadth 100 to 42–66). The largest measured amphidiscs, that is those 287–367 μ long, have broad anchors (proportion of anchor-length to anchor-breadth 100 to 72–107). Among the latter two kinds can be distinguished according to the shape of the anchors. In some of the smaller ones the anchors are narrow at the apex and composed of teeth terminally diverging from, parallel to, or only slightly converging to the shaft. In the smaller and all the larger ones, that is those 328 μ and more long, the anchors have a broad apex and are composed of distally converging teeth.

Taking into consideration both their length frequencies and the differences in the shape of their anchors, we come to the conclusion that, as stated above, seven kinds of amphidiscs are to be distinguished in this sponge:— 1, large macramphidiscs with apically broad anchors; 2, small macramphidiscs with apically narrow anchors; 3, large, 4, medium, and 5, small mesamphidiscs; 6, large micramphidiscs with slender anchors; and 7, small micramphidiscs with broad anchors.

The amphidiscs of form A are similar to those of form B but on the whole smaller and, as stated above, not so numerous. Groups 1 and 3 contained only one amphidisc each and group 5 contained none.

The *large macramphidiscs with apically broad anchors* of form B (Plate 66, figs. 3, 4) are 287–367 μ, most frequently about 320 μ long. The shaft is straight, cylindrical, 8.5–11 μ thick, and abruptly thickened in or near the middle to a central tyle 13–17 μ in diameter. An irregular verticil of truncate, cylindrical, vertical or, more rarely, oblique spines 8–14 μ long and usually about 5 μ thick arises from this tyle. The remaining parts of the shaft bear a smaller or a larger number of exceedingly low, broad protuberances. The two anchors of the same spicule are equal or unequal. Their inequality is sometimes considerable. The greatest dimensional difference of the two anchors of the same spicule observed was 14 μ in the length and 13 μ in the breadth. The anchors are 100–132 μ long, usually about a third of the whole spicule. They attain their maximum breadth some distance above the end, and here measure 79–118 μ in transverse diameter. The end-breadth is 6–9 μ less than the maximum breadth. The proportion of the length to the maximum breadth of the anchors is 100 to 72–107, on an average 100:87.6. There are usually about ten teeth in the anchor. The teeth arise nearly vertically from the shaft and are curved rather strongly in their proximal part; distally their curvature decreases. Altogether it is such that the ends of the teeth converge towards the shaft, with the axis of which they enclose angles of about 7°. The teeth are T-shaped in transverse section. The distal band-shaped part, which corresponds to the horizontal stroke of the T, is uniformly about 12 μ broad for the greater part of its length, and very blunt-pointed or rounded at the end.

The dimensions of the single spicule of this kind found in form A are:—length 315 μ; thickness of shaft 7 μ; anchor-length 90 μ; maximum anchor-breadth 95 μ; proportion of anchor-length to maximum anchor-breadth 100 : 106.

The *small macramphidiscs with apically narrow anchors* of form B (Plate 65, fig. 1) are 296–319 μ, most frequently about 308 μ long, have a shaft 6–8.5 μ thick, and are abruptly thickened in or near the middle to a central tyle 12–15 μ in diameter. Several short truncate cylindrical spines, as much as 9 μ long and 4 μ thick, arise from this tyle. Low and broad truncate protuberances also occur on other parts of the shaft. The terminal anchors are 113–140 μ long, usually a little over a third of the whole spicule, and 97–102 μ broad. The proportion of their length to their breadth is 100 to 73–87, on an average 100 : 77.3. The anchor-teeth are usually arranged in the ordinary, strictly verticillate manner, but occasionally an amphidisc of this kind is met in which one of the teeth arises at a much lower level than the rest (Plate 65, fig. 1). The anchor-teeth arise nearly vertically from the shaft. They are curved more strongly in their basal part and less strongly in their distal part than the anchor-teeth of the large macramphidiscs with apically broad anchors described above. Their total curvature is such that their ends usually diverge slightly from the shaft. Sometimes, however, their tips are parallel or even slightly convergent. The ends of the teeth are usually pointed.

In form A these spicules (Plate 66, figs. 1, 2, 5) are similar, but on the whole smaller. They are here 245–330 μ long; the shaft is 7–10 μ thick, and the central tyle 13–16 μ. Cylindrical truncate spines 4 μ long and 3–4 μ thick arise from the latter. The remainder of the shaft usually bears a good many low and broad protuberances. The anchors are 95–130 μ long and 80–105 μ broad. The proportion of their length to their breadth is 100 to 79–88, on an average 100:83.6.

The three kinds of *mesamphidiscs* (Plate 63, figs. 29–35; Plate 65, fig. 2) all have much the same shape. They are distinguished morphologically by the anchors of the larger being on the whole somewhat narrower than the anchors of the smaller, and biometrically by well-marked depressions in the length frequency-curve. The shaft is gradually thickened towards the ends and abruptly thickened in or near the middle to a central tyle. The latter bears a verticil of conspicuous spines which are cylindrical or cylindroconic, truncate, or rarely irregular; usually they are irregularly curved, some in one direction, others in others. These spines reach 5 μ in length and 2 μ in thickness. In the large and medium mesamphidiscs the remainder of the shaft bears remarkably numerous similar spines; these are shorter and usually straight. The terminal anchors are narrow. The teeth arise nearly vertically from the shaft, are curved very strongly in their basal part and much less strongly and quite uniformly in their distal and middle-part. Often they are abruptly bent down near the base. Another inconsiderable abrupt inward bend is frequently seen a short distance from the end. When such a bend is present the distal part of the tooth, lying beyond it, is generally straight or slightly curved in the opposite direction, convex to the shaft (Plate 63, figs. 29–32). Altogether the curvature of the teeth is such that their end-parts generally slightly converge towards the shaft. Sometimes, however, they are parallel to it, or even slightly divergent.

The measurements of the three kinds of mesamphidiscs of the two forms are tabulated on p. 218.

This table shows that the mesamphidiscs are in form B 55–286 μ long, in form A 105–197 μ. In the single large spicule of this kind observed in form A the anchors are broader (proportion of anchor-length to anchor-breadth 100 : 73) than in the others (proportion of anchor-length to anchor-breadth 100 to 42–66). On the whole, as stated above, the smaller these spicules the narrower the anchors; the average proportion of anchor-length to anchor-breadth being in form B: —

in the large	mesamphidiscs	100 : 58.9;
in the medium	"	100 : 54.7;
and in the small	"	100 : 52.7.

The *large micramphidiscs with slender anchors* are not numerous. Those of form B (Plate 63, fig. 36) are 30.5–48 μ long, most frequently about 38. The shaft is usually a little under 1 μ thick and slightly thickened at some place near the middle. It usually bears several minute low and broad spines in the middle-part. The terminal anchors are 14–20 μ long, usually a third to two fifths of the

Mesamphidiscs		large		medium		small	
In form		A[1]	B	A	B	A[2]	B[3]
Total length	limits μ	197	214–286	105–186	124–187		55–100
	most frequently about μ		249	143	163		
Thickness of shaft μ		5	4–7	2–4	2–4		1–2
Diameter of central tyle μ		7	6–11	2.8–6.5	3.5–6		1.4–3.5
Length of terminal anchors	limits μ	73	71–130	38–72	40–82		17–42
	most frequently about μ		108	51	63		
Maximum breadth of terminal anchors	limits μ	54	47–85	19.5–52	23–52		10–24
	most frequently about μ		65	31	44		
Proportion of length to maximum breadth of terminal anchors 100 to	limits	73	55–66	43–66	43–66		42–59
	average		58.9	57	54.7		52.7

whole spicule, and 6–11 μ broad. The proportion of their length to their breadth is 100 to 50–56, on an average 100 : 52.3. The individual teeth arise vertically from the shaft, and are strongly bent in their proximal, and fairly straight in their distal part. Their straight end-parts are usually parallel to the shaft.

In form A these spicules (Plate 63, fig. 42) are similar in shape, but smaller and provided with somewhat narrower anchors. Their dimensions are here the following: — total length 28–38 μ; length of terminal anchors 12–15 μ; breadth of terminal anchors 6–6.5 μ; proportion of anchor-length to anchor-breadth 100 to 43–50, on an average 100 : 47.5.

The *small micramphidiscs with broad anchors* are abundant. Those of form B (Plate 63, figs. 37–41; Plate 65, fig. 13) are 18.5–42 μ long, most frequently 26–32 μ. The shaft is straight, 0.6–1 μ thick, and either simple and cylindrical throughout (Plate 65, fig. 13) or thickened somewhere near the middle to a central tyle 1–1.3 μ in diameter. This tyle and the middle-part of the shaft usually bear some minute low and broad spines, either on all sides or on one side only. The anchors are 6–16 μ long, a little less than a third to two fifths of

[1] Only one observed. [2] Apparently absent. [3] Only three observed.

the whole spicule, and 5–11 μ broad. The proportion of their length to their breadth is 100 : 58–92, on an average 100 : 73.8. The teeth arise nearly vertically from the shaft, and are strongly curved in their proximal part. Their distal part is straight, or only slightly curved, concave to the shaft. Their end-parts usually diverge slightly from the shaft, sometimes they are parallel to it.

In form A these spicules (Plate 63, figs. 43–45; Plate 64, figs. 14, 15) are similar. Their dimensions are here: — total length 21–34.5 μ, most frequently 25–33 μ; anchor-length 7–12.5 μ; anchor-breadth 5–9 μ; proportion of anchor-length to anchor-breadth 100 to 56–100, on an average 100 : 71.7.

Tetradisc. In form B I found a tetractine (stauractine) spicule (Plate 63, fig. 51) with irregular terminal anchors on three of the rays. The fourth ray is broken off. The four main-rays of this spicule are densely spined, and the straight ends of the anchor-teeth, particularly of the longest, also bear conspicuous spines on their inner side. This spicule has a total diameter of 87 μ. The anchors are about 35 μ long and 36 μ broad.

The above description shows that these two sponges differ from each other in respect to the shape and size of several of their spicules, particularly their dermal and gastral pinules. These differences are quite constant and striking. I do not, however, consider these differences sufficient for specific or varietal distinction. I therefore place the two sponges in the same species and distinguish for them, within this species, two forms.

There can of course be no doubt about this species belonging to the Hexactinellida Amphidiscophora. It is more difficult to determine the genus, as the remarkable shape indicates a new generic character. Since, however, the specimens on which it is based are somewhat fragmentary, and since no trace of a stalk or other supporting apparatus is present, I refrain from doing so and place it provisionally in the genus *Hyalonema*, subgenus *Hyalonema*, some of the known species of which are quite similar in respect to spiculation.

These sponges are distinguished by their shape and the dimensions of their spicules to such an extent that they can not be assigned to any of the described species. Their nearest allies are *Hyalonema* (*H.*) *tenuifusum* and *H.* (*H.*) *tylostylum*. From these they differ by the presence of protruding ridges (folds) which are absent in the two last named species; also by the dermal pinules being smaller and having much shorter lateral rays than in *H.* (*H.*) *tenuifusum* (the dermal pinules are larger than those of *H.* (*H.*) *tylostylum*); by their gastral pinules having longer distal rays than in *H.* (*H.*) *tenuifusum* (the gastral pinules are larger than those of *H.* (*H.*) *tylostylum*); by the microhexactines being covered with conspicuous recurved spines; by the micramphidisc being longer and having much larger anchors than in *H.* (*H.*) *tenuifusum*, and being shorter and having relatively much broader anchors than in *H.* (*H.*) *tylostylum*, and by other characters. These facts together with the widely separated habitats (fully 50 equatorial degrees) are sufficient for specific separation.

Hyalonema (Hyalonema) sp. from Station 4656.

Plate 68, figs. 26–33; Plate 69, figs. 1–5.

Part of a macerated specimen was trawled off northern Peru, Station 4656, on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4063 m. (2222 f.); the bottom was composed of fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°. It is obviously the basal part of a Hyalonema but cannot be determined specifically.

The specimen (Plate 68, fig. 26) is an elongate, irregularly oval lamella 60 mm. long, 22 mm. broad, and 8 mm. thick. A stalk 5 mm. thick and broken off short arises from one of the two narrow ends. The colour is brown.

Amphiox megascleres, basal acanthophores, stalk-spicules, and microhexactines, which doubtlessly belong to the sponge, are found in large numbers in the spicule-preparations. Only a few hexactine and pentactine megascleres, pinules, and amphidiscs were seen. Some of these are probably proper to the sponge, others foreign, and it is impossible in every case to determine with certainty.

The *pinules* which seem to be proper to the sponge are of two kinds, larger and smaller. Both are pentactine. The larger have a bushy distal ray 460–540 μ long and 8–10 μ thick at the base. The distal ray, together with the spines, is 40–60 μ in transverse diameter at the point of maximum thickness, which lies high up. The lateral rays are 50–73 μ long. The dimensions of the smaller pinules (Plate 69, figs. 1, 2) are:— distal ray, length 124–360 μ, basal thickness 7–12 μ, maximum thickness, together with the spines, 15–43 μ; lateral rays, length 27–50 μ.

A *pentactine* observed has conical lateral rays 750 μ long and 35 μ thick at the base.

The *hexactines* are 0.7–1.5 mm. in maximum diameter. The rays are 16–28 μ thick at the base, and usually somewhat unequal in size in the same spicule.

The *amphioxes* are 1.3–2 mm. long and 10–17 μ thick near the centre. Most of them are distinctly centrotyle. The central tyle is generally about 5 μ more in transverse diameter than the adjacent parts of the spicule.

The *basal acanthophores* (Plate 68, figs. 27, 28, 31–33) have from two to six rays, the tetractine (stauractine) forms greatly predominating. The tri- to hexactines are 230–820 μ long and have rays 11–33 μ thick at the base. The diactines are 0.7–1.15 mm. long and 7–30 μ thick near the centre. Most of them, particularly the shorter ones, are distinctly centrotyle; their central tyle is 12–62 μ, which is sometimes 40 μ more than the adjacent parts of the spicule in transverse diameter. The ends of the rays are thickened and densely covered with rather large spines. The remaining parts of the spicules are generally smooth. In some stout-rayed tetractines a few spines arise also from the basal parts of the rays (Plate 68, fig. 31), and some diactines have a very spiny central tyle (Plate 68, fig. 27).

In the lower part of the body fragments of *uncinate anchor-spicules* have been observed. A spicule of this kind measured is 11 μ thick just above the anchor. The anchor is 25 μ long and 18 μ broad. The anchor-teeth are rather numerous, irregular, strongly recurved, and very blunt.

The *microhexactines* (Plate 68, figs. 29, 30) are mostly rather regular and measure 85–150 μ in diameter. In some, two opposite rays are longer than the other four. Such microhexactines are sometimes 200 μ long and 120 μ broad. The rays are 1.5–2.5 μ thick at the base, and usually slightly curved a little beyond the middle of their length. This curvature is often unequal in different rays of the same spicule.

Occasionally *monactine microhexactine-derivates* have been observed. A spicule of this kind measured appears as a tylostyle 120 μ in length and 1 μ in thickness, with a terminal tyle 3.5 μ in diameter.

Those *amphidiscs* (Plate 69, figs. 3–5) which can, with some degree of probability, be assigned to the sponge, fall into five categories:— large and small macramphidiscs, large and small mesamphidiscs, and micramphidiscs.

The dimensions of these five kinds of amphidiscs are tabulated below:—

	Total length μ	Length of anchor μ	Breadth of anchor μ	Thickness of shaft μ	Diameter of central tyle μ
Large macramphidiscs	280–316	76–120	90–101	9–12	13–18
Small macramphidiscs	220–225	77–80	60–70	8	10
Large mesamphidiscs	136–168	46–66	22–43	2–6	2–8
Small mesamphidiscs	45–69	23	15–18	1.5–2	
Micramphidiscs	20–29	4–7	6–8	0.6–1	

In respect to its large pinules this sponge somewhat resembles *Hyalonema* (*Hyalonema*) *placuna*, in respect to its large amphidiscs *Hyalonema* (*Hyalonema*) *polycaulum*.

Hyalonema (Hyalonema) tenuifusum, sp. nov.

Plate 67, figs. 1–26; Plate 68, figs. 1–25.

A larger (*a*), and several fragments of another, smaller (*b*) specimen of this sponge were trawled off the coast of northern Peru at Station 4656 on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4063 m. (2222 f.); it grew on a bottom of fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°. The name refers to the minute, exceedingly slender, centrotyle amphioxes so abundant in these sponges.

Shape and size. Specimen (*a*) (Plate 67, fig. 1) appears as a somewhat lacerated lamella, irregularly oval in outline, 84 mm. long, and 56 mm. broad. At one of its narrower ends a stalk, 3 mm. thick, arises from its margin. This stalk lies in the same plane as the lamellar body of the sponge. The latter is stoutest some 20 mm. above the point where the stalk arises from it, and is here 12 mm. thick. Upwards and sideways the lamella gradually thins out towards the margin. The fragments of specimen (*b*) are lacerated pieces of a lamella 1.5–3 mm. thick. The lamellar body is not simple and solid throughout, in either of the specimens, but is partly composed of two lamellae in contact with each other. The inner surfaces of these lamellae are obviously gastral surfaces and it is probable therefore that these sponges are in truth calyculate, and that their present shape is due merely to a collapse of the walls, caused by pressure exerted during or after capture.

The *colour* in spirit is brown, rather dark in (*a*), pale in (*b*).

The *skeleton.* Both the outer dermal and the inner gastral surfaces are covered by a dense pinule-fur. Smaller gastral pinules have been found in the walls of some of the canals. Below the dermal and gastral surfaces masses of paratangential rhabds form a kind of felt. These rhabds are mostly centrotyle amphioxes, but derivates of these spicules, with one actine reduced in length and often thickened and terminally rounded, also occur among them. This spicule-felt is pierced by the proximal rays of hypodermal and hypogastral pentactines. Similar amphioxes and amphiox-derivates and occasionally hexactine megascleres were observed in the interior. The microscleres are regular microhexactines, irregular microhexactines with two opposite rays much longer than the others, minute centrotyle amphioxes, minute tylostyles, large macramphidiscs, small macramphidiscs, and micramphidiscs. The large macramphidiscs are rather rare, the minute tylostyles, which may be foreign, very scarce. All the other kinds of microscleres are abundant. At the point of emergence of the stalk, numerous monactine to hexactine, stout acanthophores, occur at the base of specimen (*a*). The stalk itself consists of a dozen stout, and a number of more slender spicules twisted in the usual way.

The *dermal pinules* (Plate 68, figs. 18–21, 24, 25) are nearly always pentactine, very rarely hexactine. The distal ray is straight, 336–550 μ long, generally 430–530 μ, and, at the base, 8–11 μ thick, rarely as much as 13 μ. Its proximal end is smooth; for the rest of its length it is covered with upwardly directed spines which are sparse, stout, short, straight, or only slightly curved, and strongly divergent below, and which increase in density and length, and decrease in divergence and thickness above, up to a point a short distance below the tip of the ray. From this point onward to the end of the ray the spines again become smaller, less divergent, and more and more curved, concave to the ray, the distal parts of the uppermost spines being nearly parallel or even convergent. The maximum thickness of the distal ray, together with the spines, is 37–65 μ. The point of maximum thickness lies high up. The proportion of the total length of the distal ray to the distance of the point of maximum thickness from the centre of the spicule (the proximal end of the distal ray) is, in the dermal pinules of specimen (*a*), 100 : 64 to 84, on an average 100 : 79, in the dermal pinules of (*b*) 100 : 67 to 84, on an average 100 : 75.2. When the point of maximum thickness is very high up, the distal ray, together with the spines, appears club-shaped.

The lateral rays of the same spicule are usually fairly equal, straight, cylindroconical in the basal and middle-parts, and abruptly pointed at the end. They are, in the dermal pinules of specimen (*a*) rather smooth, and 52–90 μ long; in those of (*b*) spiny, and 40–75 μ long. The rare hexactine dermal pinules are quite similar to the pentactine. Their proximal ray reaches 103 μ in length. In a good many pentactine pinules of specimen (*b*) a little cluster of spines, about 4 μ long, arises from the centre of the proximal face of the cross formed by the lateral rays. This central spine-cluster may be a remnant of a reduced proximal ray.

The *gastral pinules* (Plate 68, figs. 2, 3) are, like the dermal, usually pentactine, rarely hexactine. The distal ray is 101–228 μ long, and 4–10 μ thick at the base. It bears sparse spines directed obliquely outward and upward. The spines are usually only slightly curved, concave to the ray. Occasionally, however, the lowest spines exhibit a strong curvature in this direction. The largest spines are usually those arising some distance below the middle of the length of the ray. Proximally they become shorter but remain nearly as thick; distally they become both shorter and more slender. The spines on the distal part of the ray are usually very small, often quite rudimentary. At the point of maximum thickness, which is generally situated below the middle of its length, the distal ray is, together with the spines, 10–46 μ in transverse diameter. The gastral pinules of specimen (*a*) appear to have on the whole more slender distal rays than those of (*b*). The lateral rays are straight, cylindroconical, and 39–92 μ long, most frequently 45–70 μ. They are spiny. In the gastral pinules of specimen (*a*) their spines are usually quite numerous and small, in those of (*b*) often sparse and very large, 2–4 μ long. The proximal ray of the hexactine forms is similar to the laterals but shorter.

The *canalar pinules* (Plate 68, fig. 4) are very variable in appearance and form a series one end of which is represented by pinules similar to the gastrals, the other by pentactines the apical ray of which is only slightly longer and bears only slightly larger spines than the laterals. The distal ray is 68–120 μ long, and 3.5–7 μ thick at the base. It bears a few obliquely ascending, nearly straight spines, which attain a considerable size in the larger pinules of this kind. At the point of maximum thickness, which usually lies at or below the middle of its length, the distal ray, together with the spines, is 8–28 μ thick.

The hypodermal and hypogastral *pentactines* have a straight proximal ray 0.5–1 mm. long, and 10–60 μ thick at the base. The lateral rays are straight, usually inclined more or less towards the proximal ray, and 0.2–1.1 mm. long. I have often noticed a great inequality in the length of the lateral rays. In some of these spicules the longest lateral is nearly twice as long as the shortest.

The choanosomal *hexactine megascleres* are 0.5–1.5 mm. in total diameter, and have conical rays 9–27 μ thick at the base. Besides the more or less intact hexactines from which these measurements were taken, fragments of such spicules were observed which indicate that hexactine megascleres also occur of dimensions considerably exceeding those given above.

The *centrotyle amphiox megascleres* are more or less curved, 0.9–3.4 mm. long, usually 1–2.4 mm., and 7–13 μ thick near the middle. The central tyle measures 16–26 μ in diameter, and is 1.2–2.9 times as thick as the adjacent parts of the spicule. The thin amphioxes have a relatively larger central tyle than the stout ones.

The *style amphiox-derivates* are as thick as the amphioxes, but shorter. In these spicules one of the two rays is properly developed, the other reduced in length, rounded at the end, and thickened so as often to attain a transverse diameter nearly equal to that of the "central" tyle, which in these spicules is of course very eccentric.

The *spicules forming the stalk* are, at the point where they arise from the sponge-body, sometimes 0.5 mm. thick. Fragments of rhabds 20–40 μ thick found in spicule-preparations of the interior are probably parts of young stalk-spicules. All the stalk-spicules observed were smooth.

The *stout acanthophores* (Plate 67, figs. 6, 7) have from one to six, most frequently from two to four rays. The rays usually taper distally, more rarely they are cylindrical. The end-part is densely covered with spines, generally somewhat thickened, and terminally rounded, or more rarely, pointed. The diactine forms are centrotyle. The three- to six-rayed forms are 335–580 μ in diameter, and have rays 10–20 μ thick. In the three-rayed forms all the rays lie in the same plane; two generally in a straight line, and the third at right angles to these. In the four-rayed forms the rays also lie in one plane, and the adjacent ones enclose angles of 90°. These spicules therefore appear as crosses (stauractines). In the rare pentactine forms four rays extend in a plane, enclose angles of 90° with each other and appear as lateral rays, whilst the fifth is vertical to the plane of the four others and appears as an apical ray. The rare six-rayed forms are regular hexactines.

In the diactine acanthophores the rays lie in a straight or slightly curved line. These spicules are 675 μ–1.1 mm. long and 10–12 μ thick. Their central tyle is 17–30 μ in transverse diameter. They are connected by transitional forms with the ordinary centrotyle amphiox megascleres. These transitional forms are about as thick as the true diactine acanthophores, but longer, reaching 2.6 mm. in length, and have smaller central tyles. The monactine forms are tylostyles 0.8–1 mm. long and 10–13 μ thick. The terminal tyle is about 22 μ in diameter.

The *regular microhexactines* (Plate 67, figs. 10, 11) have six regularly distributed, conical and sharp-pointed, straight or slightly curved rays. The curvature is, when present, usually greater in the proximal than in the distal part of the ray. The rays are nearly smooth, or slightly roughened by the presence of exceedingly minute spines, which appear to be directed backwards towards the centre of the spicule. In specimen (*a*) the regular microhexactines are 110–155 μ in total diameter, and have rays 1.5–2 μ thick at the base. In specimen (*b*) these spicules are somewhat smaller, 80–105 μ in diameter, and have rays 1–2 μ thick at the base.

In specimen (*b*) I found a microhexactine with a branch-ray on one of its rays.

In the *irregular microhexactines* (Plate 67, fig. 8; Plate 68, figs. 7–9, 12–15) two opposite rays, lying in the same spicular axis, are long and well-developed, the other four variously reduced. The two long rays may be considered as apical, the other four as lateral rays. The two long apical rays are considerably longer than the rays of the regular microhexactines, so that the maximum diameter, that is the total length of these spicules, exceeds the diameter of the regular microhexactines. The apical rays are straight or only very slightly curved in their basal and middle-part, conical, pointed, smooth, or slightly roughened by very minute spines, and are 1–2.2 μ thick at the base. The degree of reduction of the four lateral rays is equal or unequal, and is generally very considerable. They may all be present and equally long, or one, two, or three of them may be shorter or altogether absent. When one or more of these rays have disappeared altogether, the remaining lateral rays are usually very short. Spicules in which three of the lateral rays have disappeared altogether whilst the fourth is only slightly reduced in length (Plate 68, fig. 13) are very rare. It is to be noted that the reduced lateral rays are not only shorter, but often also thinner than the apical, the difference in the basal thickness of the apicals and laterals often amounting to 0.5 μ.

The irregular microhexactines in both specimens are 125–400 μ long and 8–112 μ broad. There is a very clearly pronounced correlation between the length of the apical rays (the total length of the spicule) and the degree of reduction of the lateral rays (the total breadth of the spicule); the longer the apicals and the whole spicule, the shorter are the laterals and the narrower is the whole spicule.

The irregular microhexactines	125–170	long	are	72–112	broad.
"	190–220	"	"	33–85	"
"	280–400	"	"	8–14	"

Thus these irregular microhexactines form a series connecting the (shorter) regular microhexactines described above with the (longer) minute centrotyle amphioxes described below.

The *minute centrotyle amphioxes* (Plate 67, fig. 12; Plate 68, figs. 16, 17) are more or less curved, the central part usually in one direction, the two end-parts in the opposite, so that these spicules generally look like bows. They are mostly 580–830 μ long, and 1.5–2 μ thick near the middle. The central tyle is oval and measures 3–5 μ in transverse diameter. The two rays are conical and sharp-pointed. The whole spicule is entirely smooth. The largest of these spicules are quite similar to, and only slightly shorter than, the smallest centrotyle amphioxes above described as megascleres, and they might indeed be considered as small forms of these spicules. There is, however, a very conspicuous gap which lies between 2 μ and 7 μ in the biometrical frequency-curve of the thickness of all these spicules taken together. This gap makes the distinction easy between those 2 μ thick and thinner, above described as minute centrotyle amphioxes, and those 7 μ thick and thicker, above described as centrotyle amphiox megascleres.

The rare *minute tylostyles*, which are perhaps, foreign, are 140–200 μ long. The tyle is not situated quite at the end, is oval in shape, 5 μ in diameter, and roughened by minute spines. The ray is 2–3 μ thick at the base, smooth, conical, pointed, and straight, or slightly curved.

The *amphidiscs* measured are 20–340 μ long. Their biological length frequency-curve is interrupted by a large gap between 34 and 77 μ, and by minor gaps the most conspicuous of which lies in the curve of specimen (*a*) between 160 and 230 μ, and in the curve of (*b*) between 152 and 202 μ. The amphidiscs 20–34 μ in length form, morphologically, a fairly homogeneous group; they are to be considered as micramphidiscs. The amphidiscs 77–340 μ in length are morphologically not homogeneous, the small ones having slender and long anchors, particularly in specimen (*b*), whilst the anchors of the large ones are stout and short. Since, however, the broad and narrow anchored forms are morphologically, connected by very numerous transitional forms intermediate in size, I think it best to consider all the amphidiscs 77–340 μ long as one group of macramphidiscs. The larger (on the whole broad anchored) and the smaller (on the whole narrow anchored) macramphidiscs are distinguished biometrically by the gap above referred to in their length frequency-curve (for specimen (*a*) between 160 and 230 μ, and for specimen (*b*) between 152 and 202 μ). In accordance with this gap I distinguish two kinds of macramphidiscs, small macramphidiscs (in specimen (*a*) 129–160 μ long, in (*b*) 77–152 μ) and large macramphidiscs (in specimen (*a*) 230–330 μ long, in (*b*) 202–340 μ).

The *large macramphidiscs* (Plate **67**, figs. 2–5, 15, 26; Plate **68**, fig. 1) are 230–330 μ long in specimen (*a*). The shaft is straight and cylindrical, 5–11 μ thick, apart from an abrupt thickening somewhere near the middle and a gradual thickening towards both ends. The central thickening (tyle) is 10–20 μ in diameter, usually about twice as much as the shaft. It bears a verticil of fairly straight, truncate, cylindroconical spines which are vertical to the shaft (or, more rarely, slightly inclined, and measure 5–12 μ long and 2–4 μ thick. From the other parts of the shaft arise a greater or smaller number of low truncate or terminally rounded protuberances 1–2 μ long and 2–3 μ thick. The terminal anchors are 66–110 μ, about a third of the whole spicule, and 61–97 μ broad. The proportion of their length to their breadth is 100 : 84 to 102, on an average 100 : 93.6. The anchors in the larger forms are relatively broader than in the smaller, the fraction $\frac{\text{breadth}}{\text{length}}$ being, roughly speaking, in proportion to the length of the amphidisc. The anchor-teeth arise vertically from the shaft, and are curved concave towards it. This curvature decreases distally, and is on the whole such that the ends of the teeth converge more or less. When this convergence is great the anchor may be, at its end, as much as 10 μ narrower than in its broadest part. The individual teeth are 10–15 μ broad, and abruptly and not sharply pointed (Plate **67**, figs. 3, 4; Plate **68**, fig. 1).

In specimen (*b*) the large macramphidiscs are similar but have narrower anchors. Their dimensions in this specimen are: — length 202–340 μ; thickness of shaft 5–13 μ; diameter of central tyle 8–22 μ; length of anchors 46–114 μ; breadth of anchors 43–98 μ; proportion of anchor-length to -breadth 100 : 65 to 98, on an average 100 : 80.8.

The *small macramphidiscs* (Plate **67**, figs. 13, 14, 22–25; Plate **68**, figs. 22, 23) are in specimen (*a*) 129–160 μ long, in (*b*) shorter, only 77–152 μ long. The shaft is straight or, rarely, curved and 2–3 μ thick. A cluster of irregularly disposed, more or less oblique, and often considerably curved, cylindrical, truncate spines with a maximum length of 3 μ arises from a point in or near the middle of the shaft. At this point the shaft is usually, but by no means always, gradually thickened to a tyle sometimes 6 μ in diameter. The remaining parts of the shaft are quite densely covered with smaller spines, generally cylindroconical and truncate, which have a maximum length of 2.3 μ and are 1 μ thick. The terminal anchors are somewhat different in the two specimens. In (*a*) they are 36–54 μ long, over one quarter to over two fifths of the whole spicule, and 22–30 μ broad, the proportion of their length to their breadth being 100 to 48–64, on an average 100 : 58.5; in (*b*) they are 34–63 μ long and 18–43 μ broad, the proportion of their length to their breadth being 100 to 46–75, on an average 100 : 54. Relative to the length of the whole spicule these anchors in specimen (*a*) are considerably shorter than in (*b*). The proportion of the total length of the spicule to the anchor-length is in (*a*) 100 : 27 to 34, on an average 100 : 30.5; in (*b*) 100 : 34 to 44, on an average 100 : 38.8. The individual anchor-teeth are strongly curved, concave to the shaft at the base, and only slightly and rather uniformly curved in the same direction for the remainder of their length. The tips of the teeth are sometimes abruptly bent inward. Occasionally in their middle-part, particularly in the forms with curved shaft, the teeth are slightly curved outward.

The *micramphidiscs* (Plate 67, figs. 16–21; Plate 68, figs. 5, 6) are in specimen (*a*) 24–34 μ long, in (*b*) 20–32 μ. The shaft is straight, cylindrical, and 0.8–1 μ thick. It bears a small number of irregularly scattered spines in its usually gradually thickened central part. The terminal anchors are in specimen (*a*) 5–8 μ long, a quarter to a third of the whole spicule, and 5–9 μ broad; in (*b*) 7–10 μ long and 6.2–10 μ broad. The proportion of anchor-length to anchor-breadth is 100 : 87 to 130, on an average 100 : 99.1.

The nearest allies of these sponges are *Hyalonema* (*Hyalonema*) *placuna* and *H.* (*H.*) *tylostylum*. From *H.* (*H.*) *placuna* they differ: — by their external shape; by possessing abundant minute slender centrotyle amphioxes; by having dermal pinules with much longer lateral and somewhat longer distal rays; by the distal rays of their gastral pinules being shorter; by their amphidiscs having smaller anchors; by their microhexactines being much less spiny; and by other characters. From *H.* (*H.*) *tylostylum* they differ by the larger size of their pinules; by the possession of numerous minute, slender amphioxes and microhexactines with four reduced rays; by the absence of tylostyles; and by having considerably smaller macramphidiscs.

Hyalonema (Hyalonema) tylostylum, sp. nov.

Plate 69, figs. 6–25; Plate 70, figs. 1–10.

I establish this species for two specimens trawled off northern Peru at Station 4656 on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4063 m. (2222 f.); the bottom consisted of fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°.

Shape and size. Both specimens are compressed, lamellar, and broader at one end than at the other. The narrower end is rounded, the broader irregular and lacerated. A stalk about 2 mm. thick and broken off short arises from the middle of the convexity of the narrower, rounded end. One of the specimens (Plate 70, fig. 6) is 50 mm. long, 33 mm. broad, and 7 mm. in maximum thickness; the other measures 75 by 50 by 10 mm. In both specimens the upper part consists of two lamellae pressed together and joined laterally and below. This structure and the spiculation of the inner and outer surfaces of the lamellae indicate that these sponges were, in life, cup-shaped and that they have lost their upper marginal part and have been compressed to lamellar structures without open gastral cavities during or after capture.

The *colour* in spirit is dull brown.

The *skeleton*. The distal rays of the dermal pinules form a dense fur on the intact parts of the outer surface (Plate **70**, figs. 3b, 8). Numerous amphidiscs, chiefly small macramphidiscs, occur in and just below the dermal membrane. The shafts of these spicules are situated radially. About one half of each of these amphidiscs with one anchor protrudes freely beyond the surface; the other half with the other anchor is imbedded in the sponge (Plate **70**, fig. 3a). The lateral rays of hypodermal pentactines extend just below the layer occupied by the lateral rays of the pinules. Large macramphidiscs with the shaft parallel or oblique to the surface occur a little farther. Besides these and down the proximal rays of the hypodermal pentactines, small hexactine megascleres also occur in this region. The skeleton of the inner gastral face of the lamellae (cup-wall) consists of gastral pinules and hypogastral pentactines. Tylostyles, hexactines, numerous microhexactines, a few micropentactines, and a good many amphidiscs, chiefly small macramphidiscs and micramphidiscs, are met with in the choanosome amphioxes.

The *dermal pinules* (Plate **70**, figs. 1, 2, 3b, 8) are pentactine and have a straight distal ray. One of the many observed was hexactine, and one other had an angularly bent distal ray. The distal ray is 340–379 μ long, most frequently 342–368 μ, on an average 355 μ, and, at the base, 8–11 μ thick, generally about 9 μ. Its basal end-part, for a distance of about 30 μ, is smooth, thence onward the distal ray is spiny. The lowest spines are scarce, short, and very divergent. Distally, up to a point 100–120 μ from the tip of the ray, the spines become more crowded, longer and more strongly inclined towards the ray. Farther on they again decrease in length and divergence, the uppermost being nearly parallel to the shaft. At the point of maximum thickness, which lies high up, the distal ray, together with the spines, is 31–47 μ in transverse diameter. The lateral rays are cylindrical, usually rounded at the end, spined, and 27–42 μ long, on an average 35 μ. The single proximal ray observed was about as long as the laterals.

All the *gastral pinules* (Plate **70**, figs. 9, 10) observed were pentactine. Their distal ray is straight, 120–245 μ long, most frequently 150–190 μ, on an average 166 μ, and, at the base, 5–10 μ thick, generally about 8 μ. It is sharp-pointed and markedly thickened some distance below the middle of its length.

It bears spines which are somewhat irregular, strongly divergent, often vertical below, and which increase in inclination towards the ray distally. The longest spines arise from the thickest part of the ray, a little below the middle of its length. The maximum thickness of the distal ray, together with the spines, is 23–33 μ. The lateral rays are conical, pointed or somewhat blunt, very spiny, and 45–68 μ long.

The (hypodermal and hypogastral) *pentactines* (Plate **69**, fig. 7) have a conical blunt proximal ray 0.5–0.8 mm. long, and 15–40 μ thick at the base. The lateral rays are straight, conical, blunt, usually 0.3–0.5 mm. long, rarely up to 1.4 mm.; in the same spicule they are often unequal, and vertical to the proximal ray or inclined towards it. The angle between proximals and laterals is 80–90°.

The *hexactine megascleres* (Plate **69**, fig. 6) are 0.4–1.3 mm. in diameter. Their rays are conical, straight, and frequently unequal. Occasionally one ray is reduced in length, cylindrical, and terminally rounded. The basal thickness of the rays is 13–37 μ.

The *amphioxes* (Plate **69**, figs. 11–13) are generally slightly and uniformly curved, 0.6–3.4 mm. long, and 10–30 μ thick near the middle. A central tyle can usually be made out, but it is quite insignificant, as it was not more than 3 μ thicker than the adjacent parts of the spicule in any of the amphioxes measured.

The *tylostyles* (Plate **69**, figs. 8–10) are nearly straight, and 0.8–3.1 mm. long. The terminal tyle is 6–22 μ thicker than the adjacent parts of the spicule, and measures 16–52 μ in transverse diameter. It is usually spherical and quite smooth. Sometimes (Plate **69**, fig. 10) a short oblique spine arises from it. The shaft ends in a blunt point. Close to the tyle it is 10–30 μ thick. In the small (short) tylostyles it tapers gradually from the tyle to the opposite blunt-pointed end. In the medium tylostyles it is cylindrical, of nearly uniform thickness for the greater part of its length, and tapers towards the blunt-pointed end only in the ultimate third of its length. In the large tylostyles the shaft is spindle-shaped and sometimes 20 μ thicker in its middle-portion than just below the terminal tyle.

The fragments of *stalk-spicules* observed are smooth and, at the point where they emerge from the sponge-body, have a maximum thickness of 0.5 mm.

The *microhexactines* (Plate **70**, figs. 4, 5a, 7) and their rare pentactine-derivates (Plate **70**, fig. 5b) are quite regular, the rays of the same spicule being fairly equal in size. The total diameter of these spicules is 75–170 μ, generally 104–140 μ. In most of them all the six rays are nearly straight. In some, one ray or, rarely, several rays are markedly curved. In such rays the curvature is not confined to the end-part. The rays are conical, fine-pointed, distinctly spiny, and at the base 1.5–2.7 μ thick, usually about 2 μ. The rare pentactine forms differ from the hexactine ones only by having five rays instead of six.

The *amphidiscs* are 29–410 μ long. Their length frequency-curve exhibits one great interruption between 49 and 116 μ. The amphidiscs under 49 μ in length (that is those between 29 and 49) have relatively shorter and broader anchors, the amphidiscs over 116 μ in length (that is those between 116 and 410) have relatively longer and narrower anchors. Thus both from a morphological and a biometrical point of view, two kinds of amphidisc are to be distinguished:— micramphidiscs 29–49 μ long with broad anchors, and macramphidiscs 116–410 μ long with slender anchors. The length frequency-curve of the macramphidiscs is somewhat irregular, and exhibits a broad depression at about 250 μ. In the amphidiscs under 250 μ in length the average proportion of anchor-length to anchor-breadth is 100 : 58.3, in those over 250 μ in length this proportion is 100 : 73.7. The macramphidiscs can therefore be subdivided into two groups: — small macramphidiscs 116–250 μ long with relatively more slender anchors, and large macramphidiscs 250–410 μ long with relatively broader anchors. The length frequency-curve of the micramphidiscs is quite regular and has only one very pronounced summit. These spicules form a single, homogeneous group.

The *large macramphidiscs* (Plate 69, figs. 14, 19, 24, 25) are 260–410 μ, most frequently about 378 μ long. The shaft is straight, for the greater part of its length cylindrical, and 6–12 μ thick. It is slightly and gradually thickened towards its ends, and to a greater extent and much more abruptly thickened at or near the middle to a central tyle. The ends are 2–7 μ thicker than the cylindrical part of the shaft. The central tyle is 13–28 μ in transverse diameter, that is, 6–18 μ more than the adjacent parts of the shaft. It bears a verticil of spines which are cylindrical, or only very slightly distally attenuated, terminally simply rounded or more rarely truncate, and more or less, often very considerably, curved (Plate 69, figs. 14, 19, 24, 25). The curvature is generally simple and extends in a plane which passes through the axis of the shaft. Usually all the spines of the tyle are curved in the same direction (towards the same end of the spicule) (Plate 69, figs. 19, 24). Occasionally the majority of them are curved towards one end and a minority of one or two towards the opposite end (Plate 69, figs. 14, 25). Generally the spines are simple, exceptionally bifurcate (Plate 69, fig. 14, the left one). These spines are 7–17 μ long and 3–6 μ thick. The remaining parts of the shaft bear a larger or smaller number of similar but much shorter and nearly straight spines, which are 3–6 μ long, exceptionally 12 μ, and 3–5.5 μ thick.

The terminal anchors are 95–148 μ long, usually a little over a third of the whole spicule, and 60–114 μ broad. The proportion of their length to their breadth is 100 to 57–89, on an average 100 : 73.7. Although both in the larger and the smaller of these spicules relatively broad and relatively slender anchors are met, yet the relative anchor-breadth is, on the whole, correlated to the length of the spicule, so that, roughly speaking, the smaller the amphidisc the more slender the anchors. In the largest large macramphidiscs, over 350 μ in length, the proportion of anchor-length to anchor-breadth is 100 to 62–89, on an average 100 : 78; in the smaller large macramphidiscs, under 350 μ in length, this proportion is 100 to 57–79, on an average 100 : 68.6.

The anchor consists of eight teeth. The individual teeth arise vertically from the shaft, are considerably curved, concave to the shaft in their proximal part, and slightly and quite uniformly curved in the same direction in their distal and middle-parts. The curvature is such that the end-parts of the teeth are parallel or slightly convergent. In the latter case the end of the anchor is of course narrower than a portion of its middle-part. The anchor-breadth measurements given above are always the maximum breadths. The anchor-end breadth may be 14 μ less than the maximum breadth. The teeth have the usual T-shaped transverse section. The upper and outer part, which corresponds to the upper stroke of the T, is a thin band of a fairly uniform breadth of 13–18 μ, to within a short distance of the end. The end itself is abruptly and not sharply pointed. The lower and inner keel, which corresponds to the lower stroke of the T, is 13–16 μ high near the base of the tooth and becomes gradually narrower towards the tip.

The *small macramphidiscs* (Plate **69**, figs. 20–23) are similar to the large ones, but have relatively narrower anchors, less distinct central tyles, and more spines on the shaft. These spicules are 116–240 μ long, most frequently 130–220 μ. The shaft is 2.2–6 μ thick. The central tyle is 4–14 μ in transverse diameter, that is 1.8–9 μ more than the adjacent parts of the shaft. It bears a verticil of nearly straight, or, more rarely, strongly curved spines, which are vertical or oblique to the axis of the shaft. These spines are generally cylindro-conical, blunt, and 3–5 μ long. The remaining parts of the shaft are covered with much smaller spines. These are the more numerous and the more slender the smaller the spicule.

The terminal anchors are 34–85 μ long, from less than a third to more than two fifths of the whole spicule, and 19–53 μ bread. The proportion of their length to their breadth is 100 to 46–88, on an average 100 : 58.3. As in the large macramphidiscs, the relative breadth of the anchors is, roughly speaking, in proportion to the size of the spicule. In the smaller small macramphidiscs, under 170 μ in length, the proportion of anchor-length to anchor-breadth is 100 to 46–62, on an average 100 : 55.8; in the larger, over 170 μ in length, this proportion is 100 to 48–88, on an average 100 : 60.8.

The individual teeth are curved strongly in their basal part. Distally the curvature decreases, and it is on the whole such that the end-parts of the teeth are usually slightly convergent.

In one of the spicule-preparations I found an *amphidisc with a supernumerary anchor-crowned ray* arising from the central tyle. The main shaft is 110 μ long and 2 μ thick. The central tyle is 4 μ in diameter. The main terminal anchors are 32 μ long and 31 μ broad. The supernumerary ray is 27 μ long. Its terminal anchor is 18 μ long and 28 μ broad. The ends of adjacent teeth of different anchors lie in a straight line. The main shaft and the supernumerary ray are densely spined throughout. This spicule might be termed a triadisc.

The *micramphidiscs* (Plate 69, figs. 15–18) are 29–49 μ long, most frequently about 35 μ long. The shaft is straight, 0.7–1.1 μ thick, and either uniform in thickness, cylindrical throughout, or slightly and gradually thickened at or near the middle to a central tyle which is sometimes 1.3 μ in diameter. The shaft is either quite smooth or it bears a larger or smaller number of minute spines. The anchors are 5–11 μ long, a quarter to a fifth of the whole spicule, and 5–9 μ broad. The proportion of their length to their breadth is 100 to 65–150, on an average 100 : 88.9. The anchors of the largest micramphidiscs, that is those over 40 μ in length, are, on the whole, more slender than those of the others. The proportion of anchor-length to anchor-breadth is in these large micramphidiscs 100 to 75–87, on an average 100 : 80.8. The individual anchor-teeth are curved so that their end-parts are either parallel or convergent.

The nearest allies of the sponges above described are the species *Hyalonema* (*Hyalonema*) *placuna* and *H.* (*H.*) *tenuifusum* described in this Report. From these they differ by possessing tylostyle megascleres; by being destitute of microhexactines with two longer opposite (apical) and four more or less reduced (lateral) rays; by the smaller size of the distal rays of their dermal pinules, and by other characters.

Hyalonema (Hyalonema) grandancora, sp. nov.

Plate 78, figs. 16–45; Plate 79, figs. 1–26.

One specimen of this species was trawled in the Southeastern Tropical Pacific at Station 4701 on 26 December, 1904; 19° 11.5′ S., 102° 24′ W.; depth 4142 m. (2265 f.); the bottom was composed of dark brown chocolate clay; the bottom-temperature was 35.3°. It possesses very large macramphidiscs with broad anchors, and to these the specific name refers.

Shape and size (Plate 79, fig. 12). The body of the sponge is upright, slightly compressed laterally, somewhat plicated, and rounded below. It is 35 mm. high, 42 mm. broad, and 20 mm. thick. The upper part is much injured. In the fresh state its apical face was probably concave, with a broad gastral cone arising from its middle-part. Around the gastral cone, which is still present, wide canals, separated by radial lamellae, extend downwards into the interior. An eccentrically situated stalk, 1.4 mm. thick at its point of origin, arises from the lower rounded end of the body. This stalk is broken off below. The upper part, which is still present, is 160 mm. long, and slightly curved in an irregular manner.

To the upper half of the stalk a colony of eleven polyps (Palythoa sp.) is attached. The polyps of this colony are strongly contracted and about 2 mm. high. They have an oval transverse section 4 mm. long and 3 broad, elongated in the direction of the stalk of the Hyalonema. Their stomatodeum is also oval in section and measures 1 by 1.5 mm. The individual polyps are 8–15 mm. apart (measured from centre to centre) and distributed all round the stalk in an irregularly spiral manner. The coenenchym forms a thin bark on the stalk of the Hyalonema. From this the individual polyps arise.

The *colour* of the sponge-body and of the crust of the Palythoa in spirit is brown.

The *skeleton.* A pinule-fur covers the surface of the body of the sponge. Radial pentactines occupy the subdermal and subgastral layers. Hexactine megascleres are abundant in the interior. Rhabd megascleres and microhexactines occur in all parts of the body. In its lower part are met slender, entirely spined pinule-derivate, and mon- to pentactine, ordinary stout and slender acanthophores. The mon- to pentactines with proximally smooth rays are much more abundant than the entirely spined ones. The stalk consists at its origin of nine fairly stout spicules. Four kinds of amphidiscs, all with smooth teeth, can be distinguished: — large and small macramphidiscs, and large and small micramphidiscs. The large macramphidiscs and the small micramphidiscs are abundant, the others rare. A few amphidiscs 170–230 μ long, with serrated teeth, have also been found in the spicule-preparations. Since, however, these spicules are very rare and were not observed in the sections, I take them to be foreign.

All parts of the individual polyps and the bark-like coenenchym of the Palythoa are protected by an armour which extends, in the inner dermal layer of the stomatodeum of the polyps, far down into their gastral cavities. This armour consists entirely of siliceous spicules identical with, or at least very similar to, the acanthophores of the sponge. In the Palythoa armour the acanthophores with only terminally spined rays form a small minority, the majority being entirely spined (Plate **78**, fig. 20).

The *dermal pinules* (Plate **78**, figs. 41, 44, 45; Plate **79**, fig. 20) of the upper and middle-parts of the outer surface are pentactine. The distal ray is 240–293 μ long, and 7–10 μ thick at the base. Its proximal and distal end-parts are smooth. The latter appears as a rather long and slender terminal cone. The remaining part of the ray bears spines of medium size which are generally slightly curved, and concave towards the shaft. The maximum thickness of the distal ray, together with the spines, is 17–26 μ. The lateral rays are 25–45 μ long, conical, and less rapidly attenuated towards the end in their proximal than in their distal part. They are smooth in their proximal part; their distal and middle-parts bear sparse, low, and broad spines.

The dermal pinules on the basal part of the sponge are similar but have distal rays only 190–260 μ long.

The *pinules in the walls of the large efferent canals* (Plate **78**, figs. 32, 43), which may be considered as gastral or canalar, are nearly all pentactines, only very few are hexactines. The distal ray is 250–395 μ long, and 4–8 μ thick at the base. Its basal part is smooth for a considerable length, and the ray-ends in a slender and sharp-pointed terminal cone. The spines on its middle-part are rather small; its maximum thickness, together with the spines, is 11–23 μ. The lateral rays are conical, slightly spined, and 43–72 μ long. One of the few hexactine pinules, which I measured, had a proximal ray 50 μ long.

The (hypodermal and hypogastral) *pentactines* have straight conical rays. The proximal ray is 0.4–0.7 mm. long and 22–70 μ thick at the base. The lateral rays are straight, 0.2–1.2 mm. long, and generally just perceptibly inclined towards the shaft, so that the inner contour of any two opposite rays lies in a straight line vertical to the axis of the shaft.

The *hexactines* (Plate 79, figs. 13–19) are 0.4–3 mm. in diameter, and have nearly equal or somewhat unequal, conical and pointed, straight or slightly curved rays 10–80 μ thick at the base.

The *rhabds* are centrotyle, generally more or less curved, 0.8–1.3 mm. long and 10–20 μ thick. The central tyle is 1–3 μ more in transverse diameter than the adjacent parts of the spicule.

Among the acanthophores the diactines and tetractines are much more frequent than the others. In the entirely spined forms the rays are shorter and thicker than in the ones with rays spined only terminally. The dimensions of these spicules are the following: —

Acanthophores	with 1 or 2 rays; more or less rod-shaped		with 3 more or less equally developed rays		with 4 or 5 more or less equally developed rays	
	total length μ	thickness of rays μ	total length μ	thickness of rays μ	total length μ	thickness of rays μ
with rays spined only at the end	154–1100	10–41	285–385	18–28	120–350	9–26
entirely spined	85–290	28–58	147	30	90–152	20–26

In the rod-shaped monactines and diactines which are only terminally spined an inverse proportion between length and thickness is clearly pronounced: —

the spicules of this kind 154–400 μ long are 26–41, on an average 29.7 μ thick
" " " " " 401–550 μ " " 19–26, " " " 22.5 μ "
" " " " " 551–1100 μ " " 10–23, " " " 15.2 μ "

The entirely spined spicules of this kind exhibit a similar relation between length and thickness: —

those 85–120 μ long are 35–58, on an average 43.3 μ thick
" 121–290 μ " " 28–31, " " " 29 μ "

The long and slender diactines which are only terminally spined have a central tyle 2–8 μ more in transverse diameter than the adjacent parts of the spicule. In some of the shorter and stouter ones the tyle is relatively larger. The spines are broad and conical. In the entirely spined forms they are usually about 7 μ, very rarely as much as 10 μ, long and broad; in those with rays only terminally spined they are smaller.

Besides these spicules a few *pinule-like, entirely spined pentactine and hexactine acanthophores* with one differentiated ray were found in the basal part of the sponge. The dimensions of these spicules, which I consider as pinule-derivates, are: — differentiated (distal) ray, 40–75 μ long, at the base 6.5–7.5 μ thick, and in the middle (together with the spines) 6–8 μ thick; lateral rays, 45–57 μ long; proximal ray, when present, about 15 μ long.

The few spicules with only terminally spined rays found in the Palythoa armour appear to be quite identical with the corresponding spicules (acanthophores) in the basal part of the sponge. The entirely spined spicules which form the bulk of the Palythoa armour (Plate **78**, figs. 20–40) are mon- to tetractine. The triactine and tetractine entirely spined forms, which are not numerous, are 85–164 μ in maximum diameter and have rays 20–47 μ thick. The much more numerous entirely spined monactines and diactines are 90–193 μ long, on an average 126.7 μ, and 24–60 μ thick, on an average 43.5 μ. A correlation (inverse proportion) between their length and their thickness is not indicated. These spicules usually appear as stout, terminally rounded rods. They often have one or two protuberances which are considered as ray-rudiments. The shortest spicules, relatively, of this kind, with rays longitudinally most strongly reduced, are oval (Plate **78**, figs. 23–26). The spines are conical and usually about 10 μ long and broad. The average dimensions (length and thickness) of the monactine and diactine entirely spined acanthophores

in the sponge are 122 and 38.6 μ,

in the Palythoa 126.7 and 43.5 μ.

Thus we see that, although there is no great difference between the two, these spicules are somewhat larger, particularly in thickness, in Palythoa than in the sponge. A greater difference is found in the average size of their spines, which is considerably greater in the spicules of the Palythoa armour, than in the corresponding spicules in the sponge. Finally it must not be forgotten that the percentage of entirely spined acanthophores is much greater in the Palythoa armour than in the sponge. All this shows that the Palythoa does not indiscriminately gather and embody the basal spicules shed by the sponge, on the stalk of which it grows, but *selects* and retains only the stoutest and most spiny ones as material for building its armour.

In connection with this I should like to point out that, in the literature on the armoured zoanthid colonies living as space-symbionts on the stalks of Hyalonemae, their armour is described as consisting of sand-grains only,[1] or partly of sand-grains and partly of sponge-spicules and other material,[2] or of sand-grains and various other material in their lower part, but chiefly of the

[1] *J. S. Bowerbank.* On Hyalonema mirabile. Proc. Zool. soc. London, 1867, p. 21, 23.

[2] *R. Hertwig.* Report on the Actiniaria. Supplement. Rept. Voy. Challenger, 1888, **26**, p. 39.

spicules of the sponges to which they are attached in their upper parts which lie close to the sponge-body.[1] In the Palythoae investing the stalks of *Hyalonema* (*Hyalonema*) *grandancora*, on the other hand, the armour is composed entirely of spicules of the sponge on which they grow. In these cases therefore the symbiosis appears to be considerably closer than in the Hyalonema symbiont zoanthid above referred to, which were examined by Max Schultze, Bowerbank, and R. Hertwig.

The *stalk-spicules*. The parts of the stalk-spicules present in the specimen appear as rhabds with various markings on the surface. Near the point where they arise from the sponge they are 280–400 μ thick.

The *microhexactines* (Plate 79, figs. 21–23) are 100–170 μ in diameter, and have straight, conical, sharp-pointed rays, 3.5–4 μ thick at the base. The rays bear spines. These are sparse, large, and situated vertically on their basal part; distally they become inclined backwards, towards the centre of the spicule, where they are more numerous and smaller. The largest spines are 0.8–1 μ long and 0.5–0.7 μ thick.

From a morphological point of view two kinds of *amphidiscs* can be distinguished: — those with relatively broad and short anchors, and few or no spines outside the central tyle on the shaft; and those with more slender anchors and spiny shaft. The amphidiscs are 17–510 μ long.

Apart from the few amphidiscs with serrated teeth referred to above, which are to all appearance foreign, no amphidiscs over 80 and under 250 μ in length were found. Thus there is, as the adjoined graph, based on 168 measurements, shows, a great gap in their length frequency-curve between 80–250 μ. The amphidiscs over 250 μ in length are those with the broad anchors and more smooth shaft; the amphidiscs under 80 μ in length are those with the narrower anchors and spiny shaft. Thus the morphological distinction between these two kinds of amphidiscs coincides with the biometrical, and I accordingly divide the amphidiscs into two main groups: — macramphidiscs with broad anchors and more smooth shaft over 250 μ in length, and micramphidiscs with narrower anchors and spiny shaft under 80 μ in length.

Of the eighty-five macramphidiscs measured one was only 250 μ in length, the other eighty-four were 318–510 μ. I am not quite sure whether the single macramphidisc only 250 μ long is to be considered as a normal amphidisc proper to the sponge. Assuming this to be so, two morphologically similar kinds of macramphidiscs may be distinguished, a larger and a smaller, separated biomet-

[1] *Max Schultze*. Die Hyalonemen, 1860, p. 29.

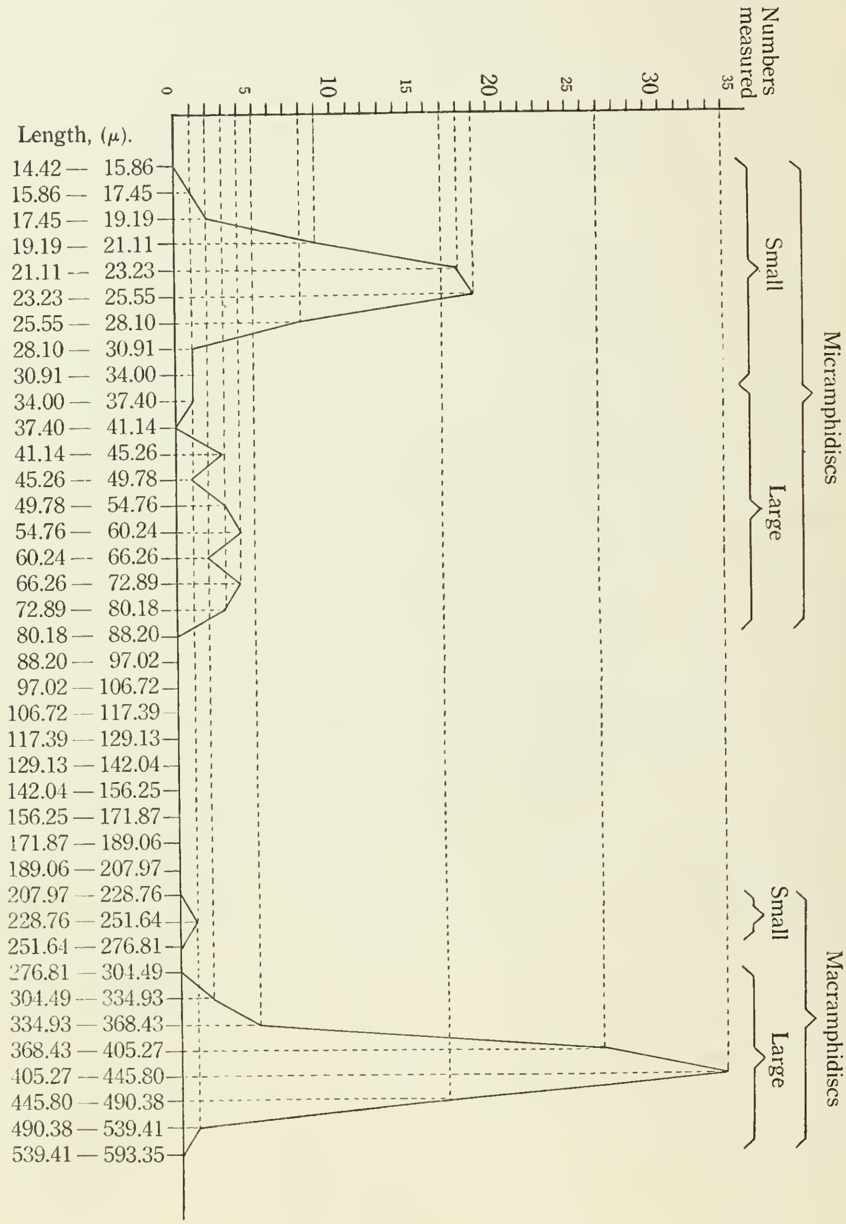

Fig. 10. — Amphidiscs.

rically by a distinct gap in the length frequency-curve. The large macramphidiscs form, as the graph shows, a biometrically perfectly homogeneous group.

Also among the micramphidiscs two morphologically and biometrically distinct kinds can be distinguished: — a larger kind, over 37 μ in length, with longer anchors and stout central tyle; and a smaller kind, under 31 μ in length, with shorter anchors and a relatively much smaller central tyle, or no central tyle at all. The part of the length frequency-curve pertaining to the first, larger kind of micramphidiscs shows several ups and downs, so that this group cannot be considered biometrically homogeneous. However, in view of the morphological similarity of these larger micramphidiscs of various size, I do not think the depressions in this part of the curve (none of which extends down to the base (0) line) sufficient for a division of them into secondary groups. The second, smaller kind of micramphidiscs forms a biometrically homogeneous group.

I distinguish accordingly four kinds of amphidiscs in this sponge: — large macramphidiscs, small macramphidiscs, large micramphidiscs, and small micramphidiscs.

The *large macramphidiscs* (Plate **78**, figs. 16–19; Plate **79**, figs. 1, 2, 26) are 318–510 μ long, most frequently about 415 μ. The shaft is generally straight, very rarely bent, cylindrical, 20–26 μ thick, and thickened gradually towards the ends, and abruptly in or near the middle to a central tyle 24–30 μ in transverse diameter, that is 3–7 μ more than the adjacent parts of the shaft. The central tyle bears a verticil of truncate conical spines. These spines are usually fairly equal, 10–20 μ long and 10–12 μ thick at the base. Sometimes one or two are large and the others more or less rudimentary. The remaining parts of the shaft are either quite smooth (Plate **79**, fig. 2), or they bear only one or very few protuberances, about as broad as the spines of the central tyle, but generally much shorter.

The terminal anchors are 83–125 μ long, a quarter to a sixth of the whole spicule, and 135–200 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 142–190, on an average 100 : 165.4. The anchor consists of eight teeth. The individual teeth arise vertically from the end of the shaft, and are curved more strongly in their proximal than in their distal half. The extreme tips of the teeth are sometimes slightly and abruptly bent inwards. The curvature of the teeth is, on the whole, such that their end-parts generally diverge slightly from the axis of the shaft.

The dimensions of the single *small macramphidisc* observed are: — length

250 μ; thickness of shaft 13 μ; diameter of central tyle 15 μ; spines of central tyle 7 μ long and 6 μ thick; anchors 74 μ long and 110 μ broad.

The *large micramphidiscs* (Plate **79**, figs. 24, 25) are 37–80 μ long, most frequently about 43, 55, and 70 μ.[1] The shaft is straight, 2–3.5 μ thick, and somewhat gradually thickened in or near the middle to a stout, often rather irregular, and not very clearly defined central tyle, 3–6 μ in transverse diameter, that is 1.5–3.5 μ more than the adjacent parts of the shaft. The tyle and the remaining parts of the shaft are quite densely covered with small, slender spines. The spines on the tyle are scattered, not arranged in a verticil.

The terminal anchors are 12–29 μ long, usually a little more than a third of the whole spicule, and 10.5–26 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 75–100, on an average 100 : 86.3. The individual anchor-teeth are strongly curved in their proximal parts and only slightly curved or nearly straight in their distal and middle-parts. Their ends generally diverge rather considerably from the axis of the shaft.

The *small micramphidiscs* (Plate **79**, figs. 3–11) are 17–31 μ long, most frequently about 23.3 μ. The shaft is generally straight, rarely bent in the middle, is 1.3–1.6 μ thick, and in the larger forms often slightly and gradually thickened in or near the middle, in the smaller generally of uniform thickness throughout. The shaft is quite densely covered with small slender spines.

The terminal anchors are 4–13 μ long, a quarter to a third of the whole spicule, and 6–14 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 85–140, on an average 100 : 123. The anchor-teeth are curved more strongly in their basal than in their distal part. Their ends are parallel or nearly so.

The species is very well characterized by the large size and the great relative breadth of the anchors of its macramphidiscs. The only species which has similar macramphidiscs and pinules is *Hyalonema* (*Prionema*) *agujanum* described in this Report. From this it is distinguished by the large and slender amphidiscs with serrated teeth which are exceedingly abundant in *H.* (*P.*) *agujanum* and absent in *H.* (*H.*) *grandancora*.

[1] Their length frequency-curve has three distinct elevations corresponding to these sizes.

Hyalonema (Hyalonema) sp. from Station 3684 (A. A. 17).

Plate 80, figs. 1–16.

A small fragment about 10 mm. long with several stalk-spicules was collected in the Central Pacific, Station 3684 (A.A. 17) on 10 September, 1899; 0° 50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); it grew on light yellow-gray Globigerina ooze. This fragment appears to have formed part of a species of Hyalonema not sufficiently well-preserved for specific determination.

The spicules of this fragment are pentactine pinules with long distal ray, pentactine pinules with short distal ray, diactine pinules; hexactine, pentactine, and diactine megascleres; acanthophores; stalk-spicules; microhexactines; macramphidiscs; and micramphidiscs.

The *pentactine pinules with long distal ray* (Plate 80, fig. 16). The distal ray in these spicules is 375–670 μ long, and 5–8 μ thick at the base. It tapers gradually towards the fine-pointed end, and bears very small and rather sparse strongly inclined spines. These decrease in size distally. The lateral rays are spiny and 60–80 μ long.

The *pentactine pinules with short distal ray* (Plate 80, fig. 14). In these spicules the distal ray is 170–260 μ long, and 4–8 μ thick at the base. It bears rather strongly inclined spines, which are larger than in the pentactine pinules with long distal ray. The maximum thickness of the distal ray, together with the spines, is usually 11–16 μ. The lateral rays are spiny and 60–70 μ long.

The *diactine pinules* (Plate 80, fig. 15). The total length of these spicules is usually 0.7–0.8 mm. The distal ray is 390–480 μ long, 5–8 μ thick at the base, and covered with small, strongly inclined spines. The lateral rays are reduced to smooth, cylindrical, terminally rounded protuberances, (measured from the axis of the spicule) 6–17 μ long. The proximal ray is 305–330 μ long.

The *pentactine megascleres* have a proximal ray 450–600 μ long, and 10–35 μ thick at the base. The lateral rays of the same spicule are more or less unequal. The length of the smallest is not infrequently only two thirds of that of the longest, sometimes even less. The lateral rays are straight, conical, blunt, and 170–560 μ long.

The *hexactine megascleres* are 0.7–1.8 mm. in diameter, and have rays 20–40 μ thick at the base.

The *diactine megascleres* are centrotyle. The diameter of the central tyle is sometimes as much as twice as great as the thickness of the adjacent parts of the spicule.

The *acanthophores* (Plate 80, fig. 13) have one to four more or less fully developed rays. The tri- and tetractine forms are 170–370 μ in maximum diameter, and have rays 13–22 μ thick at the base. The diactine forms are 400–900 μ long, and 7–10 μ thick near the centre. Most of them are centrotyle. The central tyle is not infrequently more than three times as stout as the adjacent parts of the spicule. The single monactine form observed is 260 μ long and 15 μ thick.

The *stalk-spicules* (Plate 80, figs. 11, 12) bear spiral rows of proximally directed spines on parts of their surface and terminate in anchors. The shaft of the stalk-spicule represented (Plate 80, figs. 11, 12) is 39 μ thick just above the anchor, which is 145 μ long and broad.

The *microhexactines* (Plate 80, fig. 4) are 150–170 μ in diameter, and have equal rays 3.5–4 μ thick at the base. The rays are conical, fine-pointed, spined, and nearly straight in their proximal part, but rather strongly curved towards their ends.

Of *amphidiscs* two kinds can be distinguished: — macramphidiscs and micramphidiscs.

The *macramphidiscs* (Plate 80, figs. 1, 2, 5–10) are 380–570 μ long, most frequently about 470 and 530 μ. The shaft is straight, 20–25 μ thick, and thickened in or near the middle, only very slightly, or not at all, to a tyle, which however is not clearly defined. This tyle may, when present, bear one or a few blunt insignificant spines. The rest of the shaft is generally quite smooth. The anchors are 120–228 μ long, less than a third to nearly half of the whole spicule, and 215–263 μ broad. The proportion of their length to their breadth is 100 to 115–191, on an average 100 : 147.8. The curvature of the anchor-teeth decreases distally, and their end-parts generally diverge. The extreme tip of the teeth, in the long anchors, is sometimes (Plate 80, fig. 2) bent inwards. The teeth have smooth lateral margins, and are pointed at the end (Plate 80, fig. 10).

The *micramphidiscs* (Plate 80, fig. 3) are 26–28 μ long, and have terminal anchors 9–10 μ long, about a third of the whole spicule, and 8.5–11 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 85–115, on an average 100 : 102.5.

Among the species of Amphidiscophora hitherto described, *Hyalonema martabanense* F. E. Schulze[1] appears to be the one most closely allied to the fragment described above. This fragment differs from *H. martabanense* by

[1] *F. E. Schulze.* Hexactinelliden des Indischen Oceanes. III. Abh. Akad. Berlin, 1900, p. 12, t. 2. Indian Triaxonia, 1902, p. 21, pl. 18.

having no smaller kind of macramphidiscs, no mesamphidiscs, and no spheres, and by the distal ray of its pinules being more slender, and its microhexactines much larger. Although these differences are very conspicuous and quite sufficient for specific distinction, there is a considerable degree of similarity between the two.

LEPTONEMA, subgen. nov.

Species of Hyalonema the amphidiscs of which have hyperbolic, hemispherical, or bell-shaped terminal anchors about one fourth to one third of the whole spicule in length. Without amphidiscs of any other kind. The largest amphidiscs are slender and have a thin shaft.

The collection contains one specimen of this subgenus.

Hyalonema (Leptonema) campanula, sp. nov.

Plate 81, figs. 1–26.

A single specimen of this species was trawled in the Southern Tropical Pacific at Station 4721 on 15 January, 1905; 8° 7.5′ S.; 104° 10.5′ W.; depth 3811 m. (2084 f.); it grew on light brown Globigerina ooze.

The terminal anchors of the macramphidiscs are slender and similar to the flowers of certain species of Campanula. To this the name refers.

Shape and size. The specimen (Plate **81**, fig. 15) is somewhat fragmentary. What there is of the body is an irregular mass, 18 mm. in diameter. It is drawn out to a conical protuberance in one place, and from this arises a curved stalk 70 mm. long and about 1 mm. thick.

The *colour* of the body in spirit is brown.

The *skeleton* consists of pentactine and diactine pinules, pentactine, hexactine, and diactine megascleres, modified basal spicules, stalk-spicules, microhexactines, and amphidiscs. The diactine pinules are associated with ordinary diactine megascleres. Protruding freely they probably formed together with these spicules a fringe at the boundary between the dermal and gastral parts of the surface. Some of the pentactine pinules have a very long distal ray; in others, which appear to be confined to the basal part of the sponge, the distal ray is of ordinary length. The acanthophores are for the most part diactine and pentactine. The amphidiscs are of three kinds, macramphidiscs, mesamphidiscs, and micramphidiscs. The macramphidiscs are very abundant, the other two rather rare.

The *pentactine pinules with long distal ray* (Plate **81**, figs. 12, 13, 16–18). In these spicules the distal ray is 230–810 μ long, most frequently about 600 μ, 5–8 μ thick at the base, and fairly straight or more or less, sometimes very considerably, curved. It is conical and it ends in an exceedingly fine, thread-like, spineless terminal cone. The spines of the distal ray are small, rather sparse, and strongly inclined towards the tip of the ray. They attain their largest size at a distance of a fifth to a quarter of the length of the whole ray from the centre of the spicule, and here the distal ray, together with the spines, attains its maximum thickness of 9–18 μ. The lateral rays are cylindroconical, abruptly pointed or blunt, and spiny in their distal part. Their length is, roughly speaking, in proportion to the length of the distal ray. In the pinules with a distal ray under 400 μ in length, the lateral rays are 43–52 μ long; in those with a distal ray over 400 μ in length, 50–80 μ long.

The *basal dermal pentactine pinules with shorter distal ray* (Plate **81**, figs. 25, 26). In these spicules the distal ray is straight, conical, 100–165 μ long, and 5–6 μ thick at the base. It bears rather sparse spines and ends in a sharp-pointed and rather slender terminal cone. Its maximum thickness, together with the spines, of 12–23 μ is usually situated a little above the middle of its length. The lateral rays are cylindroconical, abruptly pointed or rounded at the end, distally spined, and 37–58 μ long.

The *diactine pinules* (Plate **81**, figs. 1, 2, 14). In these pinules the distal ray is straight or curved, 0.73–1.2 mm. long, and 6–9 μ thick at the base. It bears rather sparse strongly inclined spines. The largest are 10–16 μ long, and arise about a third of the length of the distal ray from the centrum of the spicule. Here the distal ray, together with the spines, attains its maximal thickness of 12–18 μ. Distally and proximally the spines decrease in size. The slender thread-like extreme tip and the basal part of the distal ray are free from spines. The proximal ray is usually fairly straight and 450–750 μ long. The lateral rays are reduced to cylindrical, terminally rounded protuberances only 5–14 μ long (measured from the axis of the spicule).

The *pentactine megascleres* (Plate **81**, figs. 19, 20) have a straight proximal ray sometimes 1 mm. and more long, and 7–45 μ thick at the base. The lateral rays of the same spicule often differ very considerably in size. They are 230 μ to 1 mm. long, straight, or somewhat curved, and slightly inclined towards the proximal ray; the angle between them and the proximal ray is usually about 85°. The lateral rays are generally conical and terminally rounded, rarely thickened at the end (Plate **81**, fig. 19).

The *hexactine megascleres* are 550 μ–1.3 mm. in diameter. Their rays are 7–22 μ thick at the base, usually more or less curved, and only slightly attenuated toward the rounded end. The end-parts of the rays, particularly of the smaller hexactines, bear minute spines.

The *diactine megascleres* are centrotyle amphioxes. They are usually 1–1.5 mm. long and 9–18 μ thick near the centre. The central tyle is 12–22 μ in transverse diameter, that is 2–4 μ more than the adjacent parts of the spicule.

The *basal pentactine* and *diactine acanthophores* are similar to the ordinary pentactines and diactines of the body, above described, but have rays reduced in length and somewhat thickened and spined at the end.

The *stalk-spicules* (Plate 81, fig. 11) have a maximum thickness of 110 μ and all are broken off at the lower, distal end. Their proximal, upper parts are smooth. Farther down minute, strongly inclined, upwardly directed spines begin to make their appearance. Distally these spines become larger and apparently also less numerous. The spines are partly scattered, partly arranged in oblique (spiral) transverse rows.

The *microhexactines* (Plate 81, figs. 3–6) are 50–100 μ in diameter. The rays are 1–1.5 μ thick at the base, straight in their proximal, but curved in their distal part. This curvature is either fairly uniform or considerably greater just beyond the point where it begins than in the end-part, and on the whole such that the tips of adjacent rays come to be parallel or convergent.

Morphologically two kinds of *amphidiscs* can be distinguished: — those with relatively thin shaft and slender, somewhat bell-flower shaped anchors; and those with relatively stout shaft and broader, oval anchors. The former are 150 μ or more long, whilst the largest of the latter is only 118 μ long. As the adjoined graph shows, a rather conspicuous depression in their length frequency-curve divides the large and slender-anchored amphidiscs biometrically into a larger and a smaller kind. In view of the morphological identity of the larger and smaller, I think that all these slender-anchored amphidiscs can be considered as amphidiscs of the same kind, and I shall describe them as macramphidiscs.

The broad-anchored amphidiscs, 118 μ or less in length, are divided biometrically by a very wide gap in the length frequency-curve, situated between 26 and 77 μ, into a larger and a smaller kind. The larger of these amphidiscs I shall describe as mesamphidiscs, the smaller as micramphidiscs. Since the length frequency-curve in both exhibits several depressions, neither of them can be said to form a biometrically homogeneous group. Since, however, those depressions are not very great and since these amphidiscs are so rare that

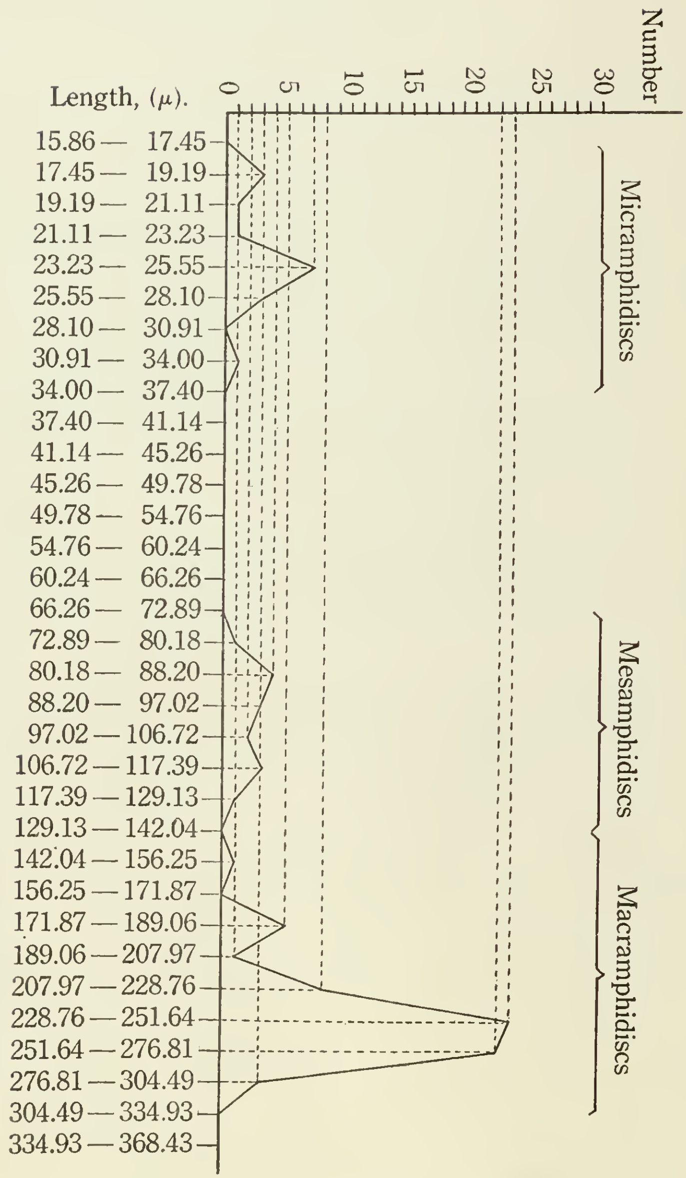

Fig. 11.— Amphidiscs.

I was unable to measure a number large enough to make the curves perfectly reliable, I shall not divide them into subgroups.

The *macramphidiscs* (Plate 81, figs. 7–10) are 150–290 μ long, most frequently about 250 μ. The shaft is straight or more or less, sometimes very considerably, curved, and 1.5–5 μ thick. It is thickened gradually towards the ends and more abruptly at or near the centre to a tyle 2.8–7 μ in transverse diameter, that is 1–3 μ more than the adjacent parts of the shaft. A few spines, 1–3 μ long and 1–2 μ thick, forming a verticil arise from the central tyle. The remaining parts of the shaft are quite smooth or bear only one or a few small spines.

The terminal anchors are 48–84 μ long, about two sevenths of the whole spicule, and 25–53 μ broad. The proportion of their length to their breadth is 100 to 46–69, on an average 100 : 57.8. The anchors are composed of eight teeth. The individual teeth are 9–12 μ broad, hardly at all attenuated distally, and simply rounded at the end. They arise vertically from the shaft and are, at a distance of about one eighth of their length from the point of origin, abruptly and very strongly bent toward the shaft. The part beyond this bend, that is the distal seven eighths, is either quite straight or somewhat bent outward; rarely the end is slightly bent inwards. These long distal parts of the teeth are divergent and enclose angles of 9° or 10° with the axis of the shaft.

The *mesamphidiscs* (Plate 81, figs. 23, 24) are 77–118 μ long, most frequently about 84 μ. The shaft is straight and 4–7.5 μ thick. It thickens gradually towards the ends, which are usually 3–4.5 μ thicker than the middle-part. There is either no central thickening at all, or it is quite insignificant, not exceeding the adjacent parts of the shaft by more than 1 μ in thickness. The shaft bears a few terminally rounded spines 3–8 μ long and 2–5 μ thick, which do not form a central verticil, but are scattered irregularly over its middle-part. Sometimes only a single large spine arises from the shaft.

The terminal anchors are 30–43 μ long, about a third of the whole spicule, and 40–47 μ broad. The proportion of their length to their breadth is 100 to 100–133, on an average 100 : 109. The anchor-teeth are in the medium-sized mesamphidiscs about 9 μ broad. They are attenuated distally, terminally rounded, and curved toward the shaft throughout their length. This curvature is much greater in their proximal than in their distal portion, and on the whole such that their end-parts diverge.

The *micramphidiscs* (Plate 81, figs. 21, 22) are 18–26 μ long, most frequently about 24.5 μ. The shaft is straight and 0.9–1.4 μ thick. A slight, not well-defined central thickening can usually be made out. This is 1.2–1.9 μ in transverse diameter, that is 0.2–0.5 μ more than the adjacent parts of the shaft.

The anchors are 5–11 μ long, one third to two fifths of the whole spicule, and 5.5–10 μ broad. The proportion of their length to their breadth is 100 to 77–129, on an average 100 : 107. The curvature of the anchor-teeth decreases distally, and their end-parts are usually fairly straight. The total curvature is such that the end-parts of the teeth are either parallel or slightly divergent.

Besides the amphidiscs above described, I found an *abnormal amphidisc* with very unequal terminal anchors. This spicule is 42 μ long and has a shaft 2 μ thick. One of its anchors measures 18 μ in length and 13 μ in breadth, the other is 8 μ long and broad. One half of this spicule appears as a mesamphidisc, the other half as a micramphidisc.

Of the species of Hyalonema hitherto described *H. divergens* F. E. Schulze [1] appears to be the one most closely allied to the sponge above described. From this it differs, however, to a considerable extent by the shape and dimensions of the spicules. The large macramphidiscs 500 μ long with ovoid anchors, which are present in *H. divergens*, are absent in *H.* (*H.*) *campanula*. The macramphidiscs with campanulate anchors are small and have a strongly spined shaft and pointed anchor-teeth in *H. divergens*, and are twice as large and have, apart from the centrum, a nearly smooth shaft and terminally rounded anchor-teeth in *H.* (*H.*) *campanula*. These and the other less conspicuous differences are, of course, quite sufficient for specific distinction.

PRIONEMA, subgen. nov.

Species of Hyalonema of which the amphidiscs of one kind have anchor-teeth with serrated margin.

The collection contains twenty-one more or less complete specimens and one fragment of this subgenus. They belong to six species, all of which are new.

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 199, pl. 28, figs. 1–11.

Hyalonema (Prionema) agujanum, sp. nov.

tenuis, var. nov. Form *A*.

Plate 72, figs. 17–21, 23–25, 27; Plate 73, figs. 1–6; Plate 74, figs. 1–5, 8; Plate 75, figs. 1–13, 15, 17, 19–27, 29–37; Plate 76, figs. 1–7, 11, 12, 15–36.

tenuis, var. nov. Form *B*.

Plate 72, figs. 16, 22, 26; Plate 73, fig. 7; Plate 74, figs. 6, 7, 9; Plate 75, figs. 14, 16, 18, 28; Plate 76, figs. 8–10, 13, 14.

lata, var. nov.

Plate 77, figs. 1–10; Plate 78, figs. 1–15.

I establish this species for five specimens collected off northern Peru, near Aguja Point, at Station 4656 on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4063 m. (2222 f.); they grew on fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°. The specific name refers to the locality. I distinguish two varieties in this species, one comprising four specimens, with narrow, one comprising one specimen with broader serrated amphidisc-anchors. In view of the difference in the anchor-breadth of these amphidiscs, I name the former *tenuis*, the latter *lata*. One of the four specimens of var. *tenuis* differs somewhat from the other three; I therefore distinguish two forms, *A* and *B*, in this variety. Form *A* comprises three specimens, form *B* one.

Shape and size. All the specimens (Plate **75**, figs. 28–30; Plate **78**, fig. 4) are inverted, conical, and more or less flattened laterally. The better preserved ones have a broad and shallow depression on their upper face and a stalk which arises from the lower narrow end. I consider the apical depression a gastral cavity. In one specimen the remnant of a gastral cone is visible in its centre. The specimens are 19–29 mm. long, 23–30 mm. broad, and 8–16 mm. thick. The stalks present are broken off quite short. The longest is 24 mm. long. A few Palythoa polyps are attached to the proximal part of the stalk just below the point where it arises from the body (Plate **75**, figs. 29, 30; Plate **76**, fig. 7).

The *colour* of all the specimens in spirit is brown.

The *skeleton.* The dermal and gastral surfaces are entirely covered with a dense fur composed of the distal rays of pentactine pinules. In the spicule-preparations a good many diactine pinules were found. These in all probability occupy the margin of the apical (gastral) cavity. In the subdermal and subgastral zones radial pentactines and paratangential rhabds are met. Similar rhabds, hexactine megascleres, and microhexactines occupy the interior. Here also occur slender-rayed pentactine and hexactine pinules, and spicules transitional between these pinules and the microhexactines. These slender-rayed pinules, and more or less pinule-like transitions to microhexactines, probably occupy the canal-walls, and may be considered as canalar pinules. Acanthophores are met with in the basal part of the sponge. These vary greatly in thickness. Most of them are tetractine or diactine. Rhabds transitional between the more slender diactine basal acanthophores and the ordinary rhabds of the upper parts of the body are also abundant here. An exceedingly small minority of the short and stout acanthophores in the basal part of the sponge-body are spined not only at the ends of the rays, but entirely. The skeleton of the stalk is continued quite through the body up to the gastral cone (Plate **76**, fig. 7). Where it arises from the lower end of the sponge-body, the stalk consists of about a dozen stout and a number of slender rhabds. Of amphidiscs four kinds can be distinguished: — macramphidiscs, serrated amphidiscs, large micramphidiscs, and small micramphidiscs. The large micramphidiscs are rare, the others abundant. The skeleton of the Palythoa (Plate **76**, figs. 4–6, 34) consists entirely of acanthophores of the sponge. A large majority of these spicules are very short and stout, and entirely spined. These sponge-spicules form an armour of the whole polyp-colony. They occupy in large masses the lateral walls, the oral face, and the stomatodeum of the individual polyps and the superficial part of the coenenchym.

The *dermal and gastral pinules* (Plate **72**, figs. 20–25; Plate **78**, figs. 9–11) do not appear to differ from each other appreciably. It is, however, to be noted that the dermal pinules of the basal part of the sponge have, at least in var. *tenuis*, form *A*, on the whole shorter distal rays than the other dermal and the gastral pinules. All the gastral and dermal pinules are pentactine. The distal rays are straight and end with a blunt or pointed terminal cone. This cone and the proximal end-part of the distal ray are free from spines. For the greater part of its length the distal ray is covered with nearly straight, mostly rather strongly inclined spines. Generally the spines are simple. Occasionally some of them bear secondary spinelets. The middle-part of the distal ray, together with the spines, is usually nearly cylindrical. The lateral rays are attenuated toward the abruptly pointed or blunt end. Distally for one half or two thirds of their length they bear rather large, stout spines. The dermal and gastral pinules of var. *tenuis*, form *B*, have more slender distal rays than those of var. *tenuis*, form *A*, and var. *lata*. Apart from this the dermal and gastral pinules of the three groups are very similar. Their dimensions are the following: —

GASTRAL AND DERMAL PINULES OF HYALONEMA (PRIONEMA) AGUJANUM.

				Distal ray			Lateral rays
				length μ	basal thickness μ	maximum thickness, together with the spines μ	length μ
var. *tenuis*	form *A*	dermal pinules	from the basal part of the sponge	123–258	8–12	28–35	42–52
			from the middle and upper part of the sponge	200–311	8–10	30–37	36–48
		gastral pinules		251–300	9–11	30–39	40–52
		dermal and gastral pinules		123–300	8–12	28–39	36–52
	form *B* [1]	dermal and gastral pinules		225–311	7–10	18–30	37–45
var. *lata*		dermal pinules		218–302	7–11	22–36	32–57
		gastral pinules		215–300	7–13	25–38	30–50
		dermal and gastral pinules		215–302	7–13	22–38	30–57

Besides the dermal and the gastral pinules described above, a considerable number of *other pinules* were found adhering to the surface or embedded in the superficial parts of the sponge. Some of these have long and bushy distal, and very short lateral rays. In others the distal rays are quite short and very slender and the laterals long. The former, which are quite frequent, resemble the pinules of *Hyalonema tenuifusum* and probably belong to that sponge, which was trawled at the same station; I accordingly consider them as foreign. The latter are rare. They may be proper to the sponge and would, in that case, have to be considered as transitions between the dermal pinules and the microhexactines. Dermal *transitional pinules*, if such, have been found in both forms of var. *tenuis* and in var. *lata*. The dimensions of the few observed are:—

[1] The single specimen of var. *tenuis* form *B* is not sufficiently well-preserved for a reliable distinction between dermal and gastral pinules; hence special measurements are not given.

		Distal ray			Lateral rays
		length μ	basal thickness μ	maximum thickness, together with the spines μ	length μ
var. *tenuis*	form *A*	120–160	3–6	4–10	70–98
	form *B*	225–280	6–7	18–20	60–80
var. *lata*		176–280	5–8	12–18	54–85

Diactine, probably *marginal pinules* (Plate 78, fig. 3) have been observed only in the preparations of var. *tenuis,* form *A*, and var. *lata*. Their distal ray is usually pointed, exceptionally reduced in length, and rounded and thickened at the end (Plate 78, fig. 3). It is covered with rather strongly inclined, distally directed, generally nearly straight spines. The proximal ray is usually more or less spiny, and pointed or rounded at the end. A central tyle, the remnant of the (reduced) lateral rays, is always present. It is irregularly spherical or composed of four distinct lobes (ray-rudiments). Generally it bears several large spines which point obliquely upward and outward.

The dimensions of the diactine pinules are:—

	total length μ	Distal ray			length of proximal ray μ	transverse diameter of central tyle μ
		length μ	basal thickness μ	maximum thickness, together with the spines μ		
var. *tenuis* form *A*	400–610	200–290	5–10	17–20	190–320	16–21
var. lata	410–490	167–260	6–9	26–33	160–260	12–23

Pentactine and hexactine spicules with very slender rays have often been observed in the interior of var. *lata*. I consider these spicules, which are connected with the microhexactines by numerous transitional forms, as *canalar pinules*. In these spicules one ray is different from, usually longer, rarely shorter, than, the others. This differentiated ray, which is to be considered as the distal, bears oblique, distally directed spines. The other rays are also spiny, but their spines are much smaller and generally situated vertically. The ray to be considered as the distal is 100–170 μ long, 3.5–7 μ thick at the base, and in its middle-part, together with the spines, usually about 6 μ thick. The rays to be considered as the laterals are 60–120 μ long. The proximal ray of the hexactine forms is 70–115 μ long. The hexactine and the pentactine forms appear to be fairly equally abundant.

The (hypodermal and hypogastral) *pentactines* (Plate 72, fig. 19) have smooth, conical, and straight, terminally rounded rays. The proximal ray is 460–900 μ long and 17–34 μ thick at the base. The lateral rays are 220–500 μ long. In the same spicule they are usually very unequal in size, the largest being sometimes as much as twice as long as the smallest.

The *hexactine megascleres* (Plate 72, figs. 26, 27) are regular or, more rarely, two opposite rays are longer than the other four. They measure 0.6–1.4 mm. in maximum diameter (length), and their straight, conical, blunt rays are 14–33 μ thick at the base.

Most of the *rhabds* of the body are centrotyle amphioxes, but tylostyles have also occasionally been observed. The centrotyle amphioxes are 0.8–3.3 mm. long and 8–19 μ thick near the centre. The central tyle is 11–23 μ in transverse diameter, that is 1.5–12 μ more than the adjacent parts of the spicule. These spicules attain a larger size in var. *lata* than in var. *tenuis*.

Among the *basal acanthophores* two kinds can be distinguished: — forms with long and slender rays, and forms with short and stout rays. The spicules of the first kind are all diactine, those of the second kind mon- to pentactine.

The *long and slender diactine acanthophores* are connected by numerous transitional forms with the ordinary rhabds of the upper parts of the body. They are 0.6–1.6 mm. long, usually 6–9 μ thick near the middle, and generally curved or, more rarely, angularly bent. The two rays of the angular forms are usually fairly straight. The curvature or angular bend of these spicules is sometimes very considerable, the latter occasionally such that the angle enclosed by the two rays is nearly a right one. The spined end-parts of the rays are often more or less thickened and often unequal. The following dimensions of a spicule of var. *lata* may serve as an example of this kind of spicule unequally thickened at the two ends: — length 1.4 mm., thickness in middle 9 μ, thickness of one end 12, of the other 19 μ.

The *stout and short mon- to pentactine acanthophores* can again be divided into two groups of forms only slightly connected by transitions: — those with rays smooth in their basal part, spined only at the end, and longitudinally less reduced (found chiefly in the sponge); and forms with rays spined throughout their length and longitudinally more reduced (found chiefly in the Palythoa).

The *stout- and short-rayed proximally smooth mon- to pentactine acanthophores* (Plate **76**, figs. 8–16, 31, 32). The pentactine forms (Plate **76**, fig. 32) are rare and have been found only in var. *tenuis*, form *A*. They are very much smaller than the others and may perhaps be spicules of another kind. The tetractine forms (Plate **76**, figs. 8, 10–13) with four fairly equally developed rays are frequent in all the specimens. Their rays extend in the same plane and enclose angles of 90°. They are usually straight and attenuated towards the end. The triactine forms are not nearly so frequent. They are evidently tetractine-derivates and differ from the true tetractines only by one ray being much reduced or suppressed altogether. Transitions between the tetractines and triactines (Plate **76**, fig. 10) are by no means rare. The diactine forms (Plate **76**, figs. 14–16) are frequent. They sometimes possess, besides the two properly developed rays, a rudiment of a third ray (Plate **76**, fig. 15). Those without such a rudiment are either centrotyle and spindle-shaped (Plate **72**, fig. 14), or simply cylindrical and rather thicker at the ends than in the middle (Plate **76**, fig. 16). The mon-actines (Plate **76**, fig. 31) are rare. They appear as tylostyles. The dimensions of these spicules are the following:—

Hyalonema (*Prionema*) *agujanum*		Only terminally spined, basal spicules with									
		5		4		3		2		1	
		more or less fully developed rays									
		maximum diameter (length) μ	thickness of rays μ	maximum diameter (length) μ	thickness of rays μ	maximum diameter (length) μ	thickness of rays μ	maximum diameter (length) μ	thickness of rays μ	maximum diameter (length) μ	thickness of rays μ
var. *tenuis*	form *A*	45	6	167–240	14–17	230–295	17–18	117–320	11–21	194	21
	form *B*			140–440	11–28	275–340	15–20	570–1400	10–20	190	17
var. *lata*				350–530	12–14	870	12				
all forms and varieties		14	6	140–530	11–28	230–870	12–20	117–1400	10–21	190–194	17–21

As the entirely spined short-rayed basal acanthophores are sufficiently abundant for proper study and measurements only in the Palythoa, and as only two specimens of var. *tenuis*, form *A*, bear Palythoa on their stalk, I shall only describe these spicules of this form.

The *entirely spined short-rayed acanthophores* (Plate 76, figs. 4–6, 17–30, 34) of var. *tenuis*, form *A*, are mon- to tetractine. The rays of the tri- and tetractines always lie in the same plane. The rays are cylindrical and rounded, sometimes also thickened at the end. The whole spicule is quite uniformly and densely covered with spines, which arise vertically or more rarely obliquely from its surface. The oblique spines, which invariably point outwards, are confined to the ends of the rays. The spines are straight, conical, 4–6 μ long, and 5–7 μ broad at the base. The entirely spined basal spicules measure 58–210 μ in maximum diameter (length), and their rays are 14–45 μ thick. It is to be noted that this thickness is by no means always in proportion to the length of the spicule. In the smaller forms, under 85 μ in length, the rays are 15–22 μ thick; in the intermediate, 85–100 μ in length, they are 14–45 μ thick, and in the larger, over 100 μ in length, they are 15–34 μ thick.

In view of the fact that the Palythoa doubtlessly derives the whole of the material wherewith it builds its skeleton from the basal part of the sponge to the stalk of which it is attached, it appears very remarkable that the basally smooth spicules, so frequent in the lower part of the sponge, are relatively so rare in the Palythoa; and that, *vice versa*, the entirely spined spicules, forming the bulk of the skeleton of the Palythoa, are so rare in the lower part of the sponge. In *Hyalonema* (*Hyalonema*) *grandancora*, where the relation between the skeleton of the lower part of the sponge-body and the skeleton of the Palythoa is the same, this difference appears to be due to the Palythoa selecting the stoutest and most spiny acanthophores of the sponge as material for building its skeleton.

The *stalk-spicules* (Plate 75, figs. 29, 30; Plate 78, figs. 1, 2), at the point where they arise from the body, are in var. *tenuis* 180–600 μ thick, in var. *lata* 60–300 μ. All those of var. *tenuis* appear to be smooth. Only some of those of var. *lata* are smooth, the others (Plate 78, figs. 1, 2) being provided with annular constrictions, usually much deeper on one side than on the other. These constrictions have a maximum depth of 12 μ, and follow each other at fairly equal intervals of about 110 μ. They render the outline of the parts of the spicules, where they occur, wavy in appearance. In these regions the axial thread exhibits a more or less clearly pronounced thickening at or near the centre of many of the bulging parts lying between successive constrictions (Plate 78, figs. 1, 2). Some of the stalk-spicules of this variety are irregularly rounded at the proximal end. In one of them the rounded proximal end is 220 μ thick.

Among the *microhexactines* two kinds can be distinguished:— regular forms with equal rays, and irregular forms with one ray or two opposite rays longer than or otherwise different from the others.

The *regular microhexactines* (Plate **72**, figs. 16–18; Plate **76**, figs. 1–3; Plate **78**, figs. 5–7) usually have perfectly straight rays. Very rarely one or the other of the rays is somewhat curved. The rays are conical and sharp-pointed. They bear conical, sharp-pointed spines (Plate **76**, fig. 1). The spines on the proximal part of the rays are sparse, vertical, and about 0.6 μ long. Distally the spines become more numerous, inclined backwards toward the centre of the spicule, and smaller; those a short distance below the end are 0.3 μ long. The regular microhexactines of the two forms of var. *tenuis* are 100–180 μ in diameter, of var. *lata* 110–240 μ. The basal thickness of the rays is in the former 3–5 μ, in the latter 3–7 μ. The centre, particularly of the larger microhexactines of var. *lata*, is often distinctly thickened.

The *irregular microhexactines* are to be considered as forms transitional between the canalar pinules and the regular microhexactines, and in respect to shape and size intermediate between these.

The *amphidiscs* were examined biometrically in the usual manner. I measured 238 of var. *tenuis*, form *A*; 66 of var. *tenuis*, form *B*; and 142 of var. *lata*. To make these three sets of measurements directly comparable I multiplied the numbers of amphidiscs of the same length-category of var. *tenuis*, form *B*, with 238:66 = 3.606, and of var. *lata* with 238:142 = 1.677. The numbers thus obtained are the ones used in constructing Figure 12.

Morphologically two main groups of amphidiscs are to be distinguished: — amphidiscs with serrated anchor-teeth, more slender shafts, and narrow anchors; and amphidiscs with smooth anchor-teeth, stouter shaft, and broader anchors. The amphidiscs of the first group, which I designate serrated amphidiscs, vary very considerably in size, their length ranging from 90 to 415 μ. The curves representing the frequency of the serrated amphidiscs of different lengths show numerous ups and downs, thus indicating that the serrated amphidiscs of different size differ in frequency. The irregularities of these curves are, however, hardly of a kind to allow of a distinction of different kinds of serrated amphidiscs according to their size. This is particularly noticeable in the curve of var. *tenuis*, form *A*. And as this curve is the most reliable one, on account of its being based on a much larger number of individual measurements than the curves of var. *tenuis*, form *B*, and var. *lata*, I refrain from subdividing the serrated amphidiscs into subgroups.

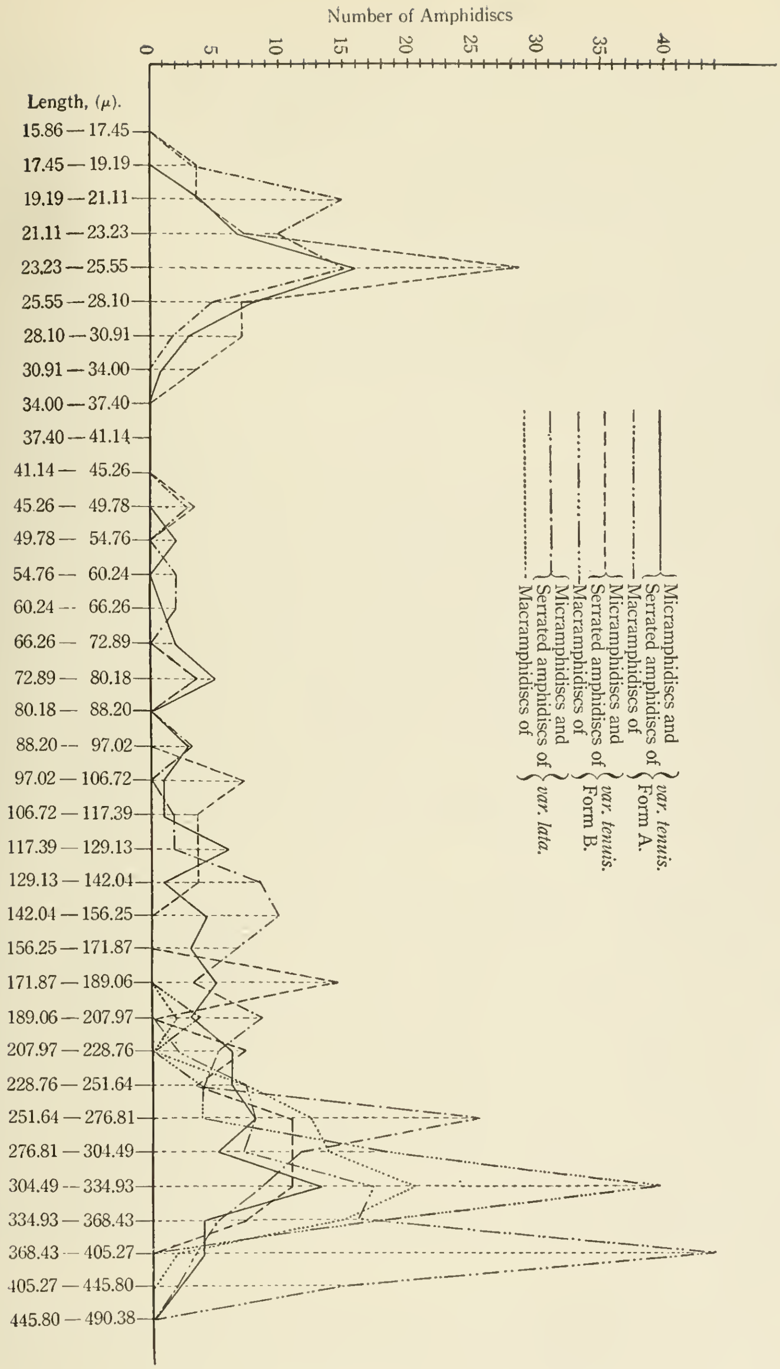

Fig. 12.—Amphidiscs.

It is different with the amphidiscs with smooth teeth, stouter shaft, and broader anchors. There is a great gap in the length frequency-curve of these spicules in all the three forms: — in the var. *tenuis*, form *A*, curve between 80 and 225 μ; in the var. *tenuis*, form *B*, curve between 78 and 200 μ; and in the var. *lata* curve between 64 and 207 μ. This clearly divides these spicules biometrically into two groups: — macramphidiscs over 200, and micramphidiscs under 80 μ in length.

Besides one well-pronounced main elevation each of the three length frequency-curves of the macramphidiscs shows only a quite insignificant secondary elevation. The macramphidisc group can therefore be considered as fairly homogeneous.

The micramphidiscs on the other hand show clearly pronounced gaps in the length frequency-curves; in the var. *tenuis*, from *A*, curve between 30 and 51 μ; in the var. *tenuis*, form *B*, curve between 33 and 47 μ; and in the var. *lata* curve between 26.8 and 47 μ. These gaps divide them into two distinct groups, one comprising the micramphidiscs over 47 μ in length, the other the micramphidiscs under 33 μ in length. For this reason, and because the former are also distinguished from the latter by their shafts, which in the larger ones are provided with a relatively very large central tyle, and which in the smaller ones are not thickened at all, or only slightly so at or near the centre, I divide the micramphidiscs into two secondary groups: — large micramphidiscs with well-developed central tyle, and small micramphidiscs with no central thickening or only a slight one.

Thus four kinds of amphidiscs are to be distinguished: — macramphidiscs, serrated amphidiscs, large micramphidiscs, and small micramphidiscs.

The normal *macramphidiscs* (Plate **73**, figs. 1–7; Plate **75**, figs. 3–21; Plate **77**, figs. 1, 9, 10; Plate **78**, figs. 12–15) have a straight and stout cylindrical shaft, slightly thickened at or near the middle to a central tyle. A verticil of stout and short, distally attenuated, truncate spines arises from this tyle. The number of spines forming the verticil is variable but never great, most frequently four to eight. The verticil is regular or irregular. Its irregularity is usually slight, rarely considerable. In the latter case there are more than eight spines. The remaining parts of the shaft are either quite smooth or they bear only a few scattered spines nearly as broad as the spines of the central tyle, but usually much shorter.

The terminal anchors are composed of eight teeth quite uniformly curved throughout (Plate **73**, figs. 4, 6) or more strongly bent at the ends than elsewhere (Plate **73**, fig. 5). Their curvature is such that the end-parts of the teeth are either parallel, or slightly convergent or divergent. The teeth have the usual T-shaped transverse section. Their upper (outer) band-shaped part arises from the margin of a transverse circular disc situated at the end of the shaft. The diameter of this disc is a little less than a third of the anchor-breadth. In apical views of the anchors, the basal parts of adjacent teeth appear connected by the interdental parts of this disc as by a web (Plate 77, fig. 10). The upper band-shaped part of the teeth is 22–27 μ broad at the base and in the middle. It is attenuated distally and pointed at the end. The contour of the tip of the tooth has the shape of a gothic arch (Plate 73, figs. 1–3; Plate 77, fig. 9).

The macramphidiscs have on the whole narrower anchors and attain a considerably larger size in var. *tenuis*, form *A*, than in var. *tenuis*, form *B*, and in var. *lata*. Their dimensions are as follows: —

NORMAL MACRAMPHIDISCS.

		Hyalonema (Prionema) agujanum		
		var. *tenuis*		var. *lata*.
		form *A*.	form *B*.	
Total length	limits μ	225–440	200–350	207–370
	most frequently about μ	387	320	320
Shaft, thickness μ		20–27	18–22	19–25
Central tyle	diameter μ	28–43	26	24–34
	difference between diameter of tyle and adjacent parts of shaft μ	4–19	5	2–11
Spines of central tyle	length μ	5–15	9	4–7
	basal thickness μ	8–11	10	5–9
Anchor	length, limits μ	63–110	55–83	65–95
	breadth, limits μ	116–172	119–160	112–168
Proportion of anchor-length to anchor-breadth.	limits 100 :	143–221	171–236	155–211
	average 100:	169	196	186.8
Proportion of anchor-length to total length of whole spicule	limits 1:	3.9–5.4	4.2–4.9	3.1–5
	average 1:	4.7	4.7	4.2

In var. *tenuis,* form *A*, I found a remarkable *abnormal* amphidisc (Plate **75**, figs. 35–37), 224 μ long with a straight shaft 20 μ thick. One of the terminal anchors is quite regular, 90 μ long and 112 μ broad; the other is somewhat irregular, and partly spirally twisted. Two large protuberances about 50 μ long arise from the rather eccentrically situated "central" tyle of the shaft. One of these terminates in a broad and thin lamella extending in a radial plane which passes through the axis of the spicule. The distal part of this lamella is strongly and abruptly bent, so as to become parallel to the shaft (Plate **75**, fig. 35). The other protuberance of the central tyle terminates in a stout oblique spine.

If we mentally construct an ovoidal (rotation-ellipsoidal) surface following the outer sides of the teeth of both anchors and entirely enclosing the whole spicule, we find that the large protuberances of the central tyle reach this surface and abruptly bend on reaching it. This indicates that such an ideal rotation-ellipsoidal surface formed a real limit to their radial growth. This limit may very likely be the surface of a cell ovoid in shape. If this be so, we might assume that the amphidisc was formed and grew within this cell, and that the outer band-shaped parts of its anchor-teeth and the distal bent parts of the protuberances of the central tyle were developed in the superficial part of the protoplasm of this cell. Thus the appearance of this abnormal macramphidisc is in favour of the view that each amphidisc is produced, like the sigms and cheles of the monaxonid sponges, in an ellipsoidal cell, the shape of the surface of which determines the shape and position of the anchor-teeth, which are formed and which grow in its superficial part.

The *serrated amphidiscs* (Plate **74**, figs. 1–9; Plate **75**, figs. 1, 2, 22, 23; Plate **76**, figs. 33, 35, 36; Plate **77**, figs. 2–7) have a rather slender, straight or, rarely, slightly bent (Plate **74**, fig. 5) shaft. The shaft is considerably thickened at or near the middle to a conspicuous central tyle. A verticil of long, more or less, often very considerably curved, cylindroconical and truncate or terminally rounded spines arises from the central tyle. In an abnormal serrated macramphidisc of var. *tenuis*, form *A*, the spines of the central tyle are in shape and position similar to the teeth of the terminal anchors, only smaller. One of the terminal anchors of this spicule (the other is broken off) is 117 μ long and 75 μ broad; the anchor-shaped spine-verticil of the central tyle is 61 μ long and 55 μ broad. The remaining parts of the shaft are covered rather densely with minute spines. These increase in number and in size towards the ends of the shaft. The terminal anchor usually consists of eight teeth. The individual teeth are generally curved in the same direction, concave to the shaft, throughout their length. More rarely a portion of a tooth is curved the other way, convex to the shaft (Plate 74, fig. 3; Plate 77, figs. 2, 3). The end-parts of the teeth are often bent rather abruptly inward and they generally converge. The teeth have the usual T-shaped transverse section. Their outer and upper band-shaped part is, in the larger serrated amphidiscs, nearly uniformly (18–22 μ) broad throughout, attenuated only slightly distally, and rounded at the end. The lateral and terminal margins of the teeth are bent down shaftwards and serrated. The serration-teeth are triangular, sharp-pointed, and usually directed more or less backwards. The lateral ones are 1.5–2 μ long and 1–2 μ broad, the terminal ones smaller.

In var. *tenuis*, form *A*, and in var. *lata* the serrated amphidiscs attain a larger size than in var. *tenuis*, form *B*; and in var. *lata* the average relative breadth of the anchors is considerably greater than in the two forms of var. *tenuis*. The dimensions of the serrated amphidiscs are: —

SERRATED AMPHIDISCS.

		var. *tenuis*.		var. *lata*
		form *A*	form *B*	
Total length	limits μ	90–410	100–342	90–415
	most frequently about μ	320	103, 180	149, 198, 264[1]
Shaft, thickness μ		3–12	5.5–7.5	3.5–8
Central tyle	diameter μ	6–17	12–15	6–14
	differences between diameter of tyle and adjacent parts of shaft μ	2.5–10	6–8	2–7.5
Spines of central tyle	length μ	5–15	8–12	5–10
	basal thickness μ	1.2–4	1.5	1–2
Anchor	length, limits μ	30–159	30–145	60–165
	breadth, limits μ	20–120	25–118	48–154
Proportion of anchor-length to anchor-breadth	limits 100:	63–106	55–83	63–105
	average 100:	71.8	70.4	83
Proportion of anchor-length to total length of the whole spicule	limits 1:	2–2.4	2.2–2.4	2.2–2.4
	average 1:	2.3	2.3	2.3

[1] When there are two or more numbers in this zone it indicates that the length frequency-curve pertaining to the spicules of the variety or form has more pronounced elevations than one; in these the serrated amphidiscs do not appear to be biometrically homogeneous groups.

The *rare large micramphidiscs* have a stout shaft with an exceptionally large, usually somewhat irregular, central tyle. This tyle bears numerous minute and slender spines. These are not arranged in a verticillate manner, but are scattered over the whole tyle. The remaining parts of the shaft also bear minute spines. The anchor-teeth, which arise nearly vertically from the end of the shaft, are curved quite uniformly throughout, through an angle of about 90°, so that their end-parts are nearly parallel. The dimensions of these amphidiscs are: —

LARGE MICRAMPHIDISCS.

		var. *tenuis*		var. *lata*
		form *A*	form *B*[1]	
Total length	limits μ	51–80	47, 78	47–64
	most frequently about μ	75		50, 60
Shaft, thickness μ		1.3–3		1.7–2.5
Central tyle	diameter μ	4–7	3.5	5.5
	differences between diameter of tyle and adjacent parts of shaft μ	2.7–4		3–4
Anchor	length, limits μ	18–39	13, 35	18–24
	breadth, limits μ	17–31	11, 26	14–20
Proportion of anchor-length to anchor-breadth	limits 100:	67–100	74–85	78–83
	average 100:	82.5	79.5	80.5
Proportion of anchor-length to total length of the spicule	limits 1:	2–3	2.2, 3.7	2.3–3
	average 1:	2.5	2.9	2.7

The *small micramphidiscs* (Plate **75**, figs. 24–27, 31–34; Plate **77**, fig. 8) have a straight shaft, which is either simple, cylindrical, and without any trace of a central tyle, or, more rarely, slightly thickened at or near the centre to a small central tyle. Such central tyles on the shaft are much more frequent in the small micramphidiscs of var. *lata* than in those of var. *tenuis*. The shaft is covered throughout with more or fewer, sometimes very numerous minute spines.

[1] Only two seen.

The spines are vertical, or inclined toward the centre of the spicule. The anchor-teeth arise vertically from the end of the shaft, and are uniformly curved through an angle of about 90°, so that their end-parts are nearly parallel. The dimensions of the small micramphidiscs are: —

		var. *tenuis*		var. *lata*
		form *A*	form *B*	
Total length	limits μ	20–30	18–33	18–26.8
	most frequently about μ	24.5	24.5	20, 24.5
Shaft, thickness μ		0.8–1.3		1–1.5
Anchor	length, limits μ	5–8.5	4–12	5–7.5
	breadth, limits μ	6–9.5	6–9	7–8.5
Proportion of anchor-length to anchor-breadth	limits 100:	93–160	75–200	100–160
	average 100:	122	107	127
Proportion of anchor-length to total length of the whole spicule	limits 1:	2.9–4.9	2.5–5.9	2.9–4.4
	average 1:	3.8	4	3.6

The above description shows that these sponges are similar enough to be considered one species. The greater average relative breadth of the serrated amphidiscs, particularly the larger, and some other peculiarities in one of the specimens, call for the recognition of two varieties: — var. *tenuis* with narrower serrated amphidisc-anchors, and var. *lata* with broader. One of the four specimens of var. *tenuis* has much smaller macramphidiscs than the others, and I consequently distinguish two forms in it: — *A* with larger, and *B* with smaller macramphidiscs.

The nearest ally of *Hyalonema* (*Prionema*) *agujanum* appears to be the sponge I describe as *Hyalonema* (*Prionema*) *pinulifusum* (p. 284). From this it differs by the shape of the macramphidiscs and particularly by the pinules; in *H.* (*P.*) *agujanum* the distal rays of the largest pinules (together with the spines) are rather slender and more or less cylindrical, in *H.* (*P.*) *pinulifusum* they are very stout and spindle-shaped.

Hyalonema (Prionema) azuerone, sp. nov.

Plate 56, fig. 1; Plate 57, figs. 1–23; Plate 58, figs. 1–22.

One specimen of this species was trawled in the Eastern Pacific at Station 4621 on 21 October, 1904; 6° 36′ N., 81° 44′ W.; depth 1067 m. (581 f.); it grew on a bottom of green mud and rock; the bottom-temperature was 40.5°. The Station is off the southern coast of western Panama, southwest of the Azuero Peninsula, to which the name refers.

Shape and size. The specimen (Plate **56**, fig. 1) appears as a soft and resilient disc with irregular lacerated margin. It is 275 mm. long, 255 mm. broad, 15–25 mm. thick, and forms (probably the greater) part of a sponge which may have been broad and low cup- or vase-shaped, perhaps similar to *Hyalonema populiferum* F. E. Schulze.[1] Fragments of large stalk-spicules, and slight remnants of a protuberance indicate that a stalk was present in the living sponge, which arose from the face bearing the protuberance. This face must be considered as dermal.

The sponge consists of a mass of curved lamellae, mostly 2–3 mm. thick, and joined to form a labyrinthic structure with elongate cavities or canals, which have a maximum width of 11 mm.

The *colour* in spirit is reddish brown.

General structure and canal-system. In those regions of the lower (dermal) surface where the superficial parts are intact, broad, oval pores covered by a fine network are observed. One of these pores (Plate **58**, fig. 4) measures 3.8 by 3.4 mm. The network covering it consists of straight threads 30–40 μ thick. The nodes are considerably thickened; the meshes are triangular or irregularly square, and 30–120 μ wide. The flagellate chambers are curved, irregular sac-shaped, and 80–140 μ wide. They form groups surrounding efferent canals and lie, within these groups, close together. The chamber-groups are attached to and held in position by a network of threads, spread out between them and the superficial membranes of the sponge-lamellae in which they lie.

The *skeleton.* The intact parts of the superficial (dermal and gastral) membranes are covered by a dense fur of pinules (Plate **58**, figs. 3a, 10, 11). Small patches of the same pinule-fur also occur at the thickened nodes of the nets covering the afferent pores (Plate **58**, fig. 4). Pinules are likewise met in the walls of some at least of the canals (Plate **58**, fig. 1b). These canalar pinules are, however, not nearly so densely crowded as the superficial ones. Rhabds extend

[1] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, taf. 2, fig. 7.

paratangentially in the superficial membranes and occupy, singly or in bundles of two or three, the axes of the threads of the nets covering the afferent pores. Similar rhabds traverse the choanosome, singly or in bundles, in various directions. Most of these rhabds are centrotyle isoactine amphioxes. In some, one actine is reduced in length and terminally thickened; these resemble tylostyles. Pentactine megascleres occur in the superficial parts of the lamellae. In the interior a few hexactine forms are found. Very numerous microhexactines and a few pentactine and diactine-derivates of these spicules are also found in the interior. Seven kinds of amphidiscs occur in this sponge: — not very numerous macramphidiscs with serrated anchor-teeth; very rare large mesamphidiscs with smooth teeth; very numerous medium mesamphidiscs, which, in places (Plate 58, fig. 2), form quite dense masses; a few similar small mesamphidiscs; numerous slender-shafted regular micramphidiscs; and two kinds of micramphidiscs, a larger and a smaller, which are stout-shafted, and generally more or less irregular.

The *superficial* (*dermal and gastral*) *pinules* (Plate 58, figs. 3a, 10, 14, 15, 17, 18, 20–22) observed were all pentactine. The distal ray is straight, 190–390 μ long, and 5–9 μ thick at the base. It ends with a very slender sharp-pointed terminal cone, and the whole of it, with the exception of its proximal and distal end-parts, is beset with spines. These spines are numerous, rather crowded and longest in the middle-part of the ray; they decrease in size both proximally and distally. The lowest arise nearly vertically; distally they become more and more inclined towards the tip of the ray. The longest spines of the middle-part of the ray usually enclose angles considerably less than 45° with the axis of the ray. These spines are conic, sharp-pointed, attain 25 μ in length, 3 μ in thickness, and are slightly curved, concave towards the tip of the ray. They are either simple, or bear one or two outwardly directed branch-spines, which sometimes reach a very considerable size (Plate 58, fig. 18). The maximum thickness of the distal ray, together with the spines, is 22–36 μ. The basal half of the lateral rays (Plate 58, figs. 14, 15) is nearly cylindrical and smooth, the distal half conic and provided with somewhat sparse, quite large, broad, and low spines. The end is blunt. The lateral rays are 25–55 μ long. They appear to be longer in the gastral than in the dermal pinules; in the former they are usually about 40 μ long, in the latter about 30 μ.

The *canalar pinules* (Plate 58, figs. 1b, 16, 19) are on the whole similar to the superficial ones but have more slender rays, a shorter distal ray, and fewer and smaller spines on the latter. It is also to be noted that they are not all pentactines, a few hexactine forms occurring among them. The measurements of these spicules are: — distal ray, length 134–290 μ, basal thickness 4–5 μ, maximum thickness together with the spines 13–28 μ; lateral rays, length 26–52 μ; proximal ray (when present), length 35–38 μ.

The *hexactine megascleres* measured were 0.7–2.4 mm. in diameter, and had smooth, conic, blunt-pointed rays, 17–45 μ thick at the base.

The *pentactine megascleres* measured had straight rays, 10–25 μ thick at the base. The proximal ray is 0.1–0.6 mm. long; the lateral rays, which enclose angles of about 80° with the proximal, are 150–300 μ long.

The *fairly isoactine centrotyle amphiox rhabds* are more or less, often very considerably curved, particularly the long ones. They are usually blunt-pointed, near the end sometimes wavy in outline, 0.6–2.8 mm. long, and 9–25 μ thick in their middle-part. The central tyle is 12–28 μ in transverse diameter, the proportion between the thickness of the adjacent parts of the spicule and the thickness of the tyle being 100 to 108–151, on an average 100 : 120.6.

The *tylostyle-like anisoactine centrotyle rhabds* are 1–2.5 mm. long, usually slightly curved, and 13–15 μ thick near the morphological centre. Their central tyle measures 14–16 μ in diameter. The terminal thickening (tyle) of the reduced ray is 17–20 μ in diameter. Besides the intact tylostyle-like spicules, the measurements of which are given above, some fragments of them with a terminal tyle sometimes 23 μ in diameter were observed.

The *microhexactines* (Plate 57, figs. 18–23; Plate 58, fig. 1c) measure 50–160 μ in diameter, usually 70–110 μ. The rays of the same spicule are generally equal. They are smooth, at the base 1–3.5 μ thick, usually about 1.8 μ, straight in their proximal part and generally slightly curved in their distal part. Their curvature appears to be, on the whole, in inverse proportion to the size of the spicule; the largest microhexactines, that is those more than 125 μ in diameter, having nearly straight rays. One of the microhexactines observed had a bifurcate ray (Plate 57, fig. 20).

The *rare micropentactines* measured were 94–150 μ in diameter, and had rays 1.5–3 μ thick at the base.

One of the *rare diactine microhexactine-derivates* measured consisted of two straight rays forming an angle of 85°. Its rays are 3 μ thick at the base; one is simple and 60 μ long, the other bifurcate and 50 μ long.

The *amphidiscs.* According to their shape, four kinds of amphidiscs are to be distinguished: — *A* large amphidiscs with relatively short anchors and serrated anchor-teeth; *B* medium amphidiscs with relatively long anchors and smooth anchor-teeth; *C* small amphidiscs with slender shafts and relatively small regular anchors; and *D* small amphidiscs with stout shafts and relatively large, usually more or less irregular anchors. Biometrically, according to the length frequency, *A* is a well-defined, simple, and homogeneous group. *B* overlaps *C* and *D* somewhat, and *C* and *D* are about equal in length. *B* is biometrically composed of three secondary groups represented by (*a*), large, (*b*), medium sized, and (*c*), small amphidiscs. *C* is biometrically a simple and homogeneous group. *D* is biometrically composed of two well-defined secondary groups represented by larger amphidiscs (*a*), and smaller amphidiscs (*b*). Thus if both their shape and the biometric character of their length-frequencies are taken into consideration seven kinds of amphidiscs are to be distinguished:— macramphidiscs (*A*); large mesamphidiscs (*B a*); medium mesamphidiscs (*B b*); small mesamphidiscs (*B c*); slender-shafted micramphidiscs (*C*); stout-shafted large micramphidiscs (*D a*); and stout-shafted small micramphidiscs (*D b*).

The *macramphidiscs* (Plate 57, figs. 1–5; Plate 58, figs. 5–9) are 300–356 μ long, most frequently about 320 μ. Their shaft, which is straight and for the most part 7–9 μ thick, thickens at the ends gradually to a conic extension 10–14 μ in diameter, and in or near the middle abruptly to a central tyle of the same diameter. The proportion of the thickness of the adjacent parts of the shaft to the thickness of the central tyle is 100 to 130–200, on an average 100 : 157.4. An irregular verticil of cylindroconic, truncate, or terminally rounded spines arises from the central tyle. These spines are 1.5–3.5 μ thick, usually 1.5–4 μ long, sometimes as much as 8 μ, and when long are irregularly curved. They bear on their terminal face a cluster of exceedingly minute secondary spinelets. Scattered spines, similar to those of the central tyle, but on the whole shorter, are met on the remaining parts of the shaft. The terminal anchors are 77–119 μ long; they are broadest usually a little over a third of the whole spicule, somewhere beyond the middle, and attenuated towards the end. Their maximum breadth is 85–104 μ, their end-breadth 75–95 μ. The proportion of length to maximum breadth is 100 to 77–114, on an average 100 : 101.5. The maximum breadth is 3–11 μ, on an average 7.1 μ, greater than the end-breadth. The anchor usually consists of nine or ten teeth. The individual teeth arise steeply from the end of the shaft, and are strongly curved in their basal part. Farther on the curvature decreases either gradually or somewhat abruptly. The decrease of curvature either continues to the end of the tooth, or it increases again just before the end. The total curvature is such that the end-parts of the teeth converge toward the shaft, with the axis of which they usually enclose an angle of 10°–20°. The teeth have the usual T-shaped transverse section. The lower, radial part, corresponding to the upright stroke of the T, extends to the end of the tooth. The upper, paratangential part, corresponding to the upper, horizontal stroke of the T, is 12–16 μ broad in its middle-part and gradually attenuated distally; its end is broad and simply rounded; its lateral margins are strongly serrated (Plate **58**, figs. 5–9). The individual saw-teeth are pointed and usually triangular. In the middle-part of the anchor-tooth these saw-teeth are 1–2 μ long and close together. Distally they become smaller and more distant; at the end they are only about 0.5 μ long. The saw-teeth are directed obliquely inward. A similar serration of the teeth was found also in *H. spinosum* (p. 276) and in a few others.

In a few of the macramphidiscs observed two or three supernumerary shaft-rudiments arose from the central tyle. In one of them, two of these rudiments bore somewhat reduced and irregular terminal anchors.

The *large mesamphidiscs* (Plate **57**, fig. 8) are very rare; the one represented is 232 μ long. Its shaft is 5.5 μ thick and its central tyle 8 μ. A verticil of spines, with a maximum length of 4 μ, arises from the latter, and numerous short and broad spines cover the remaining parts of the shaft. The terminal anchors are semioval, 108 μ long, and 72 μ broad; the proportion of their length to their breadth being 100: 67.

The *medium mesamphidiscs* (Plate **57**, figs. 6, 7; Plate **58**, figs. 2, 13) are very numerous. They measure 56–130 μ in length, most frequently about 85 μ. Their shaft is 1.3–3 μ thick and abruptly thickened in or near the middle to a central tyle 1.5–5 μ in diameter. The proportion of the thickness of the shaft to that of the tyle is 100 to 140–220, on an average 100 : 165.4. A verticillate bunch of irregularly curved, obtuse spines 1–3.5 μ long arises from the tyle. Similar, usually much shorter spines are scattered in greater or smaller numbers irregularly over the remaining part of the shaft. The degree of spinulation of the shaft is correlated with, and in proportion to, the size of the spicule; the larger the amphidisc the larger and the more numerous the spines. The anchors are 15–46 μ long, one third to nearly half of the whole spicule, and 12.5–31 μ broad. The proportion of their length to their breadth is 100 to 57–83, on an average 100 : 68.6. This proportion is correlated to the size of the spicule, the anchors being on the whole relatively the narrower, the larger the spicule (the anchor). The average proportion of length to breadth of the anchors under 20 μ in length is 100 : 80.5, of the anchors under 30 μ in length 100: 72.3, and of the anchors over 40 μ in length 100 : 65.9. The anchors usually consist of twelve or thirteen teeth. The individual teeth arise nearly vertically, are strongly and usually somewhat abruptly bent a short distance from their point of origin, and only slightly curved, concave to the shaft in their distal and middle-parts. The curvature is usually such that the end-parts of the teeth diverge from the shaft at angles of about 6°. Rarely the teeth are more strongly curved, so that their end-parts become nearly parallel to the shaft and to each other. The end-parts of such teeth are either straight or slightly curved outwards.

The *small mesamphidiscs* are rare. They connect the medium-sized mesamphidiscs described above with the slender-shafted micramphidiscs described below. The small mesamphidiscs are usually about 44 μ long, have shafts about 1.5 μ thick, and anchors measuring 15–18 μ in length and 11–16 μ in breadth. The average proportion of anchor-length to anchor-breadth is 100: 81.

The *large stout-shafted micramphidiscs* (Plate 57, fig. 9) are 38–68 μ long, most frequently about 43 μ. The shaft is straight, 1.8–2.5 μ thick, for the greater part of its length, and abruptly thickened in or near the middle to a more or less irregular central tyle, usually 4–6 μ in diameter, sometimes as much as 8 μ. The proportion of the thickness of the shaft to that of the tyle is 100 to 160–320, on an average 100: 239.8. The whole of the shaft, including the central tyle, is more or less spiny. The spines of the tyle are generally larger than the others and arranged in a verticillate manner. The anchors are usually irregular, the teeth on one side often being considerably longer than those on the other. The two anchors of the same spicule usually have the longest teeth on opposite sides, exceptionally on the same side. The maximum length of the anchor, that is the anchor-length on the side where the teeth are longest, is 15–42 μ, sometimes more than half the length of the whole spicule. On the opposite side the anchor is usually 4–10 μ shorter. The breadth of the anchors is 8.4–21 μ. The proportion of the maximum length to the breadth is 100 to 45–91, on an average 100: 66.4. The individual teeth arise vertically from the end of the shaft and are strongly curved in their basal part. Farther on the curvature decreases and their end-parts are curved only slightly, concave to the shaft, or are straight, or even curved slightly in the opposite direction. In no case do the end-parts of the teeth diverge much from a direction parallel to the shaft, either one way or the other. When, as sometimes happens, the longest teeth of the two opposite anchors lie on the same side of the spicule and are, both together, longer than the whole spicule, their end-parts lie side by side, but do not coalesce.

The *small stout-shafted micramphidiscs* (Plate 57, figs. 10–12) are 23–34 μ long, most frequently about 32 μ. They are similar to the large ones, but have more spiny shafts and relatively smaller and, on the whole, still more irregular anchors. The shaft is for the most part 1.2–2 μ thick, and abruptly thickened in or near the centre to a remarkably large central tyle which measures 2–5 μ in diameter. The remainder of the shaft is often not quite uniform in thickness. The proportion of the thickness of the shaft to that of the tyle is 100 to 133–333, on an average 100: 204.8. The whole of the shaft, including the central tyle, is beset with very numerous spines. Those on the tyle are either large and arranged in a verticillate manner, or small and quite uniformly scattered over the whole tyle. Those on the remaining parts of the shaft are always small. The maximum length of the anchors is 7–12 μ, about a third of the length of the whole spicule, their breadth 8–12 μ. The proportion of maximum length to breadth is 100 to 73–125, on an average 100 : 101.3. The individual anchor-teeth are curved so that their end-parts do not greatly diverge from a direction parallel to the shaft.

The *slender-shafted micramphidiscs* (Plate **57**, figs. 13–17; Plate **58**, fig. 12) are 30–58 μ long, most frequently about 42 μ. The shaft is regularly cylindrical, straight or, rarely, slightly curved, 1–1.7 μ thick, and thickened at some point, sometimes a long way from the middle, to a central tyle 1.4–2.4 μ in diameter. The proportion of the thickness of the shaft to that of the tyle is 100 to 114–131, on an average 100 : 121. A few blunt spines, sometimes 0.7 μ long, arise from the tyle. The remainder of the shaft is usually quite smooth. In a few, particularly in the large and slender-anchored ones, the shaft bears minute spines. The anchors are regular, 6–10 μ long, a quarter to a sixth of the whole spicule, and 9–10 μ broad. The proportion of their length to their breadth is 100 to 105–150, on an average 100 : 121.6. The number of teeth in the anchor is about seventeen. The individual teeth arise vertically and are considerably curved in their basal part. Distally the curvature decreases in a uniform manner. The end-parts of the teeth diverge more or less from the shaft.

The large slender-anchored forms above referred to connect these amphidiscs with the small mesamphidiscs.

The nearest ally of the sponge above described among the species hitherto made known appears to be *Hyalonema validum* F. E. Schulze. With this species it coincides in respect to the shape and size of all the spicules, with the exception of the stout-shafted more or less irregular micramphidiscs, which are present in *H.* (*P.*) *azuerone* and absent in *H. validum;* the microhexactines, which have more strongly bent rays in the latter than in the former; and the dermal pinules, the distal rays of which are bushy and have a thick, abruptly pointed terminal cone in *H. validum*, and are slender and have a very slender and fine-pointed terminal cone in *H.* (*P.*) *azuerone*.

Hyalonema (Prionema) spinosum, sp. nov.

Plate 48, figs. 1–31; Plate 49, figs. 1–23; Plate 50, figs. 1–5.

Three specimens of this species were trawled nearly under the equator in the Eastern Pacific at Station 4742 on 15 February, 1905; 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); they grew on very light, fine Globigerina ooze; the bottom-temperature was 34.3°.

The microhexactines bear unusually large spines. To this the specific name refers.

Shape and size. The largest specimen (Plate 48, fig. 12) is a lamella or plate, roughly round in outline when spread out flat. It is 46 mm. long, 37 mm. broad, and has a fairly uniform thickness of 8–10 mm. The margin is rounded. The lamella is folded along a straight line passing nearly through its centre. The two parts on either side of the fold are flat, and enclose an angle of about 70°. On the convex side of the fold a rounded protuberance arises near the margin. In life, the stalk, which is now, however, entirely absent, arose from this. At the opposite end of the fold the margin is slightly incised. On the convex surface of the lamella, which is the dermal, the covering (dermal) membrane is lost in many places, and this side consequently appears rough and porous. On the opposite, concave side, which is the gastral, meandric branching grooves are observed, which, on the whole, radiate from a point in the fold near the centre of the lamella. At this point a small and slender gastral cone arises from the concavity of the fold.

One of the smaller specimens (Plate 48, fig. 11) is lenticular in shape. It measures 35 mm. in horizontal diameter and is 16 mm. thick. Near the middle of one (the lower, dermal) face a rounded protuberance arises. From this, in life, the stalk, which is now absent, protruded. In respect to the structure of the surface this specimen resembles the large one. The other small specimen is fragmentary and measures 25 by 22 by 8 mm.

The *colour* of the two better preserved specimens is, in spirit, light brown; of the fragmentary one, whitish.

The lamellar or lenticular sponge-body is traversed by wide *canals* (Plate 48, fig. 13), most of which extend in a more or less vertical direction. Some of these canals are afferent and open out below, others are efferent and open out above in the gastral surface. The gastral membrane exhibits, in many places, a reticulate structure; in life the mouths of the efferent canals were probably covered with nets.

The *skeleton*. The surface is, so far as the dermal and gastral membranes are intact, covered by a dense pinule-fur (Plate 48, fig. 23). The dermal pinules on the outer (lower, convex) side, and the gastral pinules on the inner (upper, concave) side are very much alike. The gastral pinule-fur extends quite down to the bottom of the grooves above referred to. Lateral, paratangentially situated, rays of large (hypodermal and hypogastral) pentactines extend just below the level occupied by the lateral pinule-rays. In the gastral membrane numerous paratangential amphioxes accompany them. The proximal rays of the pentactines point radially inward. Large numbers of stout acanthophores, tetractine to monactine, occur in the protuberance from which, in life, the stalk arose.

The interior of the sponge is occupied by dense masses of relatively large microhexactines, which evidently form the main support of the whole sponge-body. Besides these spicules, rhabd and hexactine megascleres and amphidiscs occur in the choanosome.

The *dermal pinules* (Plate 48, figs. 17–22) are mostly pentactine, rarely hexactine (Plate 48, fig. 20). The distal ray is 100–154 μ long, usually 117–138 μ, and 3.5–4.5 μ thick at the base. It is straight, regularly conic, and not thickened in the middle. The distal end-part of the ray is, for a considerable distance, free from spines. The basal part is also smooth. The remaining parts of it are covered with sparse spines directed obliquely upward. The spines are largest on the middle-part of the ray; they are sometimes 11 μ and more long, slender, usually only 1–1.3 μ thick, basally cylindrical, distally conical, and sharp-pointed. The maximum transverse diameter of the distal ray, together with the spines, is 10–17 μ. The lateral rays are straight, sparsely spined in their distal part, and 20–50 μ long, usually 25–40 μ. The proximal ray of the hexactine forms is smooth and rarely more than 15 μ long.

The *gastral pinules* (Plate 48, figs. 23–27) are similar to the dermal and, like these, for the most part pentactine. The distal ray is 100–142 μ long, usually 105–135 μ, and 3.5–5.5 μ thick at the base. Its maximum transverse diameter, together with the spines, is 11–17 μ. The lateral rays are 22–35 μ long.

The *hypodermal and hypogastral pentactines* (Plate 49, figs. 12–14) have smooth, blunt, conic rays. The lateral rays enclose angles of 90° or a little less with the apical (proximal) ray. The apical ray is straight, or slightly curved, 0.5–2.8 mm. long, and 20–100 μ thick at the base; the lateral rays are straight, and 0.2–1 mm. long. The length of the lateral rays is not in proportion to the length of the apical ray, pentactines with a very long apical ray often having comparatively short lateral rays and *vice versa.*

The *hexactine megascleres* (Plate **49**, fig. 19) have smooth, generally fairly straight, conic rays. The intact ones measured have a maximum diameter of 0.5–1.5 mm. and rays 12–43 μ thick at the base. Some fragments with rays 43 μ thick, which I observed, indicated that these spicules occasionally attain considerably larger dimensions.

The acanthophores (Plate **48**, figs. 1–10) have one to four straight or, more rarely, curved rays, smooth in their basal part, but covered with spines in their end-part. The rays are conic or, more rarely, cylindrical and blunt-pointed or rounded, and not infrequently thickened at the end. These spicules measure 110–430 μ in maximum diameter (length); their rays are 10–30 μ thick at the base. The rays of the tetractine and triactine forms lie in one plane. In the tetractine forms, which are the most frequent, either all four rays are fairly equal (Plate **48**, figs. 1, 3) or only three, the fourth being more or less reduced in length (Plate **48**, figs. 2, 4, 5). In some of these spicules one ray is altogether suppressed. These are the triactines (Plate **48**, fig. 6). The diactines usually appear as straight centrotyle rods (Plate **48**, figs. 7–9). The rare monactines are tylostyles (Plate **48**, fig. 10). Their terminal tyle is obviously homologous to the central tyle of the diactines.

The *rhabds.* The rhabds of the gastral membrane are more or less curved, slightly centrotyle amphioxes, and mostly about 1 mm. long and 8–9 μ thick. The central tyle measures 10–13 μ in transverse diameter. In the interior similar and also much larger rhabds are met. The largest intact ones observed measured 2.9 mm. by 40 μ; the stoutest rhabd-fragment was 130 μ thick.

The six rays of the *microhexactines* (Plate **49**, figs. 14–18, 20–23) are, in the same spicule, fairly equal and regularly arranged, each one enclosing an angle of 90° with its neighbours. The microhexactines measure 108–180 μ in total diameter, usually 117–148 μ. Their rays are straight, 50–90 μ long, at the base 4.5–6 μ thick, usually about 5 μ, conic and sharp-pointed. They bear large and conspicuous, backwardly directed spines. On the proximal half of the ray the spines are 1.2–2.6 μ long, stout, and sparse; on its distal half they are smaller and much more crowded.

Among the *amphidiscs* four kind are to be distinguished:— large macramphidiscs, small macramphidiscs, large micramphidiscs, small micramphidiscs.

The abundant *normal large macramphidiscs* (Plate **48**, figs. 14–16; Plate **49**, figs. 7–9, 11; Plate **50**, figs. 1–5) are 180–298 μ long, most frequently about 255 μ. The shaft is usually straight, rarely slightly curved, for the most part nearly cylindrical, 3–8 μ thick, and abruptly thickened at or near the middle to a central tyle 6.5–17 μ in transverse diameter. The proportion of the diameter of the adjacent parts of the shaft to the diameter of the tyle is 1 : 1.3—1 : 3.2, most frequently about 1 : 2. From the central tyle a verticil of about eight large spines arises; these are slightly and irregularly curved but on the whole vertical (Plate **48**, figs. 14–16; Plate **49**, figs. 8, 9, 11). These spines are cylindrical, rounded or abruptly pointed at the end, and always quite smooth and destitute of secondary spinelets. They are 8–23 μ long and 2–3.5 μ thick at the base. The parts of the shaft outside the central tyle and its vicinity bear numerous low, cylindrical and truncate, wart-like spines, 0.5–1.5 μ high, 1–2 μ broad, and circular in outline (Plate **48**, figs. 15, 16; Plate **49**, figs. 8, 9, 11). From the terminal face of each of these spines a cluster of exceedingly minute secondary spinelets arises.

The terminal anchors are 68–107 μ long, considerably more than a third of the whole spicule, and 61–117 μ broad. The proportion of length to breadth is 100 : 73–100 : 114, on an average 100 : 94. A correlation between the anchor-proportion and the size of the spicule was not noticed. All the anchors counted were composed of eight teeth.

The individual teeth are considerably curved near the base. Distally the curvature decreases. The end is slightly and somewhat abruptly bent inward towards the shaft. The teeth have a T-shaped transverse section. The upper part is band-shaped, 9–13 μ broad near the base, very slightly attenuated distally, and rounded at the end. The lower part is a crest projecting towards the shaft. This crest is 5 μ high near the base; distally it gradually becomes lower, and it appears to vanish altogether about 10 μ from the end of the tooth. The anchor-teeth bear, on their lateral margins, secondary teeth and consequently appear serrated (Plate **49**, fig. 7; Plate **50**, figs. 1–5). These secondary teeth stand quite close together and extend from the base to within a short distance of the end of the primary tooth, leaving only the rounded end free. The secondary teeth are triangular in outline, 0.5–1.2 μ long, 1–1.5 μ broad, sharp-pointed, and directed more or less backwards. They resemble shark's teeth.

Besides the normal spicules above described a few *young* and also a few *abnormally large macramphidiscs* have been observed. The young forms have a slender shaft, a relatively stout central thickening, and short and thin anchor-teeth. One of the abnormal forms is represented on Plate **49**, fig. 10. This spicule is 235 μ long, its shaft is 5 μ thick, central tyle 9 μ thick. A verticil of short, laterally compressed, distally broadened and truncate, band-shaped spines arises from the tyle. The remainder of the shaft bears short, truncate, cylindrical spines. The anchors are about 54 μ long, 33 μ broad. The anchor-teeth have serrated margins, are strongly curved in their basal part, but nearly straight in their middle- and end-parts. The latter are nearly parallel to the shaft. Another similar spicule observed was only 180 μ long. I have also seen a few large macramphidiscs in which the spines on the central tyle were similar to the teeth of the terminal anchors, and all curved in one direction, so that the verticil formed by them was like a terminal anchor, only smaller.

The rare *small macramphidiscs* (Plate **49**, figs. 5, 6) differ from the large macramphidiscs — apart from their smaller size — chiefly by being destitute of long central spines. The small macramphidiscs are 45–126 μ long. The shaft is 1–3 μ thick, and either simply cylindrical (Plate **49**, fig. 5) or gradually thickened at or near the middle (Plate **49**, fig. 6) to a tyle sometimes 5.5 μ in transverse diameter. The proportion of the thickness of the adjacent parts of the shaft to the diameter of the tyle is 1 : 1 (when there is no tyle); 1 : 2.2 (when the tyle is most highly developed). The whole of the shaft is uniformly and densely covered with small spines. The spines on the tyle are not larger than the others. The anchors are 13–56 μ long, a third or less of the whole spicule, and 12–43 μ broad. The proportion of the length to the breadth of the anchors is 100 to 77–92, on an average 100 : 86. The individual teeth appear to differ from those of the large macramphidiscs only by being smaller.

The *large micramphidiscs* are very rare. In fact only two could be measured. These are 51 and 56 μ long, and have anchors 16 and 19 μ long and 8.5 and 9 μ broad respectively. The proportion of length to breadth of their anchors is 100 : 56 and 100 : 44.

The *small micramphidiscs* (Plate **48**, figs. 28–31; Plate **49**, figs. 1–4) are, although much more abundant than the other amphidisc-forms, still not nearly so frequent as in other hyalonematids. They are 13–29 μ long, usually 17–27 μ, and have a shaft 0.8–1.7 μ thick. The shaft generally bears a larger or a smaller number of minute, cylindrical, truncate, vertical or oblique spines. These spines are irregularly distributed; often they form a little cluster near the centre of the shaft. The anchors are 4–7.5 μ long, a fifth to a third of the whole spicule, and 5–8 μ broad. The proportion of their length to their breadth is 100 to 87–175, on an average 100 : 134.8. The individual anchor-teeth are strongly curved in their basal part, but only slightly curved or straight in their distal part. The latter is either parallel to the shaft or diverges from it only slightly.

Among the known species *Hyalonema solutum* F. E. Schulze [1] appears to be the nearest ally of the sponges above described. From this they differ by having much smaller pinules, stouter microhexactine rays, spined macramphidisc-shafts, and serrated macramphidisc-teeth. The nearest ally appears to be *H.* (*P.*) *crassum* (*infra*). From this it differs chiefly: — by the absence of macramphidiscs with short and broad anchors and smooth teeth; by the anchors of the serrated macramphidiscs being somewhat differently shaped; by the presence of small macramphidiscs; by the smaller size of the largest micramphidiscs; by the absence of stout paratangential rhabds (tignules) in the superficial membranes; and by having smaller pinules.

Hyalonema (Prionema) crassum, sp. nov.

Plate 106, figs. 4–37; Plate 107, figs. 1–20; Plate 108, figs. 1–17.

A larger and two smaller specimens of this species were trawled nearly under the equator at Station 4742 on 15 February, 1905; 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); they grew on very light, fine Globigerina ooze; the bottom-temperature was 34.3°. They possess macramphidiscs with remarkably stout shafts and thick superficial amphioxes. To these peculiarities the specific name refers.

Shape and size. The largest specimen (Plate **107**, fig. 16) has the shape of a low, thick-walled cup, irregularly circular in outline. The cup measures 36 mm. in transverse diameter and is 21 mm. high. Its wall is at the base about 9 mm. thick, near the margin about 6 mm. Its convex, outer, dermal face is fairly smooth. On the inner, concave, gastral face longitudinally (radially) extending grooves make their appearance. The margin of the cup is rounded. Just outside this rounded margin, where it passes into the outer convex face, a slightly protruding but very distinct crest makes its appearance. This crest, which forms a complete ring round the cup, probably marks the boundary between the dermal and gastral parts of the surface.

The two smaller specimens are similar, but more cake-shaped and respectively 24 and 21 mm. in maximum diameter.

The *colour* of the sponge in spirit is light dirty brown.

The *skeleton.* All the intact parts of the surface are covered with a dense

[1] *F. E. Schulze.* Hexactinellida. Ergeb. Deutsch. tiefsee-exped., 1904, **4**, p. 77, t. 31, fig. 14–22.

spicule-fur composed of the distal rays of the superficial (dermal and gastral) pinules. The dermal and gastral membranes are supported by the lateral rays of these pinules and of the hypodermal and hypogastral pentactines. Very numerous paratangentially extending amphioxes are also found in them. Many of these spicules are very stout and appear as tignules. Hexactine megascleres, amphioxes, microhexactines, and amphidiscs occur in the interior. The microhexactines are exceedingly abundant and appear as dense masses in the sections. They form the chief support of the whole sponge. Of amphidiscs four kinds can be distinguished: — macramphidiscs with smooth teeth, macramphidiscs with serrated teeth, and large and small micramphidiscs. The first two are not frequent and appear to be confined to the superficial parts of the choanosome. The large micramphidiscs are also rather rare. The small micramphidiscs, on the other hand, are exceedingly abundant and form continuous layers in the walls of some of the canals.

The *pinules* (Plate 106, figs. 26–30) of the dermal and gastral faces of the sponge agree so closely in shape and size that I shall here describe them together. All the pinules observed were pentactine. Their distal ray is straight, 110–200 μ long, most frequently 140–165 μ, and 4–5.5 μ thick at the base. The spines it bears are small and not numerous. The longest usually arise from the middle-part of its length, and here the distal ray, together with the spines, attains a maximum diameter of 14–19 μ. The lateral rays are spiny, particularly in their distal half, and generally conical and pointed, more rarely cylindroconical and terminally rounded. They are 20–30 μ long, rarely as much as 35 μ.

In the spicule-preparations I found a few fragments of *diactine pinules* and one whole pinule. Possibly such spicules occur in the above mentioned crest separating the dermal and gastral parts of the surface. I, however, failed to find any such spicules *in situ*, so that it appears very doubtful whether the few observed are proper to the sponge.

The *hypodermal pentactines* (Plate 108, figs. 1, 3–5, 8, 9) have a conical, rather blunt-pointed, usually straight, rarely bent apical proximal ray 1–1.7 mm. long, and 27–62 μ thick at the base. The lateral, paratangential rays are also blunt conical. Those of the same spicule are often markedly unequal; the length of the largest is 300–510 μ.

The *hypogastral pentactines* (Plate 108, figs. 2, 6, 7) are similar to the hypodermal but have on the whole shorter and somewhat stouter rays. Their dimensions are: — length of apical ray 0.75–1.35 mm.; basal thickness of apical ray 30–70 μ; length of lateral rays 230–320 μ.

The *hexactine megascleres* (Plate 108, figs. 10–13) are 0.7–2.5 μ in diameter, and have straight or slightly curved, blunt, conical rays 20–55 μ thick at the base.

Three kinds of *amphioxes* can be distinguished: — large ones, confined to the choanosome; intermediate and small ones, found both radially situated in the choanosome and paratangentially situated in the dermal and gastral membranes; and small stout paratangentially situated ones, confined to the dermal and gastral membranes.

The *large amphioxes of the choanosome* measured are 2.5–8.5 mm. long and 18–80 μ thick. These spicules are 90–140 times as long as thick.

The *intermediate and small slender amphioxes of all parts of the body* are 0.67–2.5 mm. long and 10–35 μ thick. These spicules are 40–160 times as long as thick.

The *small stout amphioxes* (*tignules*) *of the dermal and gastral membranes* are 410–980 μ long and 13–50 μ thick. These amphioxes are 17–39 times as long as thick. A good many of them are distinctly centrotyle, the central tyle being sometimes 9 μ more than the adjacent parts of the spicule in transverse diameter. The gastral small stout amphioxes (Plate 107, fig. 11) are, on the whole, relatively considerably thicker than the dermal, the former being on an average 23.7 times, the latter 28.4 times as long as thick.

Taking all the amphioxes of the sponge together we find that all those under 650 μ in length are less than 40 times as long as thick, while all those over 940 μ in length measured are, with a single exception, more than 40 times as long as thick.

The *microhexactines* (Plate 106, figs. 4–12, 31–37) are 108–175 μ in diameter, on an average about 140 μ. The rays of the same spicule are generally equal and regularly arranged, but are exceptionally unequal in length. The rays are straight, conical, sharp-pointed, at the base 4.5–7 μ thick, usually 5–6.5 μ, and spined. The spines of the proximal part of the ray are sparse, vertical, broad conical, sharp-pointed, and 1.5–2 μ high. Distally the spines become more numerous and crowded, smaller, more slender, and more and more inclined backwards towards the centre of the spicule.

From the morphological point of view four kinds of *amphidiscs* can be distinguished: — 1, large ones with thick shaft, broad and short anchors, and smooth teeth; 2, large ones with slender shaft, medium anchors, and serrated teeth; 3, small ones with long and slender anchors; and 4, still smaller ones with medium anchors.

Examined biometrically, according to their length frequency, the amphidiscs fall into two groups, large and small ones. These two groups are very clearly distinguished, there being no amphidiscs 62–159 μ long. This absence of intermediate amphidiscs finds its expression in the adjoined graph in the large gap of the curve between 72.89 and 129.13. The amphidiscs the lengths of which are represented by the curves to the right of the gap belong to the morphological groups 1 and 2. The two curves overlap considerably. The amphidiscs to

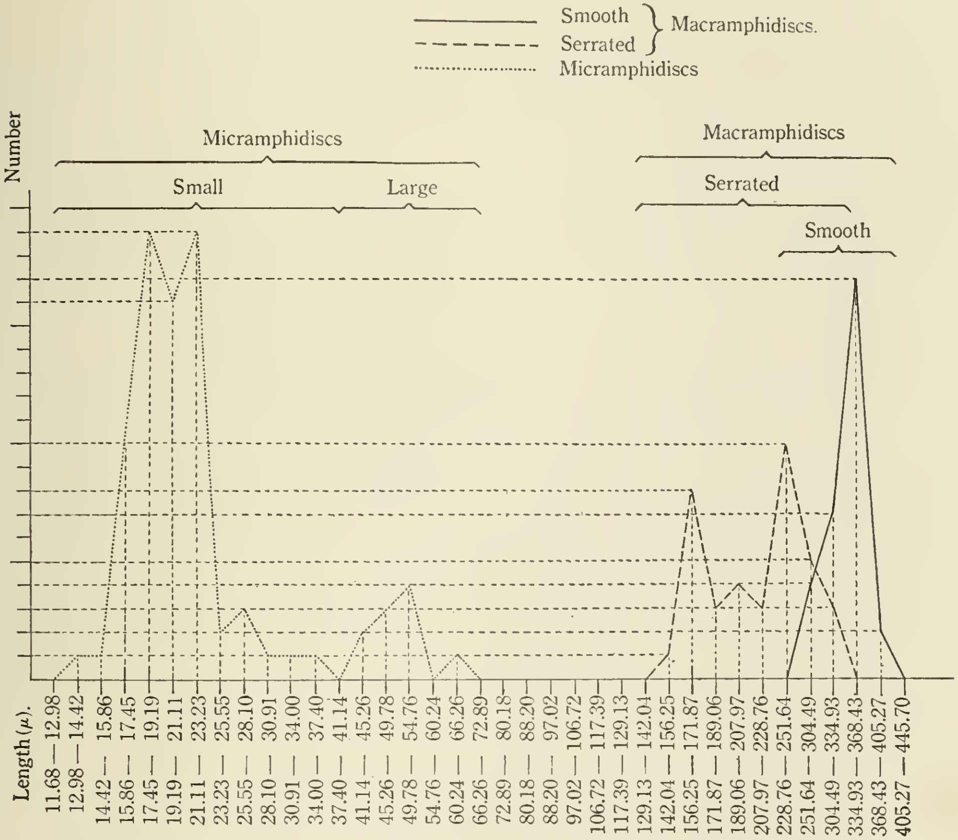

Fig. 13.—Amphidiscs.

which the curve to the left of the gap pertains are those of the morphological groups 3 and 4. There is a conspicuous depression in this curve at 37.40–41.14, corresponding to the absence of amphidiscs 37–41 μ long. This depression may be taken as the limit dividing the (smaller) amphidiscs of the morphological group 4 from the larger ones of group 3.

I designate the four groups of amphidiscs: — smooth macramphidiscs (group 1); serrated macramphidiscs (group 2); large micramphidiscs (group 3); and small micramphidiscs (group 4).

The *smooth macramphidiscs* (Plate **108**, figs. 14–17) are 290–370 μ long, most frequently about 337 μ. Their length frequency-curve is narrow and simple, and has a single summit. The shaft of these spicules is straight, cylindrical, 18–30 μ thick, usually 20–26 μ, and thickened at or near the middle of its length to a central tyle 4–12 μ more in transverse diameter than its adjacent parts. Several broad, terminally rounded spines 3–8 μ long arise from the central tyle. The remaining parts of the shaft are smooth.

The terminal anchors are 55–78 μ in length, usually one sixth to one fourth of the whole spicule, and 105–140 μ broad. The proportion of their length to their breadth is 100 to 155–236, on an average 100 : 174.3. The individual teeth attain their maximum breadth of 20–30 μ in their distal part, and are very abruptly pointed, the contour of their end-part having, when seen *en face*, the shape of a broad gothic arch. The teeth are uniformly curved; the outer contour of the anchor when seen in profile is generally nearly semicircular.

The *serrated macramphidiscs* (Plate **107**, figs. 1–5, 17–20) are 150–328 μ long. Their length frequency-curve is rather broad and irregular, and has three distinct summits. The middle one is quite insignificant; the other two, situated at about 164 and 240 μ respectively, are very pronounced. The shaft of these amphidiscs is straight, 3–6 μ thick, and thickened at or near the middle of its length to a central tyle 2–6 μ more in transverse diameter than its adjacent parts. The central tyle bears a verticil of cylindrical, terminally rounded, straight or curved spines 5–14 μ long. The remaining parts of the shaft are covered with numerous low protuberances (very short spines).

The terminal anchors are 61–105 μ long, the whole spicule being 2.5 to 3.5 times as long as the anchor. The maximum anchor-breadth is 45–100 μ. The end-parts of the teeth of some of these anchors are nearly parallel; in these anchors the end-breadth is equal to the maximum breadth; the end-parts of the teeth of others are convergent,— in these anchors the end-breadth is 2–6 μ less than the maximum breadth. The proportion of anchor-length to anchor-breadth is 100 to 72–102, on an average 100 : 83.6.

The individual teeth arise vertically from the shaft, are strongly bent in their basal part, and straight or only slightly curved in their distal part. Their tips are, as mentioned above, parallel or slightly convergent. The teeth attain their maximum breadth of 12–15 μ in their middle-part, and are attenuated both towards the base and towards the tip. The end of the tooth is simply rounded. From the lateral margins of the teeth pointed triangular protuberances arise, which stand close together and render these margins serrated. The saw-teeth are, in the middle-part of the tooth, about 1 μ high, 2 μ broad, and vertical. Distally they become narrower and smaller and more and more directed backwards (Plate **107**, figs. 17–20). The rounded distal ends of the teeth are smooth.

The *large micramphidiscs* are 42–61 μ long, most frequently about 52 μ. Their length frequency-curve is rather broad and irregular in so far as it exhibits, besides the main summit at about 52 μ, another insignificant one at about 63 μ. The shaft of these amphidiscs is straight, spiny, sometimes centrotyle, and 1.5–2.3 μ thick.

The terminal anchors are 17–22 μ long. The whole spicule is 2.2–3 times as long as its anchors. The maximum anchor-breadth is 9–14 μ. The end-breadth is equal to the maximum breadth or slightly smaller, sometimes as much as 4 μ. The proportion of anchor-length to anchor-breadth is 100 to 53–72, on an average 100 : 62.

The individual teeth, which arise vertically from the shaft, are strongly bent in their basal part and only slightly bent or nearly straight in their distal part, so that their tips are nearly parallel or slightly convergent.

The *small micramphidiscs* (Plate **106**, figs. 13–25) are 13.5–36 μ long. Their length frequency-curve is rather broad and irregular. It exhibits two equally high main summits at about 18.4 and 22.1 μ, and one insignificant summit at about 27 μ. The shaft of these amphidiscs is straight, cylindrical, 0.8–1.2 μ thick, rough or smooth, and usually centrotyle. The tyle, which exceeds the adjacent parts of the shaft 0.2–1 μ in transverse diameter, is often a good distance away from the middle of the length of the spicule.

The terminal anchors are 3.5–14 μ in length, a fifth to a third of the whole spicule, and 5–9 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 61–162, on an average 100 : 119.4. The largest of these small micramphidiscs, that is those over 30 μ in length, are transitional to the large ones above described, not only in respect to size, but also in respect to anchor-shape. The proportion of anchor-length to anchor-breadth is in these spicules on an average 100 : 65. In all the small micramphidiscs, that is in those under 30 μ in length, the anchors are broader than long, the average proportion of anchor-length to anchor-breadth being in these spicules 100 : 125.6.

The anchor-teeth of these spicules are generally strongly and rather abruptly bent at a point a third of their length from the base, and only slightly curved in their distal and proximal portions. A more or less conspicuous conical spine with a maximum height of 0.5 μ arises from the centre of the apex of the anchor. The anchors are very frequently irregular in so far as some teeth are considerably longer than the opposite teeth (Plate **106**, figs. 21–23, 25).

The nearest ally to *H.* (*P.*) *crassum* is *H.* (*P.*) *spinosum* (p. 273). From this *H.* (*P.*) *crassum* differs chiefly: — by possessing macramphidiscs with short and broad anchors and smooth teeth; by the anchors of the serrated macramphidiscs being somewhat differently shaped; by the absence of the spicules there described as small macramphidiscs; by the largest micramphidiscs attaining a much larger size; by the presence of stout paratangential rhabds (tignules) in the superficial membranes; and by having longer pinules.

Hyalonema (Prionema) pinulifusum, sp. nov.

Plate 70, figs. 11–24; Plate 71, figs. 1–11; Plate 72, figs. 1–15.

I establish this species for a fragment trawled off the south coast of western Panama at Station 4621 on 21 October, 1904; 6° 36′ N., 81° 44′ W.; depth 1067 m. (581 f.); it grew on a bottom of green mud and rock; the bottom-temperature was 40.5°. It possesses large pinules with distal rays greatly thickened in the middle and markedly fusiform in shape. To these the name refers.

Shape and size. The specimen is a flat fragment, 14 cm. long, 8 cm. broad, and with a maximum thickness of 1 cm. The margin is lacerated. The specimen is composed of lamellae about 1 mm. thick, separated by wide cavities. It probably formed part of a lamellar or cup-shaped sponge.

The *colour* in spirit is brown.

The *skeleton.* On many parts of the surface the pinule-fur is still more or less intact. A number of small wart-like protuberances, 0.5–1.5 mm. broad and high, arise on one side of the lamellar body. These bear on their summits dense masses of medium-sized pinules. Much larger scattered pinules with stout, spindle-shaped distal ray arise from the walls of the wide depressions between these protuberances. Pinules of the same kind densely cover the margins of some of the lamellae on the other side of the sponge. Other parts of the thin lamellae bear sparse, small pinules, with relatively few and small spines on the slender distal ray. Besides these three kinds of pinules, a fourth kind, with distal rays terminating in a rather long and slender terminal cone and with large secondary spinelets on the primary spines of the distal ray, has been found quite frequently in the preparations. These pinules are identical with certain pinules of *Hyalonema* (*Prionema*) *azuerone*, a large specimen of which was contained in the same bottle as the fragment of *Hyalonema* (*Prionema*) *pinulifusum*. I am therefore inclined to consider these pinules as spicules of the *H.* (*P.*) *azuerone* which got into the *H.* (*P.*) *pinulifusum* accidentally.

Of the three kinds of pinules which I consider proper to the sponge, the small ones with short and sparse spines on the distal ray are doubtlessly canalar. The two other kinds are probably dermal and gastral, but the fragmentary condition of the specimen renders it impossible to say which are which. In the following description I name these three kinds of pinules: — large pinules; medium pinules; and small, canalar pinules, respectively.

Pentactines have been found under various parts of the surface of the lamellae. Some hexactine and tylostyle megascleres and dense masses of diactine rhabds occur in the interior. The microscleres are numerous microhexactines, few micropentactines transitional between the microhexactines and the small canalar pinules, and amphidiscs. Of the latter seven kinds can be distinguished: — macramphidiscs; large and small mesamphidiscs with serrated teeth; large and small mesamphidiscs with smooth teeth; and large short-anchored, and small long-anchored micramphidiscs.

The *large pinules* (Plate **70**, figs. 15–19; Plate **71**, fig. 11) are generally pentactine, only very few hexactine ones having been observed. The distal ray is straight, fusiform, 200–400 μ long, generally 230–370 μ, on an average 358 μ, and 8–16 μ thick at the base. Above it thickens very considerably and it measures, without the spines, 18–50 μ in transverse diameter at the point of maximum thickness, which lies a short distance above the middle of its length. Farther on it again becomes thinner, and it ends in a rather broad and short, blunt- or sharp-pointed terminal cone. Its profile without the spines is elongate oval, drawn out at one end to the nearly cylindrical basal part and at the other to the terminal cone. The nearly cylindrical basal part and the distal cone are quite smooth, the remaining parts of it are covered with numerous large spines. The spines are usually all directed upwards and slightly curved, concave to the ray. The very lowest are quite divergent, the others strongly inclined, and in their end-parts nearly parallel to the adjacent part of the surface of the ray. Exceptionally (Plate **70**, fig. 19) some of the lowest spines are directed downwards. The spines are generally 12–40 μ long, 3–8 μ thick at the base, simple, conical, and sharp-pointed; they rarely bear one or two secondary spinelets on the outer, convex side. The maximum diameter of the distal ray, together with the spines, is 40–63 μ.

The lateral rays are straight, in the same spicule equal or somewhat unequal, and either nearly cylindrical throughout and terminally rounded, or cylindrical in their proximal part, conical in their distal part, and blunt-pointed. They generally bear a small number of rather larger spines on their distal part. The lateral rays are, at the base, considerably thinner than the basal part of the distal ray, and attain a length of 34–52 μ, on an average 44.5 μ.

The proximal ray of the hexactine forms is about as long as the laterals.

The *medium pinules* (Plate **70**, figs. 20–24) are pentactine. Their distal ray is straight, 165–216 μ long, generally 167–205 μ, on an average 189 μ, and 5.5–9 μ thick at the base. Their basal part is for a considerable distance free from spines, and they end in a very short likewise spineless terminal cone. Their remaining parts bear somewhat sparse and rather divergent spines which are slightly curved, concave to the ray. The spines are conical, sharp-pointed, about 3 μ thick at the base, and attain 30 μ in length. They are usually simple; occasionally one or two bear a small secondary spinelet. The maximum thickness of the distal ray, together with the spines, is 33–48 μ. The lateral rays are conical, terminally rounded, and 35–48 μ long. Their distal part bears a small number of rather large spines which sometimes form an irregular verticil below the end of the ray.

The *small canalar pinules* (Plate **70**, figs. 11–14) are generally pentactine, very rarely hexactine. The distal ray is 110–240 μ long, generally 120–206 μ, on an average 167 μ, and 3.5–8.3 μ thick at the base. Its basal part and its long and slender terminal cone are smooth; its middle-part bears a small number, generally about a dozen or so, of sparse, small, straight or slightly curved spines which are directed obliquely upwardly. The maximum thickness of the distal ray, together with the spines, is 9–25 μ. The lateral rays are cylindrical and smooth in their basal, conical and spiny in their distal part. They measure 28–62 μ in length. The proximal ray (of the hexactine forms) is about as long as the laterals.

The superficial (hypodermal and hypogastral) *pentactines* have straight, conical, terminally rounded rays. The dimensions of the few I was able to measure are: — basal thickness of rays 10–23 μ, length of proximal ray 300–410 μ, length of lateral rays 177–430 μ.

The *hexactine megascleres* observed were 0.6–1 mm. in diameter, and had straight conical rays, 10–24 μ thick at the base.

Most of the *rhabd megascleres* are rather long blunt amphioxes with hardly a trace of a central tyle. Besides these spicules, which form the bulk of the supporting skeleton, smaller amphioxes with distinct central tyle, tylostyles, and, exceptionally, amphityles are met.

The *ordinary amphioxes* are fusiform, very blunt at the ends, 0.8–2.5 mm. long, 10–33 μ thick in their middle-part, and generally curved. In a good many of them, particularly the long ones, the curvature is very considerable. A few angularly bent spicules of this kind have also been observed.

The *small centrotyle amphioxes* are generally 390–620 μ long; but larger ones, connecting them with the amphioxes above described, have also been observed. The small centrotyle amphioxes are straight or only slightly curved, and 7–14 μ thick near the middle. The central tyle is 12–30 μ in transverse diameter, that is 5–16 μ more than the adjacent parts of the spicule.

The *tylostyles* are amphiox-derivates with one ray reduced in length and terminally thickened. Their dimensions are: — total length 1.2–1.7 mm.; maximum thickness 16–22 μ at morphological centre, which lies somewhere between the middle of the length and the terminal tyle; transverse diameter of terminal tyle 13–24 μ; thickness just below terminal tyle 10–16 μ, that is 3–8 μ less than the diameter of the terminal tyle. The terminal tyle is more or less spherical, and usually bears one or two small, stout, truncate or terminally rounded spines. Occasionally a rather large spine arises from it.

The *amphityles* are amphiox-derivates with both rays reduced in length and terminally thickened. One that I measured is 1.7 mm. long, and 27 μ thick in the middle and just below one of the terminal tyles. Towards the other tyle it is attenuated to 15 μ. The two terminal tyles are respectively 41 and 22 μ in diameter.

The *microhexactines* (Plate 71, figs. 1–4, 9) are regular, the six rays of the same spicule usually being fairly equal. These spicules measure 80–120 μ in total diameter. The rays are straight or slightly curved, conical, fine-pointed, 1.5–2.2 μ thick at the base, and just perceptibly roughened by exceedingly minute spines.

A few *micropentactines* (Plate 71, fig. 10) have been found, which appear to connect the regular microhexactines with the small canalar pinules. These spicules are 80–140 μ in diameter and have rays 2–3.7 μ thick at the base.

The *amphidiscs*, which are 15–470 μ long, exhibit a remarkable degree of diversity. I have measured 178 of them. Their length frequencies are represented in Figure 14.

The figure shows that the lengths of the amphidiscs form a nearly uninterrupted series. At one point only we find the next largest amphidisc more than

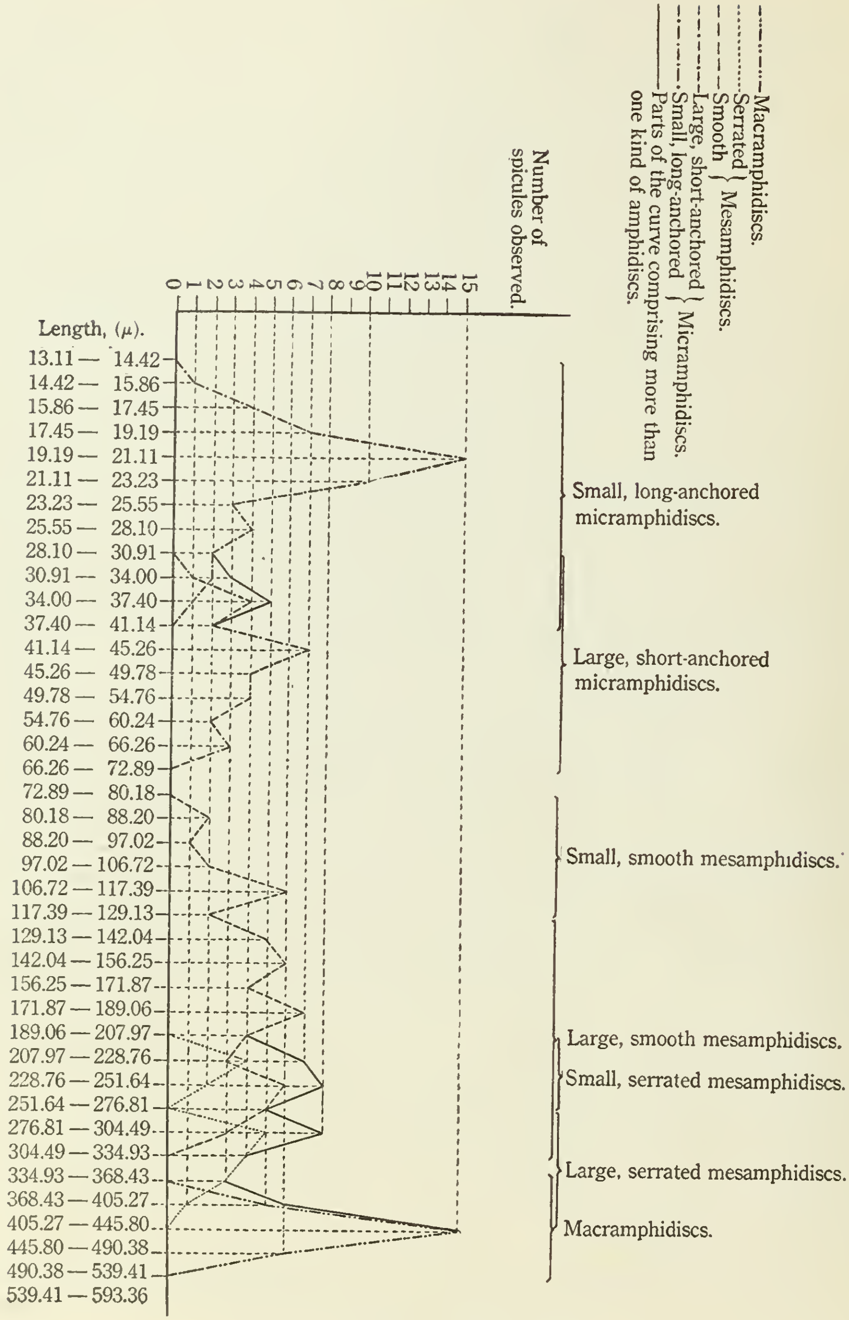

Fig. 14.—Amphidiscs, length frequencies.

1.1 times longer than the next smallest. This point lies between 62 and 84 μ. The amphidiscs 62 μ long and shorter, that is those 15–62 μ in length, I consider as micramphidiscs. Some of these micramphidiscs have relatively longer, others relatively shorter anchors. The relatively long-anchored are 15–35 μ long, the relatively short-anchored 33.5–62 μ. The length frequency-curve of the micramphidiscs exhibits two marked principal elevations which correspond respectively to the most frequent sizes of the long- and short-anchored forms. Within the micramphidiscs two groups can therefore be distinguished, both from a morphological and biometrical point of view: — *smaller long-anchored micramphidiscs*, and *larger short-anchored micramphidiscs.*

Of the amphidiscs 84 μ long and longer, that is those 84–470 μ in length, some have slender, others broad anchors. The slender-anchored are 84–380 μ long, the broad-anchored 370–470 μ. The part of the length frequency-curve pertaining to these amphidiscs exhibits one pronounced main elevation situated at about 425 μ, close to its maximum end. The amphidiscs represented by this main elevation are all broad-anchored. These spicules form a homogeneous group, which I name *macramphidisc* because it comprises the largest amphidiscs of the whole series. Some of the slender-anchored amphidiscs have smooth, others serrated teeth. Those with smooth teeth are 84–292 μ long, those with serrated teeth 214–380 μ. Since the slender-anchored amphidiscs with serrated teeth are on the whole much larger than those with smooth teeth; since all the slender-rayed amphidiscs over 292 μ in length are serrated ones; and since the morphological difference of teeth serrated and teeth smooth is of considerable importance, I propose to consider these two kinds of slender-anchored amphidiscs as belonging to two distinct groups; although biometrically, judged merely by the length frequency-curve of the amphidiscs in general, they are not differentiated. I name these two groups, which are, in size, intermediate between the micramphidiscs and the macramphidiscs, *smooth mesamphidiscs* and *serrated mesamphidiscs* respectively. The length frequency-curve of each exhibits, when taken by itself, a depression, particularly well-marked in the case of the curve of the latter. In the curve of the smooth mesamphidiscs this depression lies at 121 μ, in the curve of the serrated mesamphidiscs at 260 μ. As shown by the two depressions of these two curves, a *large* and a *small* kind of spicule can be distinguished in both of them.

The amphidiscs of *Hyalonema* (*Prionema*) *pinulifusum* can accordingly be arranged in seven groups: —

I. Macramphidiscs (1)
II. Mesamphidiscs
- A serrated mesamphidiscs
  - a large serrated mesamphidiscs (2)
  - b small serrated mesamphidiscs (3)
- B smooth mesamphidiscs
  - a large smooth mesamphidiscs (4)
  - b small smooth mesamphidiscs (5)

III. Micramphidiscs.
- A larger short-anchored micramphidiscs (6)
- B smaller long-anchored micramphidiscs (7)

The *macramphidiscs* (Plate **71**, figs. 5–8) are 370–470 μ long, most frequently about 425 μ. The shaft is straight, for the greater part of its length cylindrical, and 15–22 μ thick. It is gradually thickened towards the ends, and generally also slightly and somewhat abruptly thickened near the middle to a central tyle. The ends usually exceed the thinnest part of the shaft by 9–12 μ in thickness. The central tyle is small, or absent altogether, and measures, when present, 18–29 μ in transverse diameter, that is 1–9.5 μ more than the adjacent parts of the shaft. The shaft is very poor in spines. Sometimes it bears no spines at all. Usually one to three cylindrical and truncate, or cylindroconical and terminally rounded spines arise from the central tyle, or, when it is absent, from a corresponding point of the shaft. These spines are 4–11 μ long and 3–9 μ thick. The remaining parts of the shaft are either quite smooth or bear one or a few spines similar to the central ones.

The anchors are 126–162 μ long, about a third of the whole spicule, and 153–177 μ broad. The proportion of their length to their breadth is 100 to 103–138, on an average 100 : 115.3. They are composed of eight teeth. The individual teeth have the usual T-shaped transverse section. The upper (outer) part of the teeth, which corresponds to the upper stroke of the T, is band-shaped, 24–29 μ broad, and abruptly pointed or rounded at the end. The margins of these bands, that is the lateral margins of the teeth, are either smooth throughout, or they exhibit slight irregularities, sometimes even an indication of a serration, in their distal part. The lower (inner) part, which corresponds to the lower stroke of the T, is, at the base of the tooth, usually 19–22 μ high. The teeth arise nearly vertically from the shaft, and are curved downward in such manner that their ends are either parallel or convergent. In the latter case the anchor is, at the end, sometimes 17 μ narrower than in its broadest part, above.

The *large serrated mesamphidiscs* (Plate **72**, figs. 1, 2) are 280–380 μ long, most frequently about 295 μ. The shaft is straight, for the greater part of its length cylindrical, and 8–15 μ thick. It is gradually thickened towards the ends, and abruptly thickened at or near the middle to a central tyle 14–22 μ in transverse diameter, that is 5–7 μ more than the adjacent parts of the shaft. The central tyle bears a verticil of spines, which is either regular and situated in a plane vertical to the axis of the shaft or irregular and oblique to the axis of the shaft. The individual spines are 2–13 μ long, and 2–6 μ thick at the base. Their end-parts are generally more or less, sometimes very considerably, curved. The remaining parts of the shaft bear a smaller or larger number of similar but smaller and less curved spines.

The terminal anchors are usually regular, more rarely irregular, with longer teeth on one side than on the other. The tips of the teeth of such anchors lie in a plane oblique to the axis of the shaft. If one anchor is thus oblique, the other anchor of the same spicule is generally oblique to the same extent, but in the opposite direction, so that the two planes passing through the tips of the teeth of the two anchors are approximately parallel. In a large serrated mesamphidisc in which this obliqueness of the anchors was particularly pronounced, I found the spine-verticil on the central tyle oblique also, but in a direction opposite to that of the two planes passing through the tips of the anchor-teeth. The anchors are 111–155 μ long, a little over two fifths of the whole spicule, and 67–116 μ broad. The proportion of their length to their breadth is 100 to 56–75, on an average 100 : 66.5. The upper (outer) band-shaped parts of the individual anchor-teeth are 15–23 μ broad in their middle-part. They taper gradually to the rounded or abruptly pointed end. The teeth are curved downward (inward); more strongly in their basal part, and often at a point lying near the end; less strongly in their other parts. This curvature is, on the whole, such that the ends of the teeth converge considerably. The ends of the anchors are generally 9–17 μ narrower than their broadest parts, above. The lateral margins of the teeth are distinctly serrated. The serration is quite regular in the proximal and middle-parts of the teeth, but often irregular in their end-parts. The saw-teeth are generally higher than broad, sharp-pointed, and close together. They measure 1–3 μ in length and 1–2 μ in breadth.

The *small serrated mesamphidiscs* are similar to the large ones. Their principal dimensions are: — total length 214–240 μ, most frequently about 215 μ; length of anchors 83–110 μ; breadth of anchors 52–68 μ; proportion of anchor-length to anchor-breadth 100 to 59–66, on an average 100 : 62.3.

The *large smooth mesamphidiscs* (Plate **72**, figs. 3–6) are 122–292 μ long. Their length frequency-curve has three nearly equal elevations at about 150, 180, and 240 μ. The shaft is nearly always straight, only in two of the hundreds observed was it markedly curved. The shaft is for the greater part of its length cylindrical, and 4–9 μ thick. It is abruptly thickened at or near the middle to a central tyle 7–18 μ in transverse diameter, that is 2–11 μ more than the adjacent parts of the shaft. The tyle bears a number of spines which are generally arranged in a more or less verticillate manner, sometimes however scattered indiscriminately over the whole tyle. When these spines form a verticil, this is situated in a plane either vertical or oblique to the axis of the shaft. The individual spines are usually strongly curved or abruptly bent in their distal part, cylindroconical, and truncate or terminally rounded. They are 2–11 μ long, and about 2 μ thick at the base. The remaining parts of the shaft generally bear numerous small, and often also several large spines, 4–6 μ long, exceptionally as much as 10 μ. The small spines usually arise vertically; most of the large ones are oblique, directed and also curved in a distal direction (towards the adjacent anchors, away from the central tyle).

The anchors are, as in the large serrated amphidiscs, either regular or irregular, oblique, with the teeth on one side longer than the teeth on the other. The two anchors of the same spicule are generally fairly equal in size; sometimes, however, one is considerably larger than the other. In one of the large smooth mesamphidiscs observed, one anchor measured 133 by 78 μ, the other only 112 by 62 μ. The anchors are 47–133 μ long, usually over two fifths of the whole spicule, and 26–78 μ broad. The proportion of their length to their breadth is 100 to 49–73, on an average 100 : 57.9. The anchors are composed of ten to twelve teeth. The individual teeth are curved, more strongly in their basal part and often also in their distal than in their middle-part. Their total curvature is such that their ends are either parallel or only slightly convergent or divergent. In the forms with terminally convergent teeth the end-breadth of the anchor is sometimes 7 μ less than its maximum breadth.

The *small smooth mesamphidiscs* (Plate **72**, figs. 7, 8) are similar to the large ones, but have not so sharply defined central tyles, and relatively broader anchors. Their dimensions are: — length 84–120 μ, most frequently about 110 μ; thickness of shaft 2–5 μ; diameter of central tyle 3.4–9 μ, that is 0.6–4 μ more than that of the adjacent parts of the shaft; anchor-length 30–46 μ; anchor-breadth 21–40 μ; proportion of anchor-length to anchor-breadth 100 to 60–87, on an average 100 : 73. The anchors of these spicules are composed of about ten teeth.

The *large short-anchored micramphidiscs* (Plate **72**, fig. 15) are 33.5–62 μ long, most frequently about 44 μ. The shaft is 0.9–2.8 μ thick, and usually thickened at or near the middle to a central tyle, which is sometimes 1.1 μ more than the adjacent parts of the shaft in transverse diameter. In many of these spicules the tyle is very insignificant, and in some not a trace of a central tyle could be detected. The shaft usually bears minute scattered spines, the most conspicuous of which arise from the central tyle.

The anchors are 5–24 μ long, usually about a quarter of the whole spicule, and 8–17 μ broad. The proportion of their length to their breadth is 100 to 71–160, on an average 100 : 109.3. The individual teeth are curved rather uniformly throughout. Their ends are more or less divergent.

The *small long-anchored micramphidiscs* (Plate **72**, figs. 9–14) have remarkably stout shafts. They are 15–35 μ long, most frequently about 20 μ. The shaft is straight, 1.2–2.5 μ thick, and frequently thickened at one place to a spindle-shaped "central" tyle, sometimes 1 μ more than the adjacent parts of the shaft in transverse diameter. This tyle is usually situated very eccentrically. In the larger forms the shaft bears numerous conspicuous spines (Plate **72**, fig. 14). In the smaller ones the spines are fewer in number and smaller in size; sometimes they are absent altogether.

The anchors are 5–16 μ long, about a third of the whole spicule, and 6–13 μ broad. The proportion of their length to their breadth is 100 to 77–200, generally 100 to 83–140, on an average 100 : 112.3. The anchor-teeth are curved towards the shaft quite strongly in their basal part, and less strongly or not at all in their distal part. The tips of the teeth (their distal straight parts) are nearly parallel to the shaft.

Its fragmentary nature renders it impossible to say with certainty to which genus of the Amphidiscophora this sponge belongs. The chief reason for placing it in Hyalonema (Prionema) is the presence of serrated amphidiscs and the general resemblance of its spiculation to that of some of the species of this genus. Its nearest allies appear to be *Hyalonema hercules* F. E. Schulze,[1] and *H.* (*P.*) *agujanum* (p. 251). *Hyalonema hercules* resembles it in its general appearance, but differs from it in respect to its macramphidiscs and gastral pinules. In *H. hercules* the macramphidiscs have four large spines, arranged crossways, on the central tyle, and the gastral pinules have very long and slender distal rays. In the sponge above described the tyles of the macramphidiscs bear only from one to three quite insignificant spines, and there are no such pinules with long and

[1] *F. E. Schulze.* Amerikanische Hexactinelliden, 1899, p. 9, taf. 1, figs. 19–29.

slender distal rays as the gastrals of *H. hercules*. It is also to be noted that *H. (P.) pinulifusum* possesses amphidiscs with serrated teeth, while Schulze does not mention the occurrence of such amphidiscs in *H. hercules*. From *H. (P.) agujanum*, which agrees with *H. (P.) pinulifusum* quite well in regard to the amphidiscs, and indeed from all other Amphidiscophora with the exception of the above mentioned *H. hercules*, it differs by possessing large pinules with thick spindle-shaped distal ray. It is also to be noted that *H. (P.) agujanum* differs from it in its general appearance.

Hyalonema (Prionema) fimbriatum, sp. nov.

Plate 59, figs. 1–6; Plate 60, figs. 1–34; Plate 61, figs. 1–11; Plate 62, figs. 1–45; Plate 63, figs. 1–28.

Four fairly complete and three fragmentary specimens of this species were trawled in the Central Pacific: the four well-preserved ones and one of the fragmentary ones at Station 4742 on 15 February, 1905; 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); they grew on very light, fine Globigerina ooze; the bottom-temperature was 34.3°; the two other fragmentary ones at Station 4740 on 11 February, 1905; 9° 2.1′ S., 123° 20.1′ W.; depth 4229 m. (2422 f.); they grew on dark gray Globigerina ooze; the bottom-temperature was 34.2°.

The anchor-teeth of certain very numerous amphidiscs bear broad, fimbriate, marginal frills. To this the name refers.

Shape and size. The well-preserved specimens from Station 4742 are flattened disc- or lens-shaped and regular, broad-oval to circular (Plate **62**, fig. 30) or slightly irregular, wavy in outline (Plate **62**, fig. 29). The largest regular specimen appears as a biconvex lenticular disc. It is 31 mm. long, 28 mm. broad, and 10 mm. thick in the middle. Towards the margin it thins out to about 3 mm. One of the faces of the disc bears a rather eccentrically situated rounded protuberance 3 mm. in height, from which, in life, the stalk arose. Where the superficial membranes are intact the surface is continuous and destitute of larger apertures. In other places it is porous. Two of the three other well-preserved specimens from Station 4742 are similar. In one (Plate **62**, fig. 30) the disc measures 25 by 23 by 12 mm., and has one convex, broad and low conic face and one flat face. The protuberance from which the stalk arose is situated on the flat face; this is the dermal. The third regular specimen is 20 mm. in maximum diameter. The slightly irregular specimen (Plate **62**, fig. 29) is a lamella 35 mm. long, 27 mm. broad, and 6 mm. thick in the centre. It thins out distally, the somewhat wavy margin being 1–3 mm.

thick. The fragment from Station 4742 is a porous lamellar mass 30 mm. long. The two fragments from Station 4740 are also porous lamellar masses, and 30 and 35 mm. long respectively.

The *colour* of all the specimens in spirit is very light brown.

The *skeleton.* The dermal and gastral surfaces are covered by a dense pinule-fur. The dermal and gastral pinules appear to be quite similar. The lateral rays of these pinules, the lateral rays of large pentactines, and rhabds are found in the superficial membranes. The radial, inwardly directed apical (proximal) rays of the pentactines and radially or obliquely disposed rhabds traverse the space underlying the superficial membrane. In the lower part of this region, and in the distal zone of the choanosome, fimbriate amphidiscs are met in large numbers. In some parts of this region these spicules form dense masses (Plate 60, fig. 24). In the walls of many of the internal canals large canalar pinules form a fur, often quite dense. Besides these spicules there occur in the choanosome rhabds, often forming bundles, hexactine megascleres of various sizes, microhexactines, micropentactines, macramphidiscs, and micramphidiscs. The micramphidiscs are not numerous and occur chiefly in the canal-walls. In the basal protuberance, from which, in life, the stalk arose, the following spicules occur besides those of the choanosome: — numerous slender-rayed, long-spined tetr- to hexactine acanthophores; a few monactine-derivates of these; numerous di- to pentactine acanthophores with stout rays; numerous more slender, modified, sometimes very strongly curved acanthophore rhabds; and numerous anchor-spicules.

Besides these spicules which are doubtlessly proper to the sponge, various others, which I take to be foreign, are found, sometimes in large numbers. These are: — pentactines with a very stout, spindle-shaped proximal ray sometimes 100 μ thick; large amphidiscs of various kinds, most of which are similar to, and probably identical with, the large macramphidiscs of *Hyalonema agassizi;* giant pentactine pinules as much as 1.2 mm. long; and other kinds of pinules. The large foreign amphidiscs usually occur in clusters.

The *superficial* (*dermal and gastral*) *pinules* (Plate 62, figs. 1–4, 16–18) are always pentactine. They have a straight distal ray 63–87 μ long, on an average (of 27 measurements) 71.8 μ, and 3.2–4.8 μ thick at the base. It is thickened in or near the middle, and is here 4.5–6 μ in transverse diameter. It ends with a regular or somewhat irregular terminal cone. Its irregularities appear to be caused by the concrescence with it of the distal spines, which lie nearly parallel to it. The distal ray bears sparse, irregularly distributed spines. The basal and distal spines are short, the middle ones have a maximum length of 15–28 μ. These long spines point obliquely upwards and usually enclose an angle of 30°–40° with the axis of the distal ray. The maximum diameter of the distal ray, together with the spines, is 27–45 μ. The spines are conic, sharp-pointed, and straight or curved, concave towards the tip of the ray. They are usually simple, but occasionally bear small secondary spinelets. The lateral rays (Plate **62**, figs. 16–18) are straight, nearly cylindrical in their basal and middle-parts, abruptly pointed, and 23–36 μ long, on an average (of 42 measurements) 28.3 μ. They bear, along their whole length, with the exception of base and tip, rather sparse conspicuous spines about 2 μ long. The proximal spines are vertical, the distal ones inclined towards the tip of the ray.

Among these pinules I found an abnormal one with a reduced distal ray only 20 μ long, bent and rounded at the end, and destitute of large spines.

The *canalar pinules* (Plate **62**, figs. 19, 32–41) are also nearly always pentactine. I found only a single hexactine one among them. This had a proximal ray 53 μ long. The distal ray is straight, 80–122 μ long, exceptionally as much as 138 μ, on an average (of 29 measurements) 103.6 μ long, 3–6.5 μ thick at the base, and thickened in the middle, where it measures 4–8 μ in transverse diameter. Its end appears as a slender, sharp-pointed cone. The distal ray bears irregularly arranged spines. The number of these spines is never great. Sometimes there are only three or four (Plate **62**, figs. 32, 41). The largest spines generally arise from the middle-part of the ray; proximally and distally they become smaller. The spines are conic, sharp-pointed, straight or curved, usually concave towards the tip of the ray. They are generally simple, only very rarely they bear small secondary spinelets. The large spines of the middle-part of the ray are usually 10–52 μ long, strongly divergent and generally inclined towards the tip of the ray. Occasionally, however, some of them are vertical (Plate **62**, fig. 38) or inclined towards its base (Plate **62**, fig. 41). The maximum diameter of the distal ray, together with the spines, is 20–77 μ. The lateral rays are conic, 40–88 μ long, and bear numerous small spines.

These spicules are connected with the micropentactines described below by transitional forms, in which the spines of the distal ray are much smaller, only 1–3 μ long. The maximum transverse diameter of the apical (distal) ray, together with the spines, of these pinules (pinule-derivates) is only 7–9 μ.

The *pentactine megascleres* underlying the superficial membrane (Plate **63**, fig. 7–9) have straight or only very slightly curved, usually conic rays, 13–60 μ thick at the base. Occasionally a ray is reduced in length and terminally rounded. The apical (proximal) ray is 0.6–2.1 mm. long; the lateral rays are 0.18–0.7 mm. The latter are inclined inward and enclose with the axis of the proximal (apical) ray an angle of 75°–89°, usually about 80°.

The *hexactine megascleres* (Plate 63, figs. 1–5) measured were 0.5–2.2 mm. in diameter and had rays 10–55 μ thick at the base. Some fragments of such spicules observed, which were up to 62 μ thick, indicate that considerably larger hexactines also occur. The rays of the hexactine megascleres are straight or slightly curved, and usually conic and pointed. One (Plate 63, figs. 4, 5) or two (Plate 63, fig. 1) of the rays may be reduced in length and terminally rounded. The rays of the same spicule are either about equal in size (Plate 63, fig. 3) or unequal. The inequality is usually due to two rays lying opposite being longer than the other four (Plate 63, figs. 1, 2).

Most of the *rhabds* of the body proper are centrotyle amphioxes, but diactines with one ray reduced, and rounded and thickened at the end, also occur. These spicules resemble tylostyles.

The *centrotyle amphioxes* (Plate 63, figs. 10, 11) are nearly straight or slightly curved, 1.2–1.8 mm. and more long, and 9–21 μ thick near the centre. The central tyle measures 12–26 μ in transverse diameter. The relation between its thickness and the thickness of the adjacent parts of the spicule is 106–163, usually about 120 : 100.

The *tylostyle-like rhabds* with one ray reduced and terminally thickened (Plate 63, figs. 12–14) are 1–1.5 mm. and more long and usually 12–24 μ thick. Their terminal tyle is 18–36 μ in diameter.

The *slender-rayed, long-spined acanthophores* of the protuberance, from which in life the stalk arose (Plate 62, figs. 20–26), have four to six rays, and are connected by transitional forms with the pinules. They measure 130–220 μ in diameter, and have straight or slightly curved, pointed rays 3–4.5 μ thick and beset with numerous spines. The spines on the middle-parts of the rays are usually the largest, and are 3–21 μ long. Proximally and distally they decrease in size. The spines are either all directed obliquely outward, or only the distal ones are thus inclined, the proximal ones arising vertically. The rays of the same spicule are usually unequal in respect to their spinulation and for a certain extent also in respect to their size. Sometimes (Plate 62, figs. 20, 21, 23, 25) this inequality is inconsiderable, sometimes (Plate 62, figs. 22, 24, 26) it is very marked. In the latter case one of the rays is usually longer and provided with longer spines than the others. These spicules, which often resemble pinules quite closely, connect the more regular slender-rayed long-spined basal spicules with the true pinules. The slender-rayed long-spined basals may therefore be considered as pinule-derivates.

The *acanthophores with stout rays* are monactine to pentactine.

Among the *tri- to pentactine acanthophores* (Plate **63**, figs. 15–19) the tetractines with four rays extending in one plane (stauractines) greatly predominate. The maximum diameter of these spicules usually is 330–670 μ, but much smaller forms only 100–300 μ in diameter (Plate **63**, fig. 15) also occur. The rays are equal or unequal, fairly straight, 10–28 μ thick at the base, and slightly attenuated distally. They often have a somewhat wavy outline. Their end-parts are usually thickened, densely covered with rather short, broad spines, and blunt-pointed, or, particularly in the cases where the rays are reduced in length, terminally rounded. The thickened, spiny end-parts of properly developed long rays are accordingly usually spindle-shaped, those of reduced, short rays usually more or less spherical.

Of the diactine or monactine forms, that is the *rhabd acanthophores*, various kinds can be distinguished: — slender, long-spined tylostyles; angularly bent centrotyle diactines; straight or slightly curved, stout, centrotyle diactines; stout, strongly curved, not centrotyle rhabds with thickened ends; slender, slightly curved, long rhabds with thickened ends; and strongly curved rhabds of the last mentioned sort.

The *slender tylostyle monactine acanthophores with long spines* are very rare. A spicule of this kind measured was 220 μ long and 8 μ thick; its terminal tyle measured 18 μ in diameter. I am inclined to consider these spicules as monactine-derivates of the slender-rayed long-spined basal tri- to hexactines above described.

The *angularly bent centrotyle diactine acanthophores* are also very rare. They have a spiny tyle and two straight rays enclosing an angle of about 90°. In one of these spicules measured, the two actines were quite straight, and respectively 13 μ thick and 430 and 500 μ long. The spiny central tyle was 28 μ in diameter.

The *stout, straight or slightly curved, centrotyle diactine acanthophores* (Plate **63**, figs. 20–23) are usually 550–920 μ long, and 14–30 μ thick near the centre. The central tyle is 20–54 μ in diameter. The proportion of the thickness of the tyle to the thickness of the adjacent parts of the spicule is 114–300 : 100. When the tyle is large, it is spiny (Plate **63**, fig. 20); when it is small, it is smooth (Plate **63**, figs. 21–23). The two rays of these spicules have the same shape as the rays of the tri- to pentactine stout-rayed basals above described, but are on the whole longer. I think there can be no doubt about these spicules being diactine-derivates of the stout-rayed tri- to pentactine acanthophores.

The *stout, strongly curved, not centrotyle rhabd acanthophores* (Plate 63, figs. 27, 28) are rare. They are cylindrical, thickened at both ends, and uniformly or irregularly curved. Their middle-part is smooth; their thickened ends are spiny. These spicules are, measured along the chord connecting their ends, usually 300–400 μ long, and about 18 μ thick. The terminal thickenings (tyles) are spherical and measure 35–50 μ in diameter.

The *slender rhabd acanthophores* (Plate 63, fig. 24) are usually slightly and uniformly curved, 0.9–1.3 mm. long, and 5–15 μ thick near the middle. Their ends are more or less spiny and usually thickened. The terminal thickening is sometimes 25 μ and more in transverse diameter. A central tyle, 2–4 μ thicker than the adjacent parts of the spicule, is usually present.

The *strongly curved, slender rhabd acanthophores* (Plate 63, figs. 25, 26) are rare. They are destitute of a central tyle and appear as strongly and irregularly curved slender rods about 7 μ thick. They are usually thicker at one end than at the other, and thickened at both ends to unequal terminal tyles which are spined, more or less spherical, and have a maximum transverse diameter of 25 μ. The maximum diameter (length) of the curve formed by these spicules is usually 300–500 μ.

The *basal anchor-spicules* (Plate 62, figs. 5–11) are spined rods with an anchor at the distal end. These rods have near the middle a maximum thickness of 72 μ, and are attenuated both proximally and distally; proximally to a fine point, distally to a thickness of 9–32 μ just above the anchor. The distal and middle-parts of these rods are covered with straight, strongly inclined, inwardly directed spines 10–25 μ long. Proximally these spines become smaller and finally disappear, so that the inner end-part of the spicule appears quite smooth. The rod is traversed by an axial thread which terminates distally in the middle of the anchor. The end is thickened, and from this thickening four short branch-threads arise, which form a cross lying in a plane vertical to the rod or anchor-shaft. The terminal anchor is 22–128 μ high and 43–140 μ broad. It consists of a stout, spherical centrum from which a number of anchor-teeth arise. The centrum appears as a terminal tyle of the rod forming the anchor-shaft. The teeth extend at various angles obliquely backward (upward) and outward. They are sometimes 40 μ long, blunt, and very irregular and variable in position, shape, curvature, and size. Some are bifurcate or otherwise branched.

All the anchors observed lay altogether within the sponge. The stalk, which no doubt was present in life, is absent in all the specimens. Probably anchors of the kind described above take part in its formation. A few smooth and very stout spicule-fragments found within the stalk-protuberance make it probable, however, that either these anchors are not the sole stalk-spicules, or that the proximal, smooth end-parts of the anchor-shafts are very greatly increased in length and in thickness during the process of further growth, which leads to their distal parts being pushed out from the body to form the protruding stalk.

The six rays of the *microhexactines* (Plate **60**, figs. 25–30; Plate **62**, figs. 42–45) are usually fairly equal; more rarely two opposite ones exceed the other four markedly in length. The microhexactines with equal rays measure 56–95 μ in total diameter, most frequently 65–85 μ, on an average (of 44 measurements) 75.3 μ. Their rays are 1.8–2.8 μ thick at the base, usually about 2 μ, conic, and attenuated to fine points at the end. They bear rather sparse, minute spines. The spines of the basal and middle-parts of the ray are usually 0.2–0.5 μ long; distally they become smaller. The basal half or so of the ray is quite straight, the distal part curved. Where the straight basal part passes into the curved distal part an abrupt, sometimes quite angular bend is often discernible. The curvature of the distal part is very considerable, the direction of the end-part diverging up to 120° and more from the direction of the basal part. The direction of curvature of opposite rays is usually opposite, so that any two opposite rays together generally form an S-shaped curve.

The rare microhexactines with two opposite rays exceeding the other four in length measured were 80–90 μ long and 40–50 μ broad. In these spicules the two opposite, longer rays are not so strongly curved as the four shorter ones.

In a spicule-preparation I found a monactine microhexactine-derivate which appeared as a minutely spined tylostyle with strongly bent pointed end. Its measurements were: — chord 57 μ; thickness 2.5 μ; tyle 4.5 μ.

A few microhexactines 110–120 μ in diameter with straight rays, 4–5 μ thick at the base, were also observed. These rare spicules were perhaps foreign.

The *micropentactines* (Plate **60**, figs. 31–34; Plate **62**, fig. 28) consist of one slightly longer apical and four shorter lateral rays, which latter are fairly equal in size and extend in a plane vertical to the apical ray. The rays of these spicules are straight in their proximal and curved, generally very considerably, in their distal part. Opposite lateral rays are curved either in the same or in different directions. The rays are, measured along the chord, 35–79 μ long, conic, pointed, and 2.8–3.7 μ thick at the base. They bear conic, pointed spines, which, in the proximal part of the ray, attain a length of 0.7 μ. Distally the spines become smaller. These spicules are connected by transitional forms with the canalar pinules.

Occasionally smaller micropentactines with straight rays are met. In a spicule of this kind the rays measured were 4 μ thick at the base, the apical ray was 54 μ long; the laterals were 34 μ long.

Of *amphidiscs* several kinds can be distinguished: — A, large ones, with medium anchors the teeth of which are smooth, and have straight or outwardly curved, diverging ends; B, large, medium-sized, and small ones with slender anchors, the teeth of which bear frill-like, fimbriate membranes on their margins and have inwardly curved, convergent ends; and C, small ones with broad anchors, the teeth of which appear smooth and have end-parts more or less parallel to the shaft.

I measured 202 amphidiscs. The frequency of the various lengths is represented in the following exponential graph (Fig. 15).

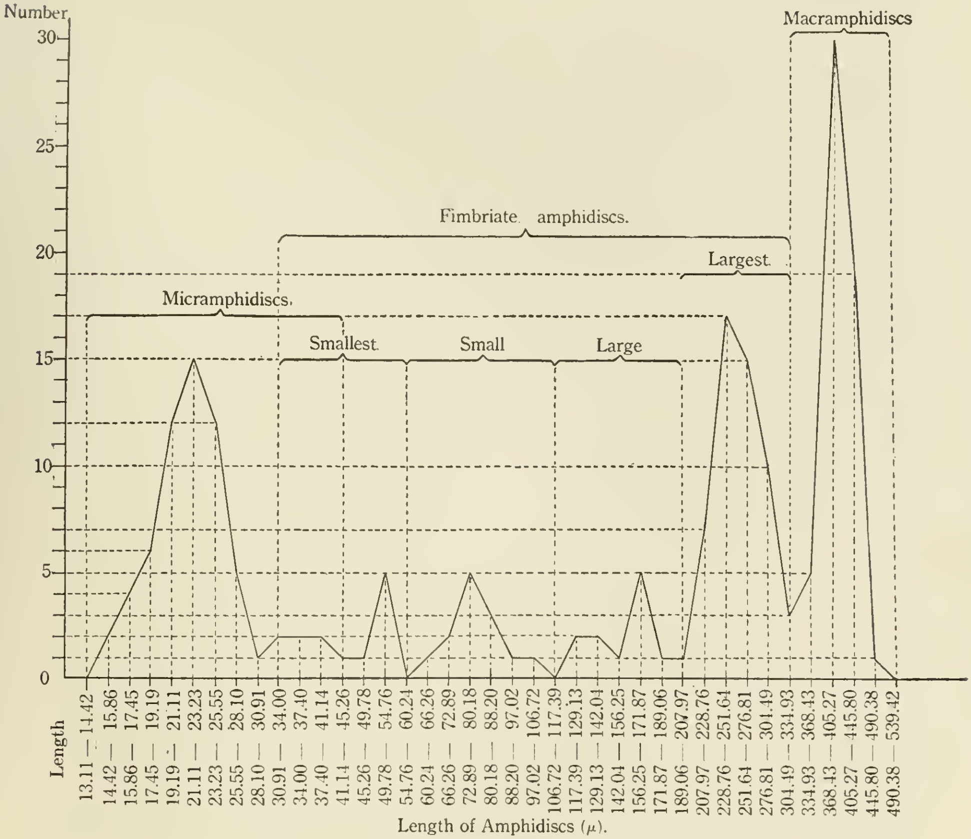

Fig. 15.—Amphidiscs.

The part of the curve between 304.49 and 490.38 μ pertains to the large amphidiscs with smooth, divergent anchor-teeth, A; the part between 34.00 and 334.93 μ to the amphidiscs with fimbriate, convergent anchor-teeth, B; and the part between 14.42 and 41.14 μ to the amphidiscs with smooth anchor-teeth with parallel end-parts, C. There is no dimensional overlapping of A and B and only a slight overlapping of B and C, 14.42 and 34.00. The dimensionally transitional forms of B and C causing this overlapping are, however, rare, so that the part of the curve between 14.42 and 34.00 pertaining to them lies quite low. The three differently shaped amphidisc-forms (A, B, and C) are differentiated accordingly not only in regard to their shape but also in regard to their size (length). Fig. 15 further very clearly shows that the amphidiscs A and C vary only slightly in size and form biometrically homogeneous groups, and that the amphidisc B has a very wide range of dimensional variation and does not form a biometrically homogeneous group. The part of the frequency-curve pertaining to this group exhibits one high and rather broad and three smaller elevations. This shows that the main-group B consists of four secondary groups, the amphidiscs belonging to one of which are frequent, those belonging to the three others, rare. It is therefore advisable to distinguish six groups (three main-groups, one of which, B, comprises four secondary groups) of amphidiscs in the sponges here described: — A, macramphidiscs, Ba, largest fimbriate amphidiscs, Bb, large fimbriate amphidiscs, Bc, small fimbriate amphidiscs, Bd, smallest fimbriate amphidiscs, and C, micramphidiscs.

The *macramphidiscs* (Plate **59**, figs. 1–6; Plate **62**, fig. 31) are 335–446 μ long, most frequently about 400 μ. The shaft is cylindrical, straight, 8–16 μ thick, most frequently about 12 μ, and abruptly thickened in or near the middle to a central tyle 11–22 μ in transverse diameter. The proportion of the thickness of the adjacent parts of the shaft to the thickness of the tyle is 100 to 121–167. From the tyle a verticillate bunch of spines arises. The number of the spines forming this bunch is variable. Sometimes they are few in number and small in size (Plate **59**, fig. 2), sometimes numerous and large (Plate **59**, fig. 1). Forms intermediate between these extremes are the most frequent. The spines forming these bunches are irregularly distributed and, when few in number, frequently confined to one side of the shaft. The individual spines are 7–26 μ long, 4–5.5 μ thick at the base, cylindrical throughout and terminally rounded, or attenuated distally, truncate, and provided with a cluster of exceedingly minute secondary spinelets on the terminal face. The primary spines arise vertically or steeply from the central thickening of the shaft and are, farther on, curved, usually all more or less in the same direction. In short spines this curvature is insignificant, in long spines, very pronounced. The long spines are usually strongly curved in their basal part and straight or slightly curved, not infrequently in the opposite direction, in their distal part. The plane of the main curvature either passes through the axis of the shaft, or it is oblique to it. Since, as above stated, all the spines on the tyle are usually curved in the same direction, the verticillate bunch formed by them appears — when the spines are long — bent, straight or spirally, toward one end of the spicule. The remaining parts of the shaft are smooth. The axial thread passes through the central tyle without being thickened, and there is no trace of an axial cross. I noted, however, a few small dots in the central part of the tyle, near the axial thread, which appeared to have the same refractive index as the axial thread.

The two anchors of the same spicule are fairly equal, or rather unequal, in size. The anchors are 80–180 μ long, a third to two fifths of the whole spicule, and 70–113 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 46–84, usually 100 to 63–80, on an average (of sixteen calculated individual proportions) 100 : 70.

The individual anchor-teeth are near the base 10–14 μ high, and a little farther out, at their widest point, 12–22 μ broad. They are attenuated distally and at the end simply rounded (Plate **59**, figs. 5, 6; Plate **62**, fig. 31) or, more rarely, divided, by a slight indenture, into two terminal lobes (Plate **59**, fig. 4). They arise steeply or vertically from the end of the shaft and are curved in their basal part through an angle of about 80°. Then they become nearly or quite straight and remain so to within a short distance of the end. This long straight part of the tooth encloses an angle of about 10° with the continuation of the axis of the shaft. The end-part of the tooth is slightly bent outward or more rarely straight and extended in the same direction as the middle-part. The plane of the normal curvature of the tooth passes through the axis of the shaft. Occasionally the end-part of a tooth is bent also in a plane vertical to this, paratangentially as it were, to one side (Plate **59**, fig. 6).

The *fimbriate amphidiscs* are all very similar. The only differences between the four biometric groups of them, that is the largest, large, small, and smallest, are those due to the relative anchor-breadth decreasing and the relative size of the central tyle of the shaft increasing with the size of the spicule. Their anchors are from a little less than two fifths to nearly half the whole spicule in length.

The *largest fimbriate amphidiscs* (Plate **60**, figs. 1–6, 24; Plate **61**, figs. 1–11;

Plate 62, fig. 27) form a biometrically homogeneous and well-defined group, entirely separated dimensionally from the (larger) macramphidiscs on the one hand and the (smaller) large fimbriate amphidiscs on the other.

The largest fimbriated amphidiscs are 200–323 μ long, most frequently about 250 μ long. The shaft is straight, on the whole cylindrical, and 4–7.5 μ thick. Its thickness is fairly proportional to the length of the spicule. The shaft is thickened slightly and gradually towards the ends, and considerably and abruptly somewhere in its middle-part. The latter thickening, the central tyle, is usually some distance, occasionally (Plate 60, fig. 5) very far away from the real (geometrical) centre of the shaft, and measures 8–14 μ in transverse diameter. The proportion between the thickness of the adjacent parts of the shaft to the thickness of the tyle is 100 to 160–325. From the central tyle a verticillate bunch of spines arises. These spines (Plate 62, fig. 27) are 5–15 μ long, at the base 2–2.8 μ thick, cylindrical, and terminally simply rounded, or attenuated distally and truncate with a cluster of exceedingly minute secondary spinelets on the terminal face. The (primary) spines are curved. The curvature is irregular, and a rather abrupt angular bend usually occurs somewhere near the middle of the length of the spine. Generally all the spines of the bunch are, as in the macramphidiscs, curved in the same direction longitudinally or obliquely (spirally). The parts of the shaft outside the central tyle bear very numerous spines, the largest of which are 1 μ long, 1.5 μ broad, cylindrical, and provided with a cluster of exceedingly minute secondary spinelets on their flat or rounded terminal face (Plate 60, figs. 5, 6; Plate 62, fig. 27). The degree of development of these scattered (primary) spines is very variable; often they are reduced to hardly perceptible protuberances on the surface of the shaft (Plate 60, fig. 3).

The two anchors of the same spicule are fairly equal, or rather unequal, in size. They usually consist of eight teeth. The anchors are 72–136 μ long, and 43–67 μ broad at their broadest point and attenuated distally, their ends measuring only 32–60 μ in transverse diameter. The difference between the maximum and end-breadth of the anchors is 3–18, on an average (of 29 measurements) 7.8 μ. The proportion of the length to the maximum breadth of the anchors is 100 to 42–72, on an average (of 29 calculated proportions) 100 : 52.2. The largest (longest) anchors are on the whole narrower than the smaller (shorter) ones. The average proportion of length to maximum breadth is in the anchors over 120 μ in length 100 : 47.8, in those under 100 μ in length 100 : 55.7.

The individual anchor-teeth arise nearly vertically from the end of the shaft, are strongly curved, concave to the shaft, for a short distance quite at the base, and slightly and quite uniformly curved in the same direction for the remainder of their length. The total curvature is such that the ends of the teeth converge towards the shaft, and enclose with it angles of about 8°–16°. The body of the tooth has the usual T-shaped transverse section. The lower (radial) part increases in height proximally to 5–9 μ. The upper (paratangential) part is 6–10 μ broad near the middle of the length of the tooth and attenuated both proximally and distally. The distal end of the body of the tooth is narrow and blunt-pointed.

The two margins of the outer part of the tooth (which corresponds to the horizontal upper stroke of the T) are continued in fine, frill-like, fimbriate, siliceous membranes, which diverge from the plane through tooth- and shaft-axis and extend obliquely inward. The tooth, together with its two fimbriate marginal membranes, has a transverse section (Fig. 16).

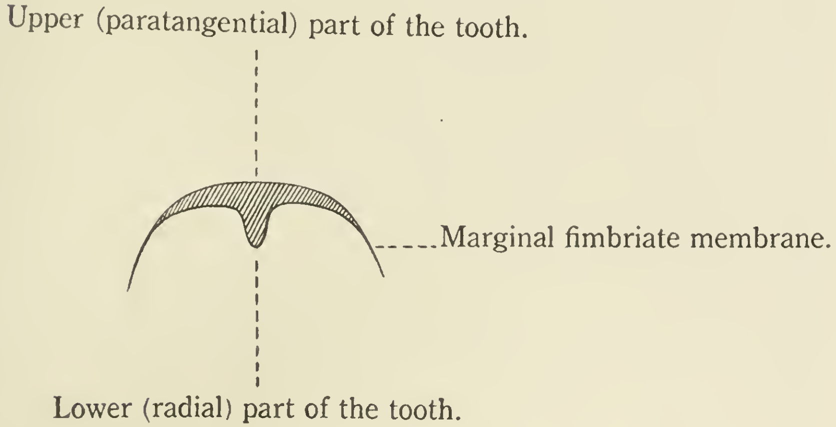

Fig. 16.—Anchor-tooth. Section.

The fimbriate marginal membranes extend from the base (Plate **61**, figs. 4, 5, 8, 9) to the tip (Plate **61**, figs. 6, 7, 10) of the tooth and even slightly beyond it. They are at the base of the tooth quite narrow, only about 1 μ broad (Plate **61**, figs. 4, 5, 8, 9); in the middle of the tooth (Plate **61**, figs. 1–3) they broaden distally and attain a breadth of about 7 μ. Beyond they again become slightly narrower and are, at the end of the tooth, about 4 μ broad. Narrow and deep incisions, extending down to the body of the tooth, divide these membranes into lobes, which are, in the distal and middle-part of the tooth, on an average about

2 μ broad; proximally they become considerably narrower. Secondary incisions subdivide the marginal parts of these primary into secondary lobes, so that they attain a somewhat dendritic appearance (Plate **61**, figs. 1–3).

I am not aware that such fimbriate marginal membranes have hitherto been observed in the amphidiscs of the Hexactinellida Amphidiscophora. They may be compared with the thin marginal parts of the cladomes of the phyllo- and discotriaenes of certain lithistid Tetraxonida.

The *large fimbriate amphidiscs* (Plate **60**, figs. 7–11) are 122–185 μ long, most frequently about 163 μ. Their shafts are 2–4 μ thick. Their thickness is fairly proportional to the length of the spicule. The central tyle is 3–7 μ in diameter, two thirds to twice as thick as the adjacent parts of the shaft. The spines arising from the tyle are similar to those of the largest fimbriate amphidiscs but proportionately smaller and usually not all curved in the same direction (Plate **60**, figs. 8, 10). The remainder of the shaft usually is more spiny than in the largest fimbriate amphidiscs. The anchors are 39–80 μ long; their maximum breadth is 26–55, their end-breadth 20–50 μ. The difference between maximum and end-breadth is 3–6 μ, on an average (of ten measurements) 5.2 μ. The proportion of the length to the maximum breadth of the anchors is 100 to 50–73, on an average (of ten calculated proportions) 100 : 58.8. A correlation between amphidisc-length and relative anchor-breadth is not discernible in the amphidiscs belonging to this subgroup.

The *small fimbriate amphidiscs* (Plate **60**, figs. 12–14) are 64–99 μ long, most frequently about 77 μ. The shaft is 1.5–1.8 μ, the central tyle usually 2–3 μ thick. Strongly bent spines usually arise from the latter. Smaller short and broad spines cover the remaining parts of the shaft quite densely. The anchors are 23–36 μ long and have a maximum breadth of 13–21 μ. The end-breadth is usually 1–2 μ less than the maximum breadth. The proportion of length to maximum breadth of the anchors is 100 to 52–72, on an average (of six calculated proportions) 100 : 59.

The *smallest fimbriate amphidiscs* (Plate **60**, fig. 15; Plate **62**, fig. 15) are 36–54 μ long, most frequently about 52 and 38 μ long. The shaft is 1.2–1.8 μ thick. A central thickening, as much as 2.8 μ in diameter, is sometimes discernible. Often, however, there is hardly any trace of such a tyle. The shaft is covered with spines about 0.5 μ long. The anchors are 16–24 μ long, and have a maximum breadth of 9.5–13 μ. The end-breadth is 1–2 μ less than the maximum breadth. The proportion of the length to the maximum breadth of the anchors is 100 to 55–75, on an average (of eight calculated proportions) 100 : 63.1.

The *micramphidiscs* (Plate 60, figs. 16–23; Plate 62, figs. 12–14) are 15–40 μ long, most frequently about 20 μ. The shaft is cylindrical, straight or, very rarely, slightly curved, and 0.7–1.7 μ thick. Sometimes it is slightly and gradually thickened near the middle up to 2 μ; more frequently no trace of a central thickening can be detected. The shaft is covered by blunt or truncate spines about 0.5 μ long. These spines are often very numerous. The anchors are 4–14 μ long, usually a little less than a third of the whole spicule, and 5–12.5 μ broad. The proportion of their length to their breadth is usually 100 to 68–130, rarely up to 100 : 156, on an average (of thirty calculated proportions) 100 : 111.5. The larger micramphidiscs have relatively narrower (more slender) anchors than the smaller. In the micramphidiscs with anchors under 7.5 μ in length the proportion of anchor-length to anchor-breadth is generally 100 to 100–130, rarely up to 100 : 156, on an average 100 : 118.9. In the micramphidiscs with anchors over 7.5 μ in length this proportion is 100 : 68–114, on an average 100 : 86.6. In consequence of the slenderness of their anchors the larger micramphidiscs appear as transitional forms connecting the smaller micramphidiscs with the smallest fimbriate amphidiscs. The individual anchor-teeth of the micramphidiscs are uniformly and considerably curved, concave to the shaft, in their basal part. Distally this curvature decreases and their end-parts are nearly straight. The total curvature is such that the (nearly straight) end-part of the teeth come to lie parallel or nearly parallel to the shaft and to each other.

The above sponges differ from all the species of Hyalonematidae hitherto described by the anchor-teeth of their fimbriate amphidiscs bearing marginal frills. In some respects, particularly in respect to the basal anchors and the microhexactines, they resemble *Hyalonema depressum* F. E. Schulze. In respect to other characters, particularly in the various kinds of amphidiscs, they differ, however, fundamentally also from this sponge.

OONEMA, subgen. nov.

Species of Hyalonema of which the amphidiscs of one of the kinds have relatively very large and broad, usually more or less semispherical, anchors about half of the whole spicule in length.

The collection contains six specimens of this subgenus, which belong to five species, four of which are new.

Hyalonema (Oonema) bianchoratum pinulina, var. nov.

Plate 82, figs. 1–34; Plate 83, figs. 1–68; Plate 84, figs. 1–32; Plate 85, figs. 1–8.

Two fine specimens of this variety were trawled off the coast of northern Peru at Station 4651 on 11 November, 1904; 5° 41.7′ S., 82° 59.7′ W.; depth 4063 m. (2222 f.); they grew on a bottom of sticky, fine, gray mud; the bottom-temperature was 35.4°. In the following description one of them is designated *a*, the other *b*.

With other characteristics these sponges differ from the typical *Hyalonema* (*Oonema*) *bianchoratum* Wilson by the distal rays of their pinules attaining not nearly so great a length. To this the name of the variety refers.

Shape and size. Both specimens are upright, cylindrical, widened above to form a shallow cup, and rounded at the lower end, from which a rather eccentrically situated stalk arises. From the bottom of the cup a cylindroconical terminally rounded gastral cone protrudes. Specimen *a* is 111 mm. long, the longest and shortest diameters of its upper end being respectively 49 and 31 mm. Specimen *b* (Plate **82**, fig. 1) is 141 mm. long. The longest and shortest transverse diameters of the central cylindrical part of its body are 49 and 42 mm., those of its upper, cup-shaped extension respectively 66 and 48 mm. The stalk of specimen *a* is broken off at a distance of 40 mm. from its point of origin, that of *b* close to the body of the sponge. An isolated stalk, in the same jar as the body of specimen *b*, which fits the stump at the lower end of the body, apparently belongs to it. This stalk, which was attached to the stump before the specimen was photographed (Plate **82**, fig. 1), is 230 mm. long, and, near its point of origin, circular in transverse section, and 3.8 mm. in diameter.

Surface. Pores could not be found where the choanosome extends up to the superficial membrane. These poreless tracts appear as broad bands which form a network with irregular meshes, the maximum diameter of which is rarely more than 1 mm. on the dermal face, but is sometimes as much as 10 mm. on the gastral face. In the meshes of this primary network are spread out reticular sieve-membranes (Plate **82**, fig. 1; Plate **83**, figs. 60–62) composed of narrow bands of superficial (dermal or gastral) tissue. The meshes of the dermal secondary reticulations are usually 100–300 μ wide, those of the gastral usually 300–500 μ. The nodes of these nets are much thickened. In the meshes of the dermal pore-sieves (Plate **83**, fig. 62) some remnants of what seems to have been a tertiary network were observed. In the meshes of the gastral pore-sieves (Plate **83**, fig. 61) no such remnants could be found.

Canal-system. The pores of the dermal sieves on the outer side of the body lead into wide canals extending into the interior. Other still wider canals extend up to the gastral sieves on the inner face of the cup. Between these wide canals, the former of which are, no doubt, afferents and the latter efferents, a tissue is found containing narrow canals, and rather densely packed small flagellate chambers (Plate **84**, fig. 2). The sections of these flagellate chambers (Plate **84**, fig. 2a) are mostly circular or broad-oval and 50–120 μ in maximum diameter.

The *colour* of both specimens in spirit is greenish brown.

The *skeleton.* The poreless parts of the surface and the strands forming the pore-sieve nets are, both on the dermal and the gastral face, covered by a dense pinule-fur (Plate **83**, figs. 45b, 61, 62). Under the poreless tracts of both faces paratangential, more or less centrotyle amphioxes and the lateral rays of pentactine megascleres form a superficial (hypodermal, hypogastral) skeleton. The strands of the dermal pore-sieve nets are supported by the lateral rays of hypodermal pentactines and a few centrotyle amphioxes (Plate **83**, fig. 62). The centra of the pentactines are here usually about 700 μ apart. In the gastral pore-sieve nets no pentactines have been found. Here centrotyle amphioxes, congregated in dense bundles, alone occupy and support the strands of the reticulation (Plate **83**, fig. 61).

Numerous centrotyle amphioxes, rather scarce hexactine megascleres, and masses of microhexactines occur in the choanosome. Some of the microhexactines have straight, others curved rays. I think it not improbable that the former, which are much the scarcer, line the walls of the wide main canals, and are to be considered as canalaria; while the latter are imbedded in the choanosomal tissue, and are to be considered as parenchymalia.

Four kinds of amphidiscs can be distinguished: — large and small macramphidiscs, and large and small micramphidiscs. The large macramphidiscs are rather scarce in both specimens and confined to the choanosome, where they appear to be irregularly scattered. The small macramphidiscs are very numerous on and in the gastral membrane of specimen *a*, where most of those seen *in situ* in the sections were found to lie between the distal rays of the pinules wholly outside the sponge, with their shafts vertical to the surface (Plate **83**, fig. 45c), while only a few are scattered irregularly in the gastral membrane. On the dermal face of this specimen small macramphidiscs have also been observed, but they are here not nearly so numerous. In specimen *b* these amphidiscs are similarly situated but much less abundant. The large micramphidiscs are very rare in both specimens, the small very numerous in *b*, but somewhat scarce in *a*. I observed a large number of these small micramphidiscs *in situ* in the gastral membrane of specimen *b*, where they lie in large part paratangentially with their shafts parallel to the surface; and I found a great many also in the centrifuge spicule-preparations of specimen *b*, both in this membrane and in the choanosome. One- to six-rayed acanthophores with terminally or, much more rarely, entirely spined rays are abundant in both specimens in the vicinity of the point of origin of the stalk. In specimen *a* these spicules are on the whole stouter than in specimen *b*. The skeleton of the stalk extends through the body of the sponge up to the gastral cone. Its upper, imbedded part consists of centrostyle amphioxes and the upper end-parts of the large spicules forming the free part. The latter, provided it really belongs to the sponge, is in specimen *b* (Plate 82, fig. 1) composed of five stout and about a dozen more slender spicules twisted spirally together. The free part of the stalk of specimen *b* is composed of about a dozen stout and a small number of slender spicules.

The *symbiotic zoantharian polyps*. To the proximal end-part of the stalk of specimen *a* is attached a tubular Palythoa colony, enclosing the stalk like a tight-fitting mantle for a distance of 17 mm. The individual polyps arising from this tubular colony are about 3 mm. high and 4 mm. broad. Polyps and coenenchym are provided with a stout skeleton composed entirely of acanthophores of the sponge, to the stalk of which the colony is attached (Plate 84, fig. 1). In the polyps longer and more slender spicules lying radially in the radii of the septa occupy the oral plate, and perhaps also the upper parts of the septa. In the superficial parts of the lateral walls of the polyps and the coenenchym shorter, stouter, and on the whole more spiny spicules, lying close together, form a dense cortex. Still shorter, stouter, and more spiny spicules are found near the axis around the mouth and in the wall of the stomatodeal funnel.

On the stalk which probably belonged to specimen *b* no polyps were observed. Its proximal end-part is, however, enveloped by a thin mantle (Plate 82, fig. 1) brown in colour, chitinous in nature, and entirely destitute of spicules; this mantle may be the basal part of the coenenchym of a zoantharian polyp-colony. In the body of specimen *a* no symbiotic polyps were observed; the dermal region of the body of *b* on the other hand contains a large number of such polyps (Plate 82, fig. 1; Plate 83, fig. 60a). These polyps (Plate 84, fig. 14) are Zoanthidae. They contain no spicules at all and are, in their present contracted state, nearly spherical, and 1.3–1.8 mm. in diameter.

The polyps lie in excavations of the sponge-body just large enough for them. Their distal ends are flush with the surface of the sponge. In life, when expanded, they probably protruded more or less beyond its surface. These polyps form groups within which they are about 4.5 mm. apart (Plate **83**, fig. 60). The coenenchym-like mantle enclosing the upper end of the stalk, which has been referred to above, may have formed part of a colony of polyps similar to those in the body of the sponge. Some of the polyps in the sponge-body which I examined bore a short thread-like protuberance on their lower (inner) end. Probably all the polyps of a group, possibly all the polyps of the whole sponge, are connected by such threads. I did not make sure of this, however, because for this purpose it would have been necessary to cut up the fine and unique specimen.

The *pinules* (Plate **82**, figs. 21–34; Plate **83**, fig. 45b). The dermal pinules of the upper and middle-parts of the body in both specimens resemble, as radial sections show, the gastral pinules, but differ from the dermal pinules on the basal part of the sponge, the latter being larger and having distal rays with more divergent spines. In the spicule-preparations of different parts of the surface besides the pinules shown by the sections to be truly proper to the region in question, I always found a few others; in the spicule-preparations of the gastral membrane and the upper and middle-parts of the dermal membrane were typically basal spicules; and in the spicule-preparations of the basal part of the dermal membrane were pinules of the type found *in situ* on the upper parts of the sponge.

The principal dimensions of the pinules are tabulated on p. 312.

The *gastral pinules* (Plate **82**, figs. 29, 30; Plate **83**, fig. 45b) *and the dermal pinules on the upper and middle-parts of the sponge* (Plate **82**, figs. 22, 31–33) are nearly always pentactine, very rarely hexactine. Their distal ray is straight and 120–280 μ [1] long. It ends with a terminal cone free from spines. Its proximal part is also spineless, and it arises with a trumpet-shaped extension from the cross formed by the lateral rays. Farther up the distal ray becomes thinner, and it attains its minimum thickness at a distance of about 30 μ from its base (the centrum of the spicule). Beyond that it again becomes thicker. At its thinnest point the smooth proximal part of the distal ray is 7–11 μ thick. The basal thickening is variable. The distal ray of a typical upper dermal pinule is 17 μ in diameter at its thickened base, 30 μ higher up, and 11 μ at its thinnest point. The whole of the distal ray, with the exception of its proximal and distal

[1] This and the following measurements refer to the pinules of both specimens together.

Pinules			Length of distal ray μ limits	Length of distal ray μ average	Thickness of the thinnest part of the distal ray near its base μ limits	Maximum thickness of the distal ray together with the spines μ limits	Length of the lateral rays μ limits	Length of the lateral rays μ average
of specimen *a*	gastral		165–265	219.5	9–10.5	20–26	35–53	43.1
	dermal	from the upper and middle-parts of the body	170–250	211.2	7–10	21–23	30–50	38.7
		from the basal part of the body	130–330	234.5	9.17	30–65	40–80	56
of specimen *b*	gastral		120–280	214.2	7.5–11	17–33	28–52	37.5
	dermal	from the upper and middle-parts of the body	180–266	217.9	8–10	20–26	32–60	40.1
		from the basal part of the body	150–305	240.7	10–16	35–65	35–62	48.5

end-parts, bears rather strongly inclined spines, which are slightly curved, concave to the ray. These spines attain their largest size at, or some distance above, the middle of the ray. Here the distal ray, together with the spines, attains a maximum thickness of 17–33 μ. The lateral rays of the same spicule are usually equal, 28–60 μ long, straight, cylindroconical, abruptly and bluntly pointed. They are smooth in their proximal part, and in their distal part are covered with rather sparse broad spines, usually up to about 1 μ long. Sometimes one ray is reduced in length, nearly cylindrical, and terminally rounded. Of hexactine forms (with a proximal ray) I have found (and measured) six, four of which were found among the gastral pinules of specimen *a*. The proximal ray is conical, pointed, covered with spines in its distal part, and 10–40 μ long.

The *basal dermal pinules* (Plate **82**, figs. 21, 23–28, 34) are, like those above described, nearly always pentactine, very rarely hexactine. Their distal ray is straight, 130–330 μ long, and spineless in its proximal part. It ends in a likewise spineless terminal cone. In these pinules the smooth proximal part is also somewhat hour-glass-shaped, and is at its thinnest point 9–17 μ thick. Its spines are usually quite strongly divergent, and markedly curved, concave towards the ray. They attain their greatest size one half to two thirds of the length of the distal ray from the centrum, or still higher up, and here the distal ray, together with the spines, attains a maximum thickness of 30–65 μ. The lateral rays are similar to those of the pinules of the upper part of the sponge, above described, but stouter and provided with larger spines. They attain a length of 35–80 μ. Of hexactine forms I found (and measured) only two, with proximal rays 12 and 20 μ long respectively. One of these is conical and pointed, the other (Plate **82**, fig. 26) cylindrical and terminally rounded.

The *hypodermal pentactines* (Plate **83**, figs. 65–67) have very blunt, conical rays. The proximal ray is often somewhat curved; the lateral rays are usually straight, occasionally curved in the plane, vertical to the proximal, in which they lie. The proximal ray is 0.4–1.3 mm. long, and 15–70 μ thick at the base. The lateral rays are 260–610 μ long. Those of the same spicule are usually fairly equal, more rarely conspicuously unequal. In a hypodermal pentactine with particularly unequal laterals the longest is 610 μ in length, the shortest only 390 μ.

The *hypogastral pentactines* (Plate **83**, fig. 68) are similar to the hypodermal, but much smaller. Their proximal ray is 210–800 μ long, and 12–46 μ thick at the base. Their lateral rays are 150–460 μ long.

The *hexactine megascleres* (Plate **83**, figs. 63, 64) are 0.35–5.5 mm. in maximum diameter. Their rays are straight or slightly and irregularly curved, 7–120 μ thick at the base, attenuated distally, at first more gradually, then more rapidly, and pointed at the end. In all the larger and in many of the smaller ones two opposite rays are considerably longer than the other four. Some of these spicules are nearly twice as long as broad.

The *dermal, gastral, and choanosomal amphioxes* are straight or more or less curved, rarely angularly bent, centrotyle, 0.5–2.8 mm. long, and 7–59 μ thick near the tyle. The tyle is 9–60 μ in diameter, that is 1–23 μ, usually 2–6 μ, more than the adjacent parts of the spicule. The dimensions of the different kinds of these spicules (dermal, gastral, and choanosomal) in the two specimens are given in the table on page 314.

The amphioxes of the dermal and gastral membranes are in both specimens considerably shorter, stouter, and less curved than those of the choanosomal. The gastrals are in both specimens stouter than the dermals. The amphioxes of specimen *b* are on the whole slightly stouter than those of *a*. This difference is particularly well-pronounced in the gastrals. The two limbs of the angularly

Amphioxes		of specimen a			of specimen b		
		dermal	gastral	choanosomal	dermal	gastral	choanosomal
Length limits mm.		0.56–1.7	0.6–1.9	0.7–2.6	0.5–1.6	0.46–1.8	0.75–2.8
thickness limits μ		11–32	0.45	8–30	12–34	7–59	8–29
Relative length	limits	28–120	24–150	58–173	23–87	22–91	83–137
(length: thickness = 10000 :)	average	66.9	59.6	116.8	63.2	44.3	103.3
Transverse diameter of central tyle, limits μ		14–34	11–50	14–33	14–42	9–60	11–32
The tyle exceeds the adjacent parts of the spicule in thickness, by (limits) μ		2–6	1–19	2–6	2–16	1–23	1–7

bent amphioxes usually enclose an angle of 130°–140°. Their bend is generally situated so much nearer one end than the other that one limb is six to eight times as long as the other, the spicule consequently having the appearance of a promonaen. Rarely the bend lies in the middle. The tyle is, as stated above, generally only 1–6 μ thicker than the adjacent parts of the spicule, and in that case simply oval. Occasionally, however, much stouter tyles are observed, and in these cases it is clearly to be seen that the tyle is composed of from one to four rounded knobs representing rudimentary rays. A few spicules of this kind were triactine, a perfectly developed ray occupying the place of one of the knobs. Such triactines were observed both among the superficial and the choanosomal amphioxes.

The proportion of length to thickness is in the choanosomal amphioxes of both specimens together 10000 to 58–173, on an average 10000 : 109.3. As the curve ——— (Fig. 17), in which the reciprocal proportions (thickness × 10000 : length) are represented, shows, there is no great difference in the average relative thickness of the smaller and the larger choanosomal amphioxes.

In the superficial (dermal and gastral) amphioxes (Plate 82, figs. 13–19) the proportion of length to thickness is 10000 to 74–447, on an average 10000 : 241.3. Among these the shorter are, on the whole, as the following table shows, relatively much thicker than the longer.

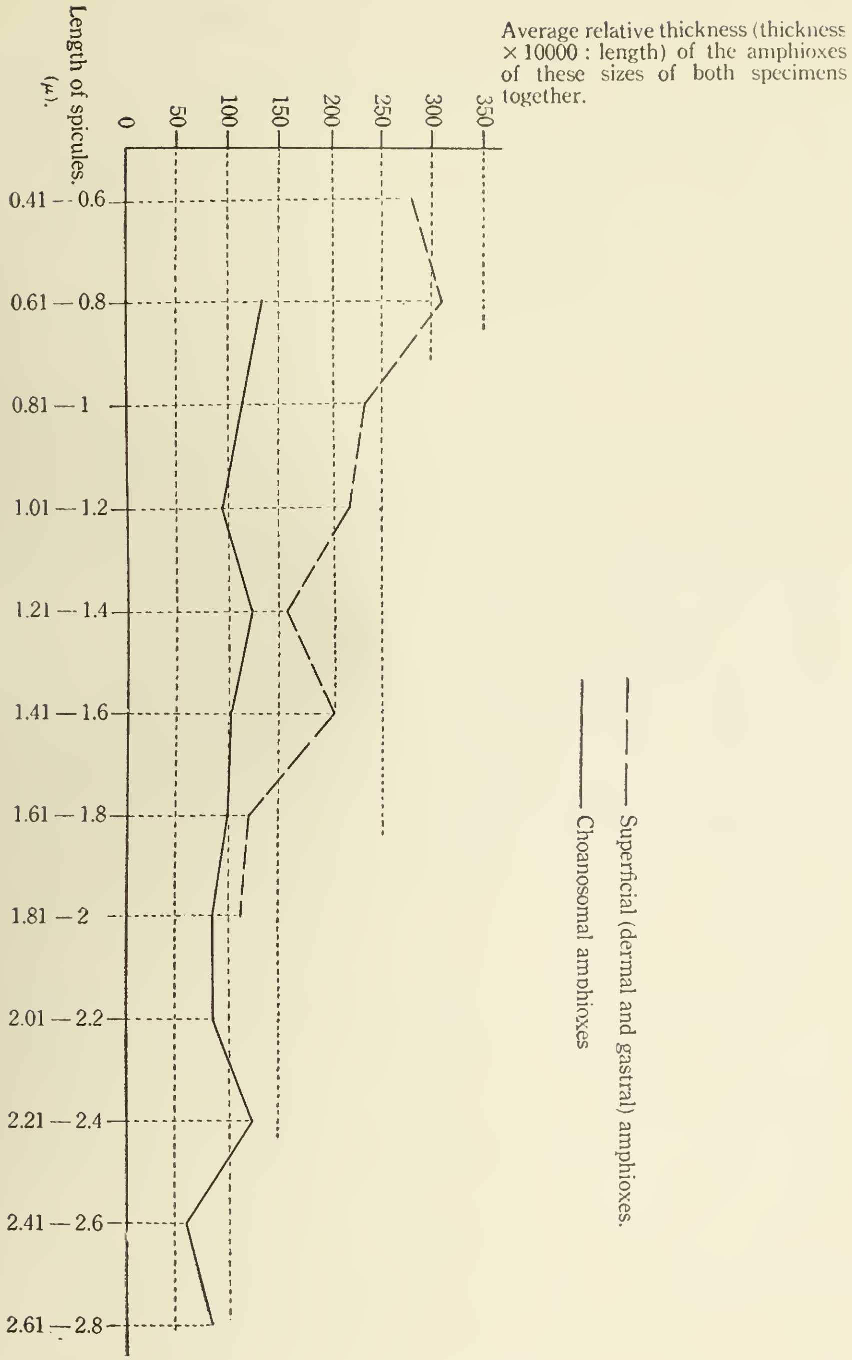

Fig. 17.— Amphioxes.

The relative thickness (thickness × 10000 : length) of the superficial (dermal and gastral) amphioxes of different lengths of both specimens together is shown in the following table: —

Length, mm.		0.41–0.6	0.61–0.8	0.81–1	1.01–1.2	1.21–1.4	1.41–1.6	1.61–1.8	1.81–2
Relative thickness (thickness × 10000: length)	limits	177–356	109–447	09–39	075–445	084–346	08–393	082–159	074–147
	average	279.3	309.3	231.7	217.3	156.2	202.4	118.7	101.5

This correlation between length and relative thickness comes out very clearly in the curve -------- in the graph., Fig. 17.

To ascertain whether the superficial amphioxes of varying relative thickness form a continuous series I arranged the 94 measured according to this relation and the result is represented in Figure 18.

The frequency-curve of the different relative thicknesses in this figure clearly shows that, biometrically, two kinds of superficial amphioxes must be distinguished: — more slender ones, in which the proportion of length to thickness is 10000 : 74–210, most frequently about 10000 : 112, and stouter ones in which this proportion is 10000 : 210–447, most frequently about 10000 : 312. Among the superficial amphioxes

0.41–0.8 mm. long 82 % belong to the stout and 18% to the slender kind.
0.81–1.2 " " 49 % " " " " " 51% " " " "
1.21–1.6 " " 27 % " " " " " 73% " " " "
1.6 –2 " " 0 % " " " " " 100% " " " "

It is to be noted that the shortest superficial amphioxes observed, that is those 0.41–0.6 mm. long, are on the whole relatively not quite so stout as those 0.61–0.8 mm. long, which are on the whole the stoutest. These smallest amphioxes are probably young forms. Also among the spicules 0.61–1.6 mm. long there are, no doubt, some young forms of larger ones. And since the larger ones are all the slender kind these young forms will probably for the most part be young forms of the slender ones.

The distal ends of the *spicules of the free part of the stalk* are all broken off. The parts present have a maximum thickness in specimen *a* of 0.8 mm., in *b* of 1.3 mm. The spiral twist, which all the long fragments exhibit, is such that there is one whole turn in about 23 cm. of length. The spicules forming the upper part of the stalk imbedded in the sponge-body are not centrotyle amphioxes. The largest one observed was 7 mm. long.

The *acanthophores* (Plate **83**, figs. 1–35) are normally composed of one to six rays. One quite abnormal one (Plate **82**, fig. 24), which I found in specimen *a*, has two long and six more or less reduced rays.

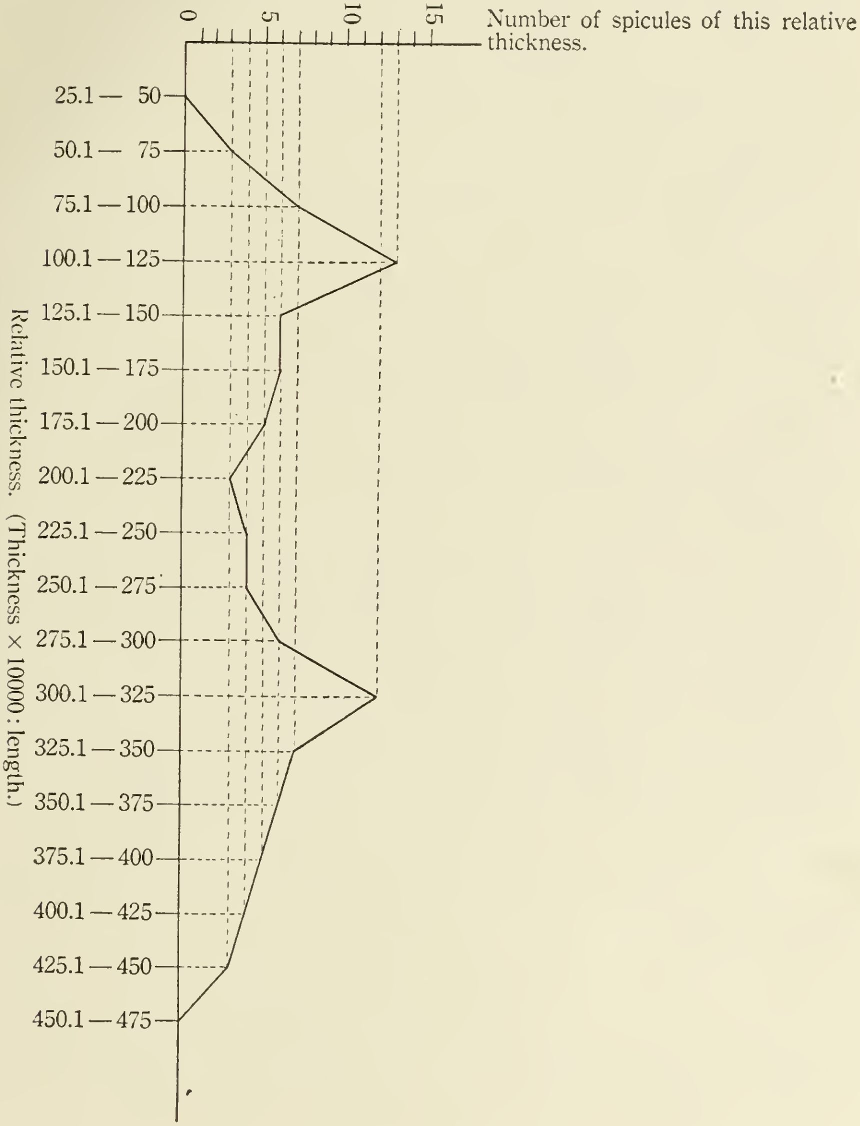

Fig. 18.—Amphioxes.

The rare monactine and frequent diactine rhabd-forms are in specimen *a* 270 μ–1.3 mm. long and 17–37 μ thick, on an average 25.4 μ; in *b* 145 μ–1.4 mm. long and 9–40 μ thick, on an average 16 μ. The more slender ones, 20 μ or less thick, are, in both specimens together, 420 μ–1.4 mm. long, the stouter ones, over 20 μ thick, only 270–740 μ long. The rare triactine and frequent tetractine forms are in specimen *a* 120–420 μ long, with rays 20–44 μ thick, on an average 31 μ; in *b* they are 110–500 μ long, with rays 12–34 μ thick, on an average 22.4 μ. The pentactine and hexactine forms, both of which are not numerous, are in specimen *a* 180–350 μ long, with rays 15–24 μ thick; in *b* they are 80–390 μ long, with rays 8–25 μ thick.

The rays of the tri- to hexactines usually differ in length more or less, often very considerably. The rays of the tri- and tetractines always extend in one plane, whilst the pentactine and hexactine forms resemble, in respect to the position of their rays, the pentactine and hexactine megascleres above described. The rays are more or less, exceptionally (Plate **82**, figs. 11, 12) very considerably, curved and nearly always simple, very rarely branched (Plate **82**, fig. 17). They are cylindrical or cylindroconical, not infrequently somewhat uneven, and rounded and usually thickened at the end. The terminal thickenings are particularly well-developed in the rhabd-forms, and these usually also have a central tyle. In a fairly typical diactine spicule of this kind, 1 mm. long and 16 μ thick, the central tyle is 18 μ in transverse diameter, and the terminal tyles 30 μ and 34 μ respectively. The central tyle is either well-defined (Plate **83**, fig. 5) or not (Plate **83**, fig. 1). In all the larger and a good many of the smaller basal spicules, the proximal and middle-parts of the rays are smooth, apart from the occasional slight undulations of their surface. The end-parts are nearly always densely spined, or exceptionally smooth (Plate **82**, figs. 19, 20, 34). A good many of the smaller basal spicules (Plate **82**, figs. 10, 18, 28–30) are entirely spined, the spines on their proximal parts being usually slightly smaller than those on their distal parts. The entirely spined forms are much more frequent among the basal spicules of specimen *a* than among those of *b*. The spines are broad and conical. Those measured were 2–6 μ long, rarely up to 10 μ.

The *spicules forming the skeleton of the Palythoa* attached to the stalk of specimen *a* (Plate **83**, figs. 36–44, 46–59) are monactine to tetractine. The rare monactine and frequent diactine rhabd-forms are 122–520 μ long and 20–40 μ thick, on an average 32.4 μ. The rare triactine and frequent tetractine forms are 90–290 μ long and 20–40 μ thick; the average thickness is 31.6 μ.

These spicules are similar to the corresponding basal spicules of specimen *a*, and differ from these only by being thicker and more spiny. While in the majority of the acanthophores in the sponge the proximal and middle-parts of the rays are smooth and only the distal part spiny, we find among the (similar) spicules of the Palythoa skeleton relatively many fewer with rays smooth in their proximal part, the majority being here entirely spined. It is to be noted also that the spicules of the Palythoa skeleton have, on the whole, larger spines than the corresponding spicules in the basal part of the sponge. In the larger spicules of the Palythoa skeleton the spines are on the distal parts of the rays very much larger than on their proximal parts. In the smaller forms this difference is not nearly so conspicuous, and in the smallest all the spines appear to be fairly equal in size. The largest spines measured were 15 μ long, and 14 μ broad at the base.

The average thickness of the rays

of the rhabd acanthophores of specimen	*b* is 16.0 μ
" " " " " "	*a* " 25.4 μ
" " " " " the Palythoa on the stalk of specimen . .	*a* " 32.4 μ
" " tri- to tetractine acanthophores of specimen	*b* " 22.4 μ
" " " " " " " "	*a* " 31.0 μ
" " " " " " " the Palythoa on the stalk of specimen	*a* " 31.6 μ

Thus these spicules are in *a* much stouter than in *b*, and in the Palythoa attached to the stalk of *a* thicker than in the sponge itself.

The fact that the Palythoa spicules are, on the whole, stouter and more spiny than those of the sponge is, no doubt, due to the Palythoa *selecting* for the purpose of building its skeleton the stoutest and most spiny of the spicules shed by the sponge. That these spicules are in *a* (on the stalk of which Palythoa polyps with sponge-spicule skeletons grew) much stouter than in *b* (the symbiotic polyps of which have no skeleton) either may have nothing to do with their symbiotic polyps, and be in respect to them accidental; or it may be due to an influence of the spicule-requiring Palythoa on the sponge, comparable to that of a gall-wasp clutch on the vegetable tissue surrounding it; an influence which, in this case, might cause the sponge to produce abnormally stout and spiny acanthophores.

The *microhexactines* (Plate 82, figs. 2–11, 20), which are the same in both specimens, have equal, regularly arranged rays and measure 57–152 μ in total diameter. The rays are 2–3.8 μ thick at the base, conical, and attenuated distally to a fine point. They are straight in their proximal part and usually curved in their distal part, more rarely straight throughout. The curvature is such that the tangents of the end-parts of the rays enclose angles of 120°–150°, exceptionally only 90°, with the continuation of the axis of their proximal parts. The proximal end-part of the rays is smooth for a short distance, the distal end-part for a considerable distance. The remaining, middle-part bears spines as much as 0.7 μ long, which are generally vertical. As stated above, I think it probable that the straight-rayed microhexactines are canalaria, and only the curved-rayed ones true parenchymalia.

In specimen *b* I found a microhexactine-derivate with only one ray. This monactine spicule appears as a spined tylostyle curved towards its pointed end. Its measurements are: — length 105 μ; basal thickness of single ray 4.5 μ; tyle 8.5 μ.

Morphologically two kinds of *amphidiscs* can be distinguished: — those with stout shaft and relatively broad anchors; and those with slender shaft and relatively narrow anchors.

To study them biometrically I measured 275 (134 of specimen *a* and 141 of specimen *b*) and drew Figure 19, in which the length frequency-curves of the amphidiscs are represented as follows: — of specimen *a* (---------); of specimen *b* (– – –); and of both specimens together (———).

In specimen *a* the amphidiscs are 18–480 μ long. Their length frequency-curve (----------) exhibits two main elevations at about 33 μ and about 164 μ, a number of small elevations, and three large gaps between 54 and 79 μ, between 90 and 110 μ, and between 200 and 220 μ. The amphidiscs 18–54 μ and 79–90 μ long are all thin-shafted and narrow-anchored; those 110–200 μ and 220–480 μ long are all thick-shafted and broad-anchored.

The amphidiscs of specimen *b* are 21.5–492 μ long. Their length frequency-curve exhibits two main elevations corresponding exactly to the two main elevations of the curve for specimen *b*; a number of small elevations, some of which correspond to the small elevations of *b*, and some of which do not so correspond; and three principal gaps between 66 and 79, 87 and 118 μ, and 187 and 212 μ. The amphidiscs 21.5–66 μ and 79–87 μ long all belong to the thin-shafted slender-anchored kind, those 118–187 μ and 212–492 μ long to the stout-shafted, broad-anchored kind.

In both specimens therefore two main groups of amphidiscs can be distinguished both morphologically and biometrically: — macramphidiscs with stout shaft and broad anchors, in both specimens together 110–492 μ long, and micramphidiscs with thin shaft and slender anchors, in both specimens together

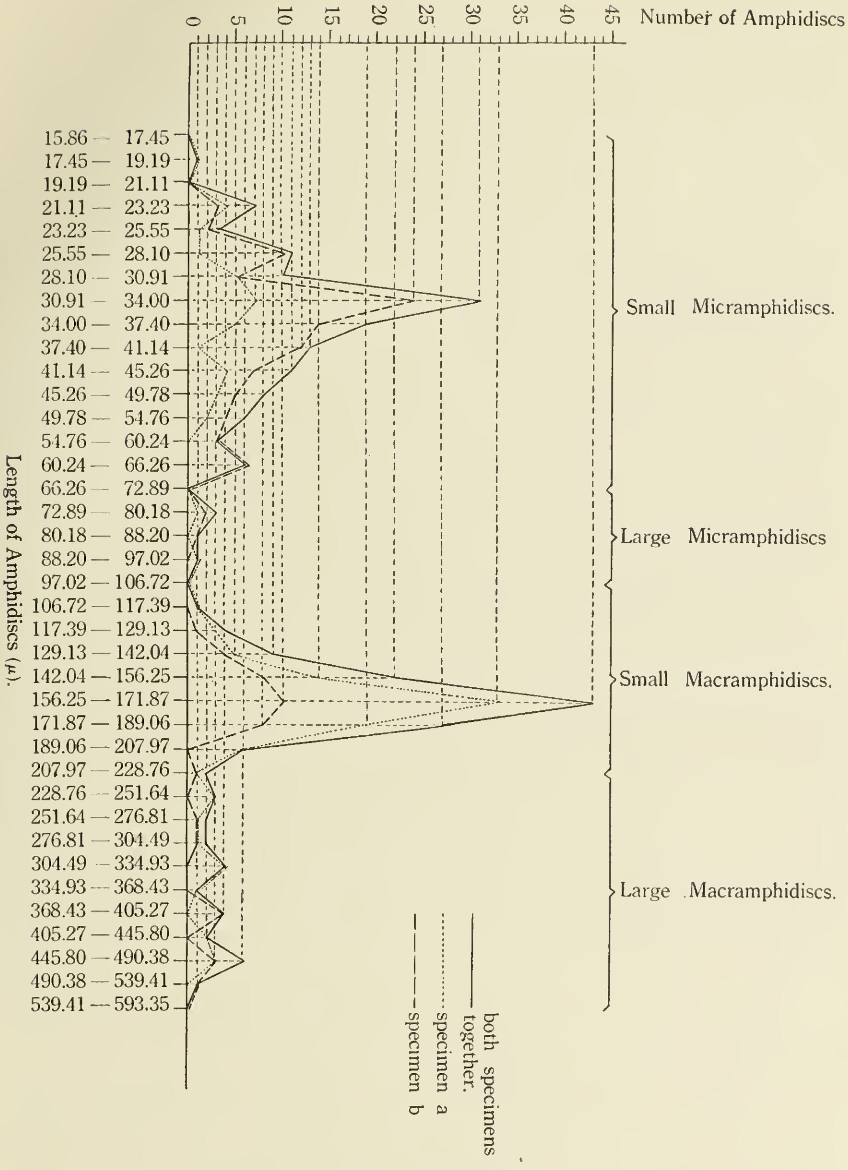

Fig. 19.—Amphidiscs

18–90 μ long. It is to be noted that the macramphidiscs are much more numerous in a than in b, while the micramphidiscs are much more numerous in b than in a. In consequence of this the number of macr- and micramphidiscs measured and plotted in the figure are very different in the two specimens, and the summits of the two main elevations of the a- and b-curve are very different in height.

The larger (longer) macramphidiscs differ from the smaller (shorter) ones morphologically by having relatively shorter anchors. The length frequency-curves of the macramphidiscs show that these spicules by no means represent a biometrically homogeneous group in respect to their length. The parts of the macramphidisc curves below (to the left of) the above mentioned gaps between 200 and 220 μ in a and between 187 and 212 μ in b are very regular and obviously pertain to biometrically homogeneous groups; the parts of these curves above (to the right of) the gaps are on the other hand very irregular [1] and in no way in harmony with the others below (to the left) of them. I therefore think that the group macramphidiscs should be subdivided into two secondary groups: — large macramphidiscs with relatively short anchors, in both specimens together 212–492 μ long; and small macramphidiscs with relatively long anchors, in both specimens together 110–200 μ long.

The length frequency-curves of the micramphidiscs of both specimens exhibit, besides the single main elevation, a number of small elevations. Most of these are, as in the case of the large macramphidiscs, probably due to the scarcity of the micramphidiscs of these sizes, which made it impossible to measure a larger number of them. Some of these elevations (two in the a-curve; and one in the b-curve, corresponding to one of the former) pertaining to the largest micramphidiscs are, however, separated from the rest of the micramphidisc curves by very conspicuous gaps (between 54 and 79 μ in the a- and between 66 and 79 μ in the b-curve). I therefore think it well to divide the micramphidiscs according to these gaps into two subgroups: — large micramphidiscs, in both specimens together 79–90 μ long; and small micramphidiscs, in both specimens together 18–66 μ long.

The chief dimensions of the *large macramphidiscs* (Plate **85**, figs. 1–7) are tabulated on page 323.

In these amphidiscs the shaft is straight and usually centrotyle. It is either quite smooth (Plate **85**, fig. 7) or bears a few low rounded knobs (Plate **85**, figs. 2, 4–6), sometimes also a single, straight, cylindrical, terminally rounded spine (Plate **85**, fig. 1), which arises from its centre (central tyle). Occasionally

[1] These irregularities are partly at least probably due to the rarity of these spicules, which made it impossible to measure a larger number of them.

			of specimen *a*	of specimen *b*	of both specimens together
Length μ	limits		220–480	212–492	212–492
	most frequently about		240, 320, 468	277, 387, 468	468
Shaft, thickness, limits μ			17–26	19–28	17–28
Central tyle	transverse diameter of tyle, μ limits		17–31	19–32	17–32
	the tyle thicker than the shaft by μ, limits		0–8	0–9	0–9
Terminal anchors	length, limits μ		90–122	94–140	90–140
	breadth, limits μ		148–195	140–210	140–210
	proportion of anchor-length to anchor-breadth	limits 100 to	141–177	131–189	131–189
		average 100 to	161.4	158.6	160.1
	proportion of anchor-length to total length of whole spicule	limits 1:			2.1–3.9
		average 1:			3.2

a stout knob or two are observed also on other parts of the shaft (Plate **85**, figs. 1, 2). The single large spine on the central tyle is, in the normal large macramphidiscs, sometimes 21 μ long and 14 μ thick. I have never seen more than one such large spine on a normal spicule of this kind. In a few abnormal large macramphidiscs I observed (Plate **85**, fig. 3) one or two clusters of verticils of projections arising some distance from the middle of the shaft. These had a maximum length of 45 μ, and were inclined or curved towards the centrum. They appear to be supernumerary anchor-teeth.

The proportion of the terminal anchor to the total length of the whole spicule is (in both specimens together), as stated above, 1 to 2.1–3.9, an average of 1 : 3.2. The difference between total length and anchor-length is the greater the larger the spicule. In the large macramphidiscs 400 μ and more in length the above proportion is 1 : 3.2–3.9, in those under 300 μ in length 1 : 2.1–3.

The anchor-teeth are about 30 μ broad and pointed at the end. They arise nearly vertically from the shaft and are quite strongly curved in their proximal, and straight in their distal part. Their total curvature is such that their end-parts diverge at an angle of 12°–22° from the shaft.

The chief dimensions of the *small macramphidiscs* (Plate **83**, fig. 45c; Plate **84**, figs. 3–13, 26–32) are: —

			of specimen *a*	of specimen *b*	of both specimens together
Length μ	limits		110–200	118–187	110–200
	most frequently about		164	164	164
Shaft, thickness, limits μ			13–20	14–20	13–20
Terminal anchors	length, limits μ		46–87	50–81	46–87
	breadth, limits μ		74–135	85–126	74–135
	proportion of anchor-length to anchor-breadth	limits 100 to	153–185	130–172	130–185
		average 100 to	167.5	153.6	161.1
	proportion of anchor-length to total length of the whole spicule	limits 1:			2–2.5
		average 1:			2.3

In these amphidiscs the shaft is straight, regularly cylindrical, destitute of a central tyle, and perfectly smooth.

The proportion of the length of the anchors to the total length of the whole spicule is in both specimens together, as stated above, 1 to 2–2.5, on an average 1 : 2.3. The difference between total length and anchor-length is in the small macramphidiscs, in contradistinction to that of the large, on the whole the greater the shorter the spicule. In the longer small macramphidiscs, over 180 μ in length, the above proportion is 1 to 2.2–2.3, in the shorter, under 130 μ in length, 1 to 2.4–2.5.

The terminal anchors are composed of from eight to twelve teeth. Eight is the most frequent number, but small macramphidiscs with from nine to twelve are by no means rare and in no way abnormal. The position of the teeth of the two terminal anchors of the same spicule is alternate. The individual teeth have a T-shaped transverse section. The upper band-shaped part is, in its middle-part, 22–30 μ broad and attenuated both distally and proximally (Plate **82**, fig. 26). It is not only longitudinally, but also transversely curved, concave to the shaft (Plate **84**, fig. 27), and usually rounded, very rarely pointed, at the end. The keel, that is the part corresponding to the lower stroke of the T, is low distally but attains a great height and thickness proximally (Plate **84**, figs. 26, 28, 32). The outer contour of the tooth, when seen in profile, appears as a line strongly curved near the base and at the tip, but only slightly curved in its middle-part. The middle-part of this line diverges at an angle of 20–30° from the shaft; its end-part is convergent to the shaft. The end-parts of the inner contour (the inner margin of the keel) and the lateral margin, on the other hand, diverge from the shaft.

In specimen *a* I found a remarkable abnormal small macramphidisc (Plate 85, fig. 8) 190 μ long, with terminal anchors respectively 80 and 100 μ long and about 100 μ broad. In this spicule each anchor is composed of two partly incomplete and somewhat irregular verticils of anchor-teeth, instead of a regular single one. This duplication is much more pronounced in one (the upper one in the figure) than in the other terminal anchor. Some of the teeth belonging to the inner (supernumerary) verticils are nearly straight, extend obliquely backwards, and are widened at the end to irregularly oval terminal discs. The position of these terminal discs is such that if the whole amphidiscs were assumed to be enclosed in a tight-fitting ovoid mantle or shell, the outer faces of the terminal discs would come to lie exactly in the (inner) surface of such mantle or shell. This observation seems to me to be of similar import as the one on an abnormal amphidisc found in *Hyalonema* (*Prionema*) *agujanum* var. *tenuis* (p. 262, Plate 75, figs. 35–37); both favor the view that each amphidisc is formed within a single ovoid cell.

The chief dimensions of the *large micramphidiscs* are: —

			of specimen *a*	of specimen *b*	of both specimens together
Length μ	limits		79–90	79–87	79–90
	most frequently about		85	82	84
Shaft, thickness, limits μ			4	3.5	3.5–4
Central tyle	transverse diameter of tyle, limits μ			4	4
	the tyle thicker than the shaft by, limits μ			0.5	0.5
Terminal anchors	length, limits μ		26–35	26–29	26–35
	breadth, limits μ		23–40	23–25	23–40
	proportion of anchor-length to anchor-breadth	limits 100 to	80–114	83–88	80–114
		average 100 to	79	86.3	91.2
	proportion of anchor-length to total length of whole spicule	limits 1:			2.4–3.2
		average 1:			2.8

In these amphidiscs the shaft is straight. The central tyle is not defined and passes gradually into the adjacent part of the shaft. Tyle and shaft are very spiny.

The chief dimensions of the *small micramphidiscs* (Plate 84, figs. 15–25) are: —

			of specimen *a*	of specimen *b*	of both specimens together
Length μ	limits		18–54	21.5–66	18–66
	most frequently about		33	33	33
Shaft, thickness, limits μ			1–1.7	1–2.5	1–2.5
Central tyle	transverse diameter of tyle, limits μ		1–3	1–4.5	1–4.5
	the tyle thicker than the shaft by, limits μ		0–1.6	0–2.5	0–2.5
Terminal anchors	length, limits μ		7–20	6.5–23.5	6.5–23.5
	breadth, limits μ		7–17	8.5–23	7–23
	proportion of anchor-length to anchor-breadth	limits 100 to	77–128	80–146	77–146
		average 100 to	97.4	102.6	100.6
	proportion of anchor-length to total length of whole spicule	limits 1:			2.7–4
		average 1:			3.2

In these amphidiscs the shaft is usually straight, rarely curved. In some place at or near the middle it is thickened, gradually in the larger, more abruptly in the smaller, to a rather stout central tyle. In the larger forms the tyle and the adjacent parts of the shaft, about one third of its total length, are densely covered with spines sometimes 1 μ long. The end-parts of the shaft of these amphidiscs are smooth or only roughened by exceedingly minute spines. In the smaller forms the spines on the shaft are so small that they can hardly be made out as such, and merely render the shaft somewhat rough in appearance.

The anchor-teeth are curved rather strongly in their proximal part, but only slightly or not at all in their distal part. Their end-parts are generally slightly divergent.

A few abnormal small micramphidiscs were found in specimen *b*. In one of these, 26 μ long, a straight cylindrical branch arises very obliquely from the shaft. This branch is as thick (1.6 μ) and half as long as the shaft, and broken off at the end. In another small micramphidisc (45 μ long, with terminal anchors 19 μ long and 22 μ broad), two opposite rays lying in the same straight line and both vertical to the shaft arise from the centrum of the spicule. These rays are straight, as thick as the shaft (2 μ), and, like the shaft, covered with spines. One of them is broken off short; the other, which is intact, is 23 μ long and bears on the end a narrow and pointed anchor-rudiment 10 μ long and 8 μ broad, similar in appearance to a half closed umbrella.

There can be no doubt that the two sponges above described belong to the same systematic unit. There can also be no doubt that they are very nearly related to the sponge described by Wilson [1] as *Hyalonema bianchoratum*. Indeed the similarity between them is so great that the Albatross specimens must be considered as a variety of the species described by Wilson.

The distal ray of the largest pinules is in the typical *Hyalonema bianchoratum* Wilson very much longer than in the sponges above described. Also in shape the pinules do not quite agree, and while all the pinules of the former are pentactine, some of the pinules of the latter are hexactine. The hypodermal and hypogastral pentactines are larger in the former than in the latter. The microhexactines of Wilson's type do not attain so large a size and have stouter rays than those of the variety *pinulina*. The shafts of the large macramphidiscs are in the former stouter than in the latter. The small macramphidiscs have in the former a centrotyle shaft and eight anchor-teeth; in the latter a simple cylindrical shaft without tyle and quite often more than eight, sometimes as many as twelve, anchor-teeth.

These differences, although insufficient for specific distinction, are quite sufficient for varietal distinction. I therefore divide Wilson's *Hyalonema bianchoratum* into two varieties: — var. *typica* (for Wilson's type) and var. *pinulina* (for the sponges above described).

Hyalonema (Oonema) henshawi, sp. nov.

Plate 97, figs. 1–36; Plate 98, figs. 1–7.

One specimen of this species was trawled in the Eastern Tropical Pacific at Station 4649 on 10 November, 1904; 5° 17′ S., 85° 19.5′ W.; depth 4086 m. (2235 f.); it grew on a bottom of sticky, gray mud; the bottom-temperature was 35.4°.

I name it after the Director of the Museum of Comparative Zoölogy, Mr. Samuel Henshaw.

Shape and size. The single specimen (Plate **97**, fig. 15) has the shape of a deep, conical cup, rounded off below. The upper margin is lacerated. The stalk, which, in life, doubtlessly projected from its lower end, has been com-

[1] *H. V. Wilson.* Mem. M. C. Z., 1904, **30**, p. 22, pl. 2, figs. 1–11.

pletely torn off. The cup is 123 mm. long and above, at the margin, 80 mm. in transverse diameter. The wall of the cup is only 6 mm. thick. A great part of the dermal membrane is lost; of the gastral membrane extensive tracts are present. The lower part of the gastral membrane, which lines the deeper parts of the cavity of the cup, appears to contain but few efferent pores. Extensive pore-sieve nets, with pores sometimes 1.7 mm. in diameter (Plate 97, fig. 32), occur in its upper part.

The *colour* in spirit is rather dark dirty brown.

The *skeleton* consists of dermal, gastral, and canalar pinules; hypodermal and hypogastral pentactines; superficial paratangential and choanosomal more or less radial amphioxes; choanosomal hexactine megascleres; abundant microhexactines in all parts of the body; and three kinds of amphidiscs, macramphidiscs and large and small micramphidiscs.

The *dermal pinules* (Plate 97, figs. 2, 31) are nearly always pentactine, hexactine forms being met only exceptionally. The distal ray is straight, 180 μ–600 μ long, most frequently about 390 μ, and 10–22 μ thick at the base. It ends in a terminal cone and bears spines, which are short, conical, and vertical on its basal part, but strongly inclined and large, sometimes 25 μ long, farther up. The maximum thickness of the distal ray, together with the spines, is 15–68 μ; in those rays over 500 μ long this thickness is always over 40 μ. The lateral rays are 37 μ–70 μ long; in the dermal pinules with a distal ray over 500 μ in length the lateral rays are always over 50 μ long. These rays are cylindroconical or nearly cylindrical, and rounded at the end. They bear a few scattered spines, which usually congregate a little beyond the middle of the length of the ray. The proximal ray of the few hexactine forms is 15–75 μ long. The dermal pinules of the lower part of the body appear to be on the whole shorter than those of the upper part. Among the former a fair number with distal rays only 260–280 μ long have been observed, while the distal ray of the latter is only quite exceptionally less than 320 μ long.

The *gastral pinules* (Plate 97, figs. 1, 3–5, 29, 30) are similar to the dermal, and like them nearly always pentactine, exceptionally hexactine. Their distal ray is straight, 142–710 μ long, generally 342–650 μ, and at the base 12–27 μ thick; in those over 600 μ long, always 20 μ or more thick. The spines on the distal ray of these gastral pinules appear to be stouter, shorter, and less inclined than those on the distal ray of the dermal. The maximum thickness of the distal ray, together with the spines, is 25–85 μ; in those over 600 μ in length this thickness is always over 64 μ and usually about 80 μ. The lateral rays are similar to those of the gastrals and 42–70 μ long. The proximal ray of the single hexactine form observed is 30 μ long.

The *canalar pinules* (Plate 97, fig. 6) are pentactine or, more rarely, hexactine. The distal ray is 120–220 μ long and 6–10 μ thick at the base. The lateral rays are 53–110 μ long; the proximal ray is, when present, 28–65 μ long. All the rays are pointed, conical, and spined. The spines are very small, so that, even with the spines, the distal ray is nowhere thicker than at its base.

The *hypodermal and hypogastral pentactines*. A large number of hypodermal pentactines were observed, but few hypogastral. The hypogastrals and hypodermals appear to be quite similar. Their rays are straight, smooth, conical, and blunt. The proximal ray is 550–900 μ long and 26–47 μ thick at the base. The lateral rays are 320–650 μ long.

The *hexactine megascleres* are 0.6–1.4 mm. in diameter, and have fairly straight, conical, and blunt rays, 13–32 μ thick at the base.

The *amphioxes* are centrotyle, nearly straight or curved, rarely angularly bent near one end. They are 0.9–1.6 mm. long and 8–23 μ thick near the middle. The central tyle is 12–27 μ in transverse diameter, that is 1–6 μ more than the adjacent parts of the spicule.

The rays of the *microhexactines* (Plate 97, figs. 33–36) are nearly always perfectly straight; only quite exceptionally one of the rays exhibits a slight curvature. The microhexactines are 108–230 μ in diameter, generally 110–190 μ, and their conical, pointed rays are 3.5–7 μ thick at the base. The rays bear spines, the largest of which are 0.7–1.5 μ long. Generally the spines are sparsely scattered over the greater part of the length of the ray, leaving the distal end-part free for a distance of about 10 μ. The proximal spines are vertical, the distal inclined backwards.

Among the *amphidiscs* two kinds can be clearly distinguished morphologically: — *A*, a stout kind with large anchors, about half the length of the whole spicule; and *B*, a slender kind with small anchors, much less than half, usually about a third, of the whole spicule in length.

The length frequency-curve (Figure 20) has *three* main elevations separated by deep depressions. The part of the curve to the right of 106.72, the summit of which lies at about 179, pertains to the morphological group *A*, and comprises all amphidiscs of this kind. The deep depression (down to 0) between this part of the curve and the other parts shows that the amphidiscs it pertains to form a distinct group. This coincides with their morphological character, and so a special group must doubtlessly be established for these

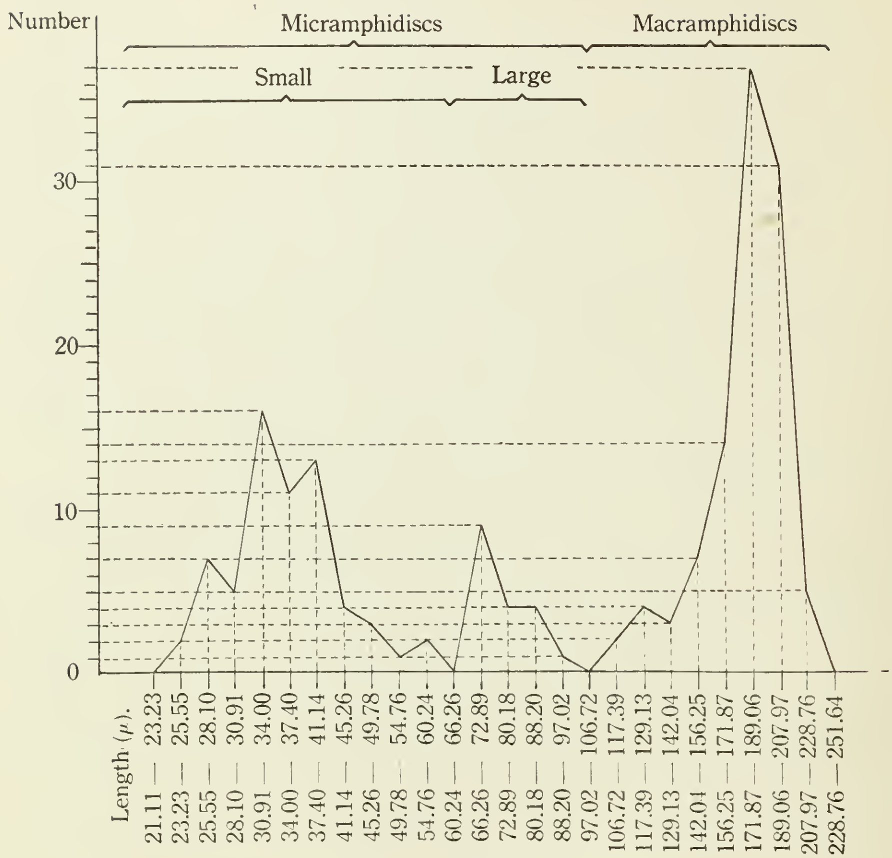

Fig. 20. — Amphidiscs.

amphidiscs, which, as they are the largest forms, I name macramphidiscs. All the other amphidiscs differ morphologically from these but are similar among themselves. They can, as they comprise the small forms, be named micramphidiscs. The part of the curve pertaining to these micramphidiscs is divided by the deep depression at about 63.2 into two parts, one comprising the larger, the other the smaller forms. Although the larger of these amphidiscs are very similar morphologically to the smaller, there could, after their biometrical study had pointed the way, be found certain morphological differences between them, particularly in the curvature of the anchor-teeth, which corroborate their biometrical distinction, and which, although slight, in my opinion justify a division of the micramphidiscs into two subgroups: — large micramphidiscs over 63.2 μ in length, and small micramphidiscs under that.

I do not think that any importance is to be attached to the minor irregularities of the curve, although some of these, particularly those in the part of it pertaining to the small micramphidiscs, are not inconsiderable.

According to the above three kinds of amphidiscs are to be distinguished:—macramphidiscs, larger forms with relatively large anchors; large micramphidiscs, forms of medium size with rather small anchors; and small micramphidiscs, small forms with rather small anchors.

The *macramphidiscs* (Plate 97, figs. 7–14; Plate 98, figs. 1–7) are 114–227 μ long, most frequently about 179 μ. The shaft is cylindrical, smooth, straight, and 12–20 μ thick. The terminal anchors are 50–111 μ in length, about half of the whole spicule, and 70–169 μ broad. The proportion of the length to the breadth of the anchors is 100 to 123–187, generally 100 to 136–178, on an average 100 : 156.8. The number of the teeth in an anchor is usually eight. The teeth of the two anchors of the same spicule are situated alternately, but this alternation is often somewhat irregular, the adjacent anchor-teeth planes (of opposite teeth) not intersecting at exactly 22.5°. The outer contour of the individual teeth is curved considerably in its basal part for about 0.4 part of the length of the tooth, curved only slightly beyond that up to about 0.8 of this length, and curved again strongly at the end, so that the tips of the teeth become strongly convergent. The outer band-shaped part of the tooth attains its maximum width somewhere beyond the middle of its length, and here measures 20–31 μ in transverse diameter. The tip of the tooth is rounded or, more rarely, somewhat pointed, like a gothic arch. The keel, in the larger forms, is over 30 μ high at the base, and becomes gradually lower distally. It terminates before reaching the end of the tooth.

Somewhat irregular forms are not infrequent among these amphidiscs. Considerable inequalities in the two anchors of the same spicule (Plate 98, fig. 6) or in the teeth of the same anchor (Plate 98, fig. 4) are often met, and sometimes irregularities occur on the apices of the anchors (Plate 98, fig. 7).

The *large micramphidiscs* (Plate 97, figs. 16–20) are 67–91 μ long, most frequently about 69.5 μ. The shaft is straight, centrotyle, and 2–4 μ thick. The tyle passes gradually into the adjacent parts of the shaft. It is 3.5–5 μ in transverse diameter, that is 0.5–3 μ more than the adjacent parts of the shaft. With the exception of its end-parts, the whole shaft is covered with spines. The spines on the tyle are much larger than the others, sometimes 3 μ long, and often strongly curved. The terminal anchors are 20–35 μ, usually a little more than a third of the whole spicule in length. Their breadth is 18–

30 μ. The proportion of anchor-length to anchor-breadth is 100 to 69–100, on an average 100 : 89.5. The teeth arise nearly vertically from the ends of the shaft, and are curved strongly at the base and decreasingly towards the end. The tips of the teeth are usually parallel or slightly divergent.

The *small micramphidiscs* (Plate **97**, figs. 21–28) are 24–57 μ long, most frequently about 32.4 μ. The shaft is 0.8–2 μ thick, and generally centrotyle. The central tyle is 1.8–2.6 μ in transverse diameter, that is 0.3–1 μ more than the adjacent parts of the shaft. Small spines are scattered over tyle and shaft in the larger forms; in the smaller these spines are so minute that it is difficult to make them out, often they appear to be absent altogether. The anchors are 7–22 μ long, usually about a third of the whole spicule. The anchor-breadth is 7–19 μ. The proportion of anchor-length to anchor-breadth is 100 to 71–121, on an average 100 : 89.7. The teeth are sometimes remarkably numerous. They arise vertically from the ends of the shaft and are more strongly curved some distance from the base than proximally; beyond the strong bend, they decrease in curvature, so that their end-parts are nearly straight and parallel. The teeth are pointed at the end.

The nearest allies of the above sponge are the species *Hyalonema* (*Oonema*) *densum*, *H.* (*O.*) *sequoia*, and *H.* (*O.*) *crassipinulum* described in this Report. From these it differs by being destitute of the large macramphidiscs. From *H.* (*O.*) *densum* also it differs by having straight-rayed micramphidiscs, and from the other two also by its superficial pinules being smaller and their distal rays much more slender.

Hyalonema (Oonema) crassipinulum, sp. nov.

Plate 92, figs. 1–23; Plate 93, figs. 1–10; Plate 94, figs. 1–33.

One specimen of this species was trawled in the Central Pacific at Station 3684 (A.A. 17) on 10 September, 1899; 0° 50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); it grew on a bottom of light yellow-gray Globigerina ooze.

It possesses pinules with large, remarkably divergent spines on the proximal part of the distal ray. To this the name refers.

Shape and size. The single specimen (Plate **93**, fig. 9) has the shape of an inverted bell, 105 mm. long, 95 mm. broad, and now strongly compressed laterally and only about 18 mm. thick. In life the sponge was probably laterally compressed much less, or not at all. A stalk, 2.5 mm. thick and broken off rather short, protrudes from the lower rounded end. The lower and lateral surfaces, which are the dermal, are continuous and fairly smooth. The upper surface, which is the gastral, now appears rugose. In life wide cavities, separated by upright walls, probably occupied the upper part of the interior. Reticulate pore-sieves are observed on some parts of the surface. Indications of flagellate chambers about 140 μ in diameter were noticed in some of the sections.

The *colour* in spirit is light dirty brown.

A small colony of Palythoa polyps is attached to the upper part of the stalk.

The *skeleton.* A fur composed of distal rays of large pinules covers the whole sponge. The gastral pinules, particularly those on the pore-sieves, are very large, the dermal considerably smaller. Very numerous large micramphidiscs lie in and on the surface. Microhexactines, paratangentially extending amphioxes, and the lateral rays of pentactines occur just below the lateral rays of the superficial pinules. Some hexactine and abundant rhabd megascleres, very numerous microhexactines, a few monactine microhexactine-derivates, canalar pinules, and amphidiscs are found in the interior. The internal amphidiscs are of four kinds: — 1, very scarce large macramphidiscs; 2, not numerous small broad-anchored macramphidiscs; 3, very scarce small macramphidiscs; and 4, very numerous micramphidiscs. It is possible, but not probable, that 1 and 3 are foreign spicules. Numerous acanthophores for the most part diactine and tetractine occur in the basal part of the sponge-body. The canalar pinules are rare, and found only here and there in the canal-walls. In the walls of some of the canals masses of micramphidiscs are observed. The remnant of the stalk consists of a few stout and several slender spicules.

In the superficial part of the coenenchym and in the lateral and oral walls of the individual polyps of the Palythoa, spicules occur in large numbers; these are similar to the smaller and stouter acanthophores of the basal part of the sponge.

The *gastral superficial pinules* have a distal ray 250–1130 μ long (measured in the case of the curved ones along their chord). The length frequency-curve of the distal ray has two distinct elevations, at about 600 and 850 μ. This indicates that two kinds of gastral pinules, a large and a small, should be distinguished.

The *large gastral pinules* (Plate 92, figs. 1–4, 20, 22, 23), which greatly preponderate in the reticulate pore-sieves, are all pentactine. Their distal ray is straight or, comparatively very frequently, curved in its distal part. The curvature is usually not great but sometimes very marked. In one of these pinules the distal part of the axis of the distal ray enclosed an angle of nearly 90° with its proximal part. The distal ray is (measured in the case of the curved ones along the chord) 680–1130 μ long, most frequently 800–950 μ, 20–35 μ thick at the base. Above it thickens considerably, and attains at its point of maximum thickness, which lies a little above the middle of its length, without the spines, a transverse diameter usually a little more than twice as great as that of its base. At its distal end the ray is attenuated very abruptly to a blunt point or is, exceptionally, rounded and dome-shaped. The proximal part of the distal ray bears short and very stout, vertical, conical spines, which extend quite down to its base. Farther on the spines become longer, curved, concave towards the shaft and more and more inclined towards its distal end. The longest spines attain a length of 20–40 μ. The spines are usually regularly arranged; only occasionally an irregular arrangement of those occupying the concave side of curved distal rays is observed. The maximum diameter of the distal ray, together with the spines, is 75–115 μ. The lateral rays are, at the base, slightly thinner than the proximal end of the distal ray. They are nearly cylindrical in their proximal and conical in their distal part, very blunt, 64–150 μ long, and spined. The spines are quite numerous, very stout, vertical, conical, and generally up to about 6 μ long.

The *small gastral pinules* (Plate **92**, figs. 5, 18, 21) are likewise all pentactine. The distal ray is generally straight, 250–640 μ long, most frequently 500–640 μ, and 12–28 μ thick at the base. Above it thickens very considerably and attains without the spines, at the point of maximum thickness, which lies a little above the middle, a transverse diameter two to five times as great as that of its base. Distally the ray is attenuated more gradually than in the large gastral pinules, so that its end appears more slender. The distal ray is covered with spines down to its base. The spines increase in length up to a point a little beyond the middle of the ray, where they are sometimes 20–30 μ long. Beyond they again decrease in size. The lowest spines are, like those of the larger gastral pinules, short, stout, conical, and vertical; but as we proceed in a distal direction and the spines become longer, their tips curve upwards more and more, and a short distance below the middle of the ray they pass, often quite abruptly, into spines inclined and bent towards the end of the ray to such an extent that their end-parts are very strongly inclined, parallel, or even convergent. The distal part of the ray consequently has an appearance very different from that of its proximal part, the former looking nearly smooth, the latter bristling with large spines. The lateral rays are similar in shape to those of the large gastral pinules, but only 50–125 μ long.

The *dermal superficial pinules* have distal rays 250–790 μ long. Their length frequency-curve exhibits, like that of the gastrals, two very distinct elevations, so that also among these pinules two kinds, a large and a small one, must be distinguished.

The *large dermal pinules* (Plate 92, fig. 6) are pentactine. Their distal ray is usually straight and 500–790 μ long, most frequently 600–650 μ. It is 15–24 μ thick at the base, and thickened above. At its point of maximum thickness, which lies a little above the middle, it attains a transverse diameter about twice as great as its basal thickness. The distal ray ends with a low and broad terminal cone. Its spinulation is similar to that of the gastral pinules. The spines are proportionately smaller. The maximum diameter of the distal ray, together with the spines, is 50–90 μ. The lateral rays are cylindroconical, and 45–95 μ long. They bear small, sparse, broad, and low, conical spines.

The *small dermal pinules* (Plate 92, figs. 7, 18) are rather similar to the larger ones and, like them, all pentactine. Their dimensions are: — distal ray, length 250–440 μ, basal thickness 10–17 μ, maximum thickness together with the spines 28–65 μ; lateral rays, length 45–70 μ.

The *canalar pinules* (Plate 92, figs. 16, 17) are pentactine or hexactine. The distal ray is straight, 120–150 μ long, and 5–9 μ thick at the base. It is slightly thickened above, gradually attenuated to a fine point, and bears rather sparse, small, straight spines directed obliquely upwards. Its maximum thickness, together with the spines, is 7–30 μ. The lateral rays are 45–95 μ long; the proximal, when present, is 50–70 μ. Both the lateral rays and the proximal are spiny.

There seems to be no great difference between the *hypodermal and hypogastral pentactines*. Both have straight, conical, blunt rays. The lateral rays are 230–550 μ long; the proximal ray is 400–700 μ long and 15–60 μ thick at the base.

The *hexactine megascleres* generally have fairly equal rays. In some, two opposite rays are a little longer than the others, but the difference never appears to be great. The hexactine megascleres observed are 0.8–1.2 mm. in diameter. The basal thickness of their rays is 25–30 μ.

The *amphioxes* of the dermal and gastral membranes (pore-sieve reticulations) and the choanosome are centrotyle, straight or curved, sometimes very considerably, and 0.7–1.7 mm. long. Near the middle they are 8–29 μ thick. The central tyle is 10–34 μ in diameter, that is 2–5 μ more than the adjacent parts of the spicule.

In the axial part of the sponge a few much larger *amphioxes* were observed; they had a maximum length of 8 mm. and were 160 μ thick. These appear to take part in the formation of the upper end-part of the stalk, which is imbedded in the body of the sponge.

The *spicules of the stalk* are broken off rather short. Where they arise from the body of the sponge they are 50–500 μ thick.

The *acanthophores in the sponge-body* (Plate **94**, figs. 24–33) are mostly diactines and tetractines, but monactine, triactine, and pentactine forms also occur. The monactines are tylostyle, the diactines centrotyle. The monactine and diactine rhabd-forms are 160–840 μ long, and 13–29 μ thick near the tyle. The tyle in the longer ones is often very large. The tri- to pentactines are 85–480 μ, on an average 223.6 μ, in maximum diameter, and have rays 12–30 μ thick at the base. The ends of the fully developed rays are always spiny. The same is the case in the rays reduced in length, provided the reduction has not gone too far. The rays reduced to mere knobs are smooth. The central parts of these spicules are usually smooth (Plate **94**, figs. 24, 26, 28–33), more rarely covered with sparse small spines (Plate **94**, figs. 25, 27).

The *acanthophores of the sponge used by the Palythoa to build its skeleton* (Plate **94**, figs. 14–23) are di- to pentactine. The diactines are not nearly so numerous among them as among the basal spicules from the sponge. The diactines are centrotyle, 170–400 μ long, and 20–30 μ thick near the central tyle. Among the tri- to pentactines, forms with two fully developed and one or two partly reduced rays are the most frequent. These spicules are 90–260 μ in maximum diameter, very rarely as much as 350 μ, on an average 206.7 μ, and their rays are 14–35 μ thick at the base, rarely up to 45 μ.

The average measurements of the tri- to pentactines of the sponge-body (223.6 μ) and of the Palythoa (206.7 μ), given above, show that the former have on the whole a larger maximum diameter than the latter. Also the rhabd-forms show this, the average length of those of the sponge being considerably greater than of those of the Palythoa. Apart from this it is to be noted that the Palythoa spicules have stouter rays, and are more spiny than those of the sponge. These facts seem to indicate: — 1, that the more slender and less spiny acanthophores are young forms of the stouter and more spiny ones; 2, that none, or only a few, of these young spicules, but many of the old spicules, are shed by the sponge; and 3, that of the old, stouter, and more spiny spicules which are shed and thus placed at the disposal of the Palythoa, the latter selects the smaller (shorter) ones for building up its skeleton.

The rays of the *microhexactines* (Plate **92**, figs. 9–15) are usually nearly equal and all quite straight or nearly so. Only rarely microhexactines are found in which one or two of the rays are distinctly curved in their middle-part. The rays are 3.5–7 μ thick at the base, conical, pointed, and covered with spines. The spines on the proximal half of the ray are sparse, vertical or slightly inclined towards the centre of the spicule, and up to 2 μ long. The spines on the distal half are more numerous, smaller, and rather strongly inclined towards the centre of the spicule. Most of the microhexactines have rather long and slender rays. These spicules (Plate **92**, figs. 9, 10) are 90–220 μ in total diameter, and the basal thickness of their rays (3.5–6.5 μ) is fairly in proportion to their size. Some microhexactines have much shorter and relatively much stouter rays. These spicules (Plate **92**, fig. 11) are only 65–80 μ in diameter, and have rays as much as 7 μ thick at the base.

The rare *monactine microhexactine-derivates* appear as strongly spined tylostyles. They are about 130 μ long, and 8 μ thick near the tyle. The terminal tyle itself is about 9 μ in diameter.

Morphologically four kinds of *amphidiscs* can be distinguished: — 1, large amphidiscs with fairly smooth shaft and broad and short anchors, about a third of the whole spicule in length; 2, medium amphidiscs with a stout smooth shaft and broad and long anchors, usually a little more than half the whole spicule in length; 3, medium amphidiscs with a slightly spined, rather slender shaft, and long, narrow anchors, more than a third of the whole spicule in length; and 4, small amphidiscs with slender, spined shaft and rather short anchors, only about a third of the whole spicule in length.

The amphidiscs belonging to the first kind are 375–480 μ long, those belonging to the second kind 110–200 μ, those belonging to the third kind 112–137 μ, and those belonging to the fourth kind 31–106 μ. The first and the fourth kinds are accordingly distinguished both morphologically and biometrically. The second and third kinds, although distinguished in the same manner from the first and fourth, are distinguished from each other morphologically only, and not biometrically.

As the measurements given above and the adjoined graph show, the gap in the length frequency-curve separating the fourth from the second and third kinds is much narrower than that separating the second and third from the first kind. In spite of the width of this gap, and the entire absence of transitions between the second and third kinds of amphidiscs on the one hand and the first kind of amphidiscs on the other, I am inclined to combine the first, second,

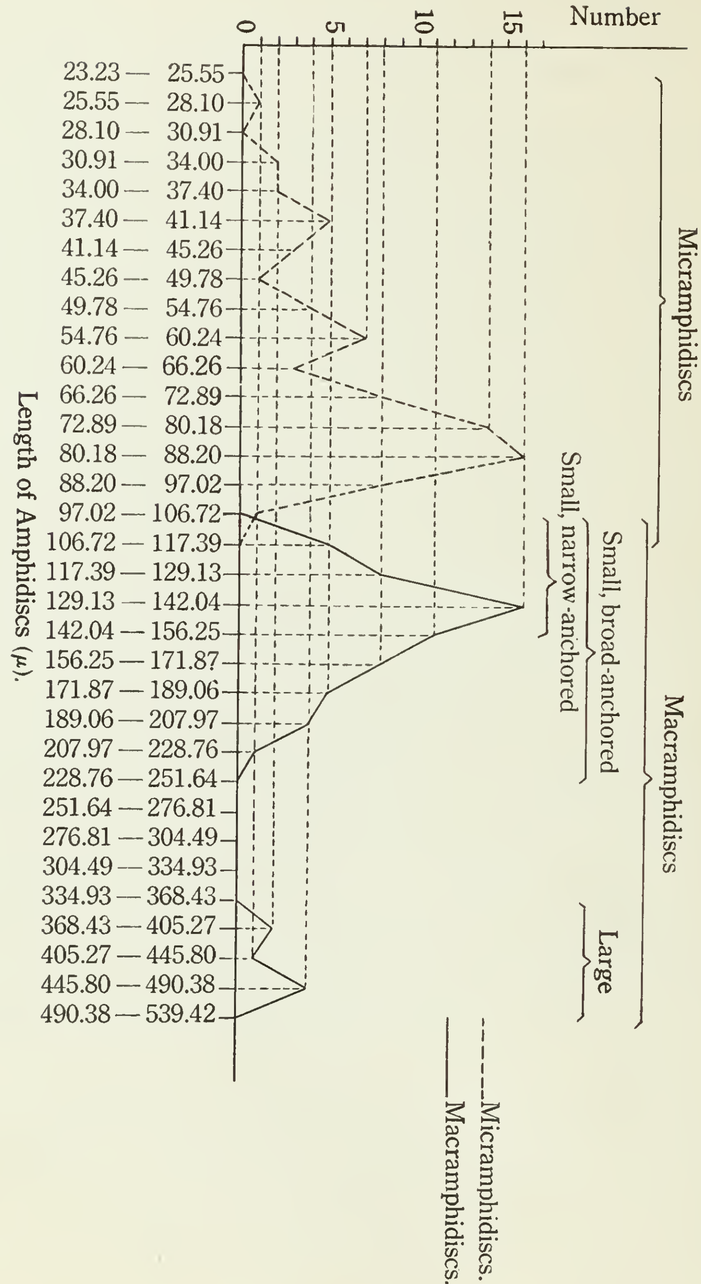

Fig. 21. — Amphidiscs.

and third kinds, because in other closely allied species they are not so clearly separated biometrically. I distinguish accordingly two main groups of amphidiscs: — macramphidiscs 110–480 μ long, and micramphidiscs 31–106 μ long.

The macramphidiscs comprise the first, second, and third kinds of amphidiscs. As shown above, the first kind is very clearly distinguished from the second and third both morphologically and biometrically. I therefore divide the macramphidiscs into two groups, large macramphidiscs 375–480 μ long, and small macramphidiscs 110–200 μ.

The length frequency-curve of the large macramphidiscs has two distinct elevations. However, in view of the morphological similarity of the largest and the smallest, and the smallness of the number of large macramphidiscs observed and measured, I do not attach much importance to this, and consider the large macramphidiscs as a simple group.

The length frequency-curve of the small macramphidiscs has a single elevation, and is remarkably regular biometrically. These spicules accordingly form a remarkably homogeneous group. Morphologically, however, two kinds of small macramphidiscs are to be distinguished: — those with relatively smaller, chiefly narrower anchors; and those with relatively larger, chiefly broader anchors.

The micramphidiscs form morphologically a nearly continuous series, the smallest being connected by intermediate forms with the largest with hardly any break. Their length frequency-curve, however, shows four elevations and three depressions, one of which (at about 47.5 μ) is rather conspicuous. In view of the slightness of the morphological differences between the micramphidiscs to which the four elevations of the curve pertain, I abstain from subdividing them into subgroups corresponding to these elevations.

Thus I distinguish four kinds of amphidiscs in this sponge: — large macramphidiscs, small broad-anchored macramphidiscs, small narrow-anchored macramphidiscs, and micramphidiscs.

The *large macramphidiscs* (Plate 93, fig. 10) are very rare. In fact I found only seven in all, and although some of these were observed in the sections, it is not impossible that they are foreign; the probability is, however, greatly in favor of their being proper to the sponge. These spicules are 375–480 μ long, most frequently about 468 μ. The shaft is cylindrical, 22–29 μ thick, smooth, and slightly thickened in or near the centre. The terminal anchors are 168–215 μ long, about a third of the whole spicule, and 210–260 μ broad. The proportion of their length to their breadth is 110 to 107–155, on an average 100 :

129. The individual anchor-teeth are usually not curved quite uniformly, and pointed at the end. Their end-parts are parallel or slightly divergent.

The *broad-anchored small macramphidiscs* (Plate **93**, figs. 3–8; Plate **94**, figs. 1–3) are very much rarer than in the allied species. They are 110–200 μ long, and have a smooth cylindrical shaft 8–17 μ thick. Their anchors are 57–100 μ long, usually 1–6 μ more than half the whole spicule, and 58–172 μ broad. The proportion of their length to their breadth is 100 to 101–179, on an average 100 : 144.6. It is to be noted that the smaller of these spicules have relatively narrower anchors, the larger relatively broader anchors. Thus the proportion of anchor-length to anchor-breadth is in those under 130 μ in length 100 to 101–148; in those over 180 μ in length 100 to 150–179. The most frequent number of anchor-teeth is eight. The teeth of the two anchors of the same spicule are usually situated alternately (Plate **93**, figs. 5, 7); sometimes, however, all the teeth, or at least some of them, lie opposite, and appear to be in contact with each other (Plate **93**, fig. 3). The outer contour of the teeth usually at first slightly ascends. It is uniformly curved, concave to the shaft to within a short distance from the tip of the tooth, and abruptly bent inward at the end. The keel of the tooth extends as far as the curvature of the outer contour continues uniform. At the point of maximum breadth, which lies about two thirds of their length from their base, the teeth measure 22–31 μ in transverse diameter. Distally the teeth are slightly attenuated. The end is rounded.

The *narrow-anchored small macramphidiscs* (Plate **93**, figs. 1, 2; Plate **94**, fig. 4) are very rare. I observed only five of them, and it is possible that they are foreign. These spicules are 112–137 μ long. The shaft is 5–7 μ thick, slightly centrotyle, and roughened with indications of spines. The central tyle is 1–3 μ more in transverse diameter than the adjacent part of the shaft. The terminal anchors are usually shorter than half the length of the spicule, rarely a little longer. They are 52–70 μ long and 52–59 μ broad. The proportion of their length to their breadth is 100 to 84–104, on an average 100 : 95. The anchor-teeth are strongly curved in their basal part, but only slightly curved in their distal part. Some of these spicules have irregular anchors, composed of teeth unequal in length.

The *micramphidiscs* (Plate **94**, figs. 5–13), particularly the larger ones, are very abundant. They are 31–106 μ long, most frequently about 84 μ. The shaft is straight, centrotyle, and 1.5–4 μ thick. The central tyle is 3.5–5.5 μ in transverse diameter, that is 0.6–2.6 μ more than the adjacent parts of the shaft. An irregular verticil of spines, up to about 1 μ long, arises from the central tyle, and a good many similar spines are found also on other parts of the shaft. The spines are more abundant in the larger than in the smaller forms, and in some of the former (Plate 94, figs. 6, 7, 13) are remarkably numerous. The terminal anchors are 9–38 μ long and 8–39 μ broad. The proportion of their length to their breadth is 100 to 81–125, on an average 100 : 94. As stated above, the micramphidiscs of different sizes, are very similar in shape, the differences in the proportions of their different dimensions being only slight. In the micramphidiscs over 80 μ in length the proportion of anchor-length to anchor-breadth is 100 to 89–114, on an average 100 : 95, and the proportion of the anchor-length to the length of the whole spicule 1 to 2.6–3.2, on an average 1 : 2.9. In the micramphidiscs under 50 μ in length the proportion of anchor-length to anchor-breadth is 100 to 78–125, on an average 100 : 90.5; and the proportion of the anchor-length to the length of the whole spicule 1 to 2.8–4, on an average 1 : 3.16. The curvature of the anchor-teeth decreases distally. This decrease is more marked in the smaller than in the larger micramphidiscs. The teeth are 4–7 μ broad, and rounded at the end; their tips are usually nearly parallel.

This sponge is obviously most closely allied to *Hyalonema* (*Oonema*) *sequoia*. From this it differs by the absence of the smaller kind of small macramphidiscs with numerous anchor-teeth; by the presence of narrow-anchored small macramphidiscs, and superficial pinules with long strongly divergent spines on the proximal part of the distal ray; and by the smaller size of several kinds of its spicules, chiefly the superficial pinules.

Hyalonema (**Oonema**) **densum,** sp. nov.

Plate 94, figs. 34–42; Plate 95, figs. 1–20; Plate 96, figs. 1–14.

One specimen of this species was trawled in the Eastern Tropical Pacific at Station 4649, on 10 November, 1904; 5° 17′ S., 85° 19.5′ W.; depth 4086 m. (2235 f.); it grew on a bottom of sticky, gray mud; the bottom-temperature was 35.4°.

The name has reference to the remarkable density of the sponge.

Shape and size. The single specimen (Plate 95, fig. 4) appears as an inverted cone cut off obliquely and considerably extended at one side above. The upper portion protrudes on this side like a bulging rim for a distance of 8 mm. The sponge is 57 mm. high, and the regularly oval upper face 46 mm. long and 39 mm. broad. This upper face, which is to be considered as the gastral, is convex and perforated by numerous broad-oval efferent apertures 0.2–0.9 mm. wide (Plate **95**, fig. 3). A pointed, very eccentrically situated gastral cone 8 mm. high and, at the base, 6 mm. thick arises from it. The conical body is slender and has no pores visible with the unaided eye. Its surface is to be considered as the dermal face of the sponge. Its lower end is torn off.

The *colour* in spirit is dirty light brown.

Canal-system. In the choanosome more or less radial canals, sometimes 0.8 mm. wide, are observed. Indications of elongate, perhaps tubular, flagellate chambers 30–70 μ broad are observed in the sections.

Skeleton. The whole of the surface is covered with a dense pinule-fur (Plate **95**, figs. 1, 2). Between the proximal parts of the freely protruding distal rays of the pinules forming it are met small macramphidiscs, mostly with the shaft in a radial position. The dermal and gastral membranes are supported by the lateral rays of the superficial pinules, paratangential centrotyle amphioxes, and the lateral rays of hypodermal or hypogastral pentactines. Masses of microhexactines and some small macramphidiscs occur in and just below these membranes. A good many large micramphidiscs, dense masses of microhexactines, and a few canalar pinules occur in the canal-walls. The micramphidiscs appear to be restricted to the efferent canals. Apart from these canalar spicules, one finds in the interior a few large macramphidiscs, hexactine megascleres, and small micramphidiscs, numerous ordinary small choanosomal amphioxes, and some large axial amphioxes forming the upper continuation of the stalk. In the lower part of the sponge-body numerous acanthophores are added to these spicules. These extend remarkably far up. The upper acanthophores have long, slender, and usually fairly straight and not very spiny rays. In the lower acanthophores the rays are either reduced in length, stout, and very spiny, or long, slender, not particularly spiny, and more or less, often considerably curved.

The *dermal pinules* have a distal ray 230–855 μ long. The length frequency-curve of their distal rays has a very marked depression at about 530 μ, and two perfectly distinct elevations at 370 and 650 μ. I therefore distinguish two kinds of dermal pinules, a large and a small.

The *large dermal pinules* (Plate **95**, figs. 1, 15, 19, 20) are pentactine. Their distal ray is straight, 560–855 μ long, most frequently about 650 μ, and 12–23 μ thick at the base. It ends with a short and stout terminal cone, and bears spines which extend quite down to its base, or nearly so. The lowest spines are very short, stout, conical, and vertical; distally the spines become larger and more inclined and curved concave towards the tip of the ray. The largest spines usually attain a length of about 27 μ. The maximum diameter of the distal ray, together with the spines, is 32–85 μ. The lateral rays are 40–77 μ long, nearly cylindrical in their proximal, and conical in their distal part. Their middle and sometimes also their proximal parts bear broad and low spines. The end-parts are smooth and sharply or bluntly pointed.

The *small dermal pinules* are similar to the large ones. They are nearly always pentactine. Exceptionally a remnant of a proximal ray, sometimes 15 μ long, is present. The distal ray is straight, 230–505 μ long, most frequently about 370 μ, and 6–10 μ thick at the base. Its maximum diameter, together with the spines, is 12–47 μ. The lateral rays are 40–68 μ long.

The *gastral pinules* (Plate **95**, figs. 2, 11–14, 16–18). Although the length frequency-curve of the distal rays of these spicules is irregular and exhibits no less than five elevations, these are separated by depressions so shallow that differently sized kinds of gastral pinules cannot be distinguished. The gastral pinules are generally pentactine, rarely hexactine. The hexactine forms are, however, not so rare among these pinules as among the dermal. Apart from this the gastral pinules are quite similar in shape to the dermal. The distal ray is straight, 300–930 μ long, most frequently 400–650 μ, and 10–28 μ thick at the base. Its maximum thickness, together with the spines, is 25–80 μ. The spines are sometimes 35 μ long. The lateral rays (Plate **95**, figs. 11, 12) are 35–82 μ long. The proportion of the length of the distal to that of the lateral rays of the same spicule is 7–13 to 1, on an average 9 : 1. The proximal ray, when present, is, in shape and spinulation, similar to the laterals and 20–68 μ long.

The scarce *canalar pinules* are mostly pentactine. The distal ray is 150–200 μ long, and 7–10 μ thick at the base. Its maximum transverse diameter, together with the spines, is 12–22 μ. The lateral rays are 50–60 μ long.

The *hypodermal and hypogastral pentactines* are very similar. Both have a straight, conical, terminally rounded proximal ray 540–860 μ long, and 20–48 μ thick at the base. The lateral rays are also straight, conical, and rounded. Those of the same spicule are often very unequal in size. Their length is 250–530 μ.

The *hexactine megascleres* are 1.1–3.5 mm. long and 1.1–1.8 mm. broad. In the larger, two opposite rays are longer than the other four. In the smaller the six rays are usually fairly equal in size. The rays are 40–90 μ thick at the base, straight, generally regularly conical, and rounded at the end. Occasionally the thickest part of the ray does not lie at its proximal end but farther out, some distance from the centre of the spicule. The largest hexactine observed was of this kind. In this spicule the two longer opposite rays measured 1.1 mm. and 2.4 mm. in length respectively. The longer of the two is 70 μ thick at the base. Its point of maximum thickness is 0.4 mm. from the centre of the spicule, and here the ray measures 80 μ in transverse diameter. At the rounded end it is 15 μ thick. In the proximal part of the ray the axial thread is simple and quite thin (0.5 μ in diameter); distally it gradually increases in thickness to 5 μ at the end of the ray. In its distal and middle-parts it is not simple but provided, at frequent intervals, with verticillate groups of strongly inclined branches with a maximum length of 15 μ.

The *superficial and ordinary choanosomal amphioxes* are centrotyle, usually 0.6–2.2 mm. long, and 7–27 μ thick near the middle. The central tyle, which not infrequently protrudes much more on one side of the spicule than on the other, is 13–37 μ in transverse diameter, that is 1–18 μ more than the adjacent parts of the spicule.

The *large axial amphioxes* and rod-shaped fragments found in the central part of the sponge are 25–130 μ thick. The largest intact one observed is a fusiform amphiox, blunt at both ends, 5 mm. long, and 28 μ thick.

The *acanthophores* (Plate **94**, figs. 34–36) have from two to six, most frequently two or four rays. The dimensions of these spicules are tabulated below.

ACANTHOPHORES.

Number of rays more or less developed	from higher up in the sponge		from the lower end of the sponge	
	total length (maximum diameter) of spicule μ	basal thickness of rays μ	total length (maximum diameter) of spicule μ	basal thickness of rays μ
2	620–1560	7–19	100–790	12–30
3	390–490	12–15	170–300	28
4	390–610	13–29	120–565	11–38
5	615	21	217–540	20–26
6	300–400	14–19	600	21

The table shows that, apart from the few hexactine forms, which appear only partly to conform to the rule, the acanthophores situated farther up are larger and have more slender rays than those situated farther down. The rod-shaped diactine acanthophores are longer than any of the others. Apart from this the size (ray-length) of these spicules is by no means in inverse proportion to the ray-number; the triactines, for instance, are shorter than the tetractines. The thickest rays are met in the tetractines. This applies both to the upper and the lower tetractines. The diactines have a central and often also two terminal tyles. The latter sometimes attain remarkably large dimensions. In a spicule of this kind 780 μ long and 15 μ thick, the two terminal tyles were respectively 50 and 60 μ in diameter. The small acanthophores are often spined throughout; in the large ones the spines are confined to the ends of the rays. The spines are low and broad, and attain 10 μ in length and 16 μ in breadth. They are conical and pointed or, more rarely, rounded at the end and dome-shaped. The acanthophores with rounded spines are characteristic of the species. The rays are straight or curved. Strongly curved rays are met particularly among the larger tri- to hexactines situated below. The rays of all the small acanthophores, of all the diactine acanthophores, and of all kinds of acanthophores situated farther up, are usually fairly straight.

The *microhexactines* (Plate **94**, figs. 37–40) are 60–165 μ in diameter, usually 95–160 μ. The rays are equal, conical, finely pointed, 3–6 μ thick at the base, and curved slightly but quite distinctly and quite uniformly throughout their length. They bear spines which are rather sparse, vertical, and sometimes 1 μ high in their proximal part, and which are more numerous, smaller, and directed backwards in their distal part. Toward the ends of the rays the spines decrease in size to such an extent that the end-parts themselves merely appear rough, even under the highest power.

From a morphological point of view four kinds of *amphidiscs* can be distinguished: — *A*, large ones, with broad, short anchors, less than a third of the whole spicule in length, and no protuberance, or only one or two, on the shaft; *B*, middle-sized ones with long and broad anchors, about half the length of the whole spicule; *C*, middle-sized ones with short elliptical anchors, about a third of the length of the whole spicule, and a shaft spined throughout; and *D*, small ones with short U-shaped anchors, less than a third of the whole spicule in length.

The length frequency-curve of the amphidiscs, shown in Figure 22, exhibits four very distinct elevations separated by deep depressions or gaps. These

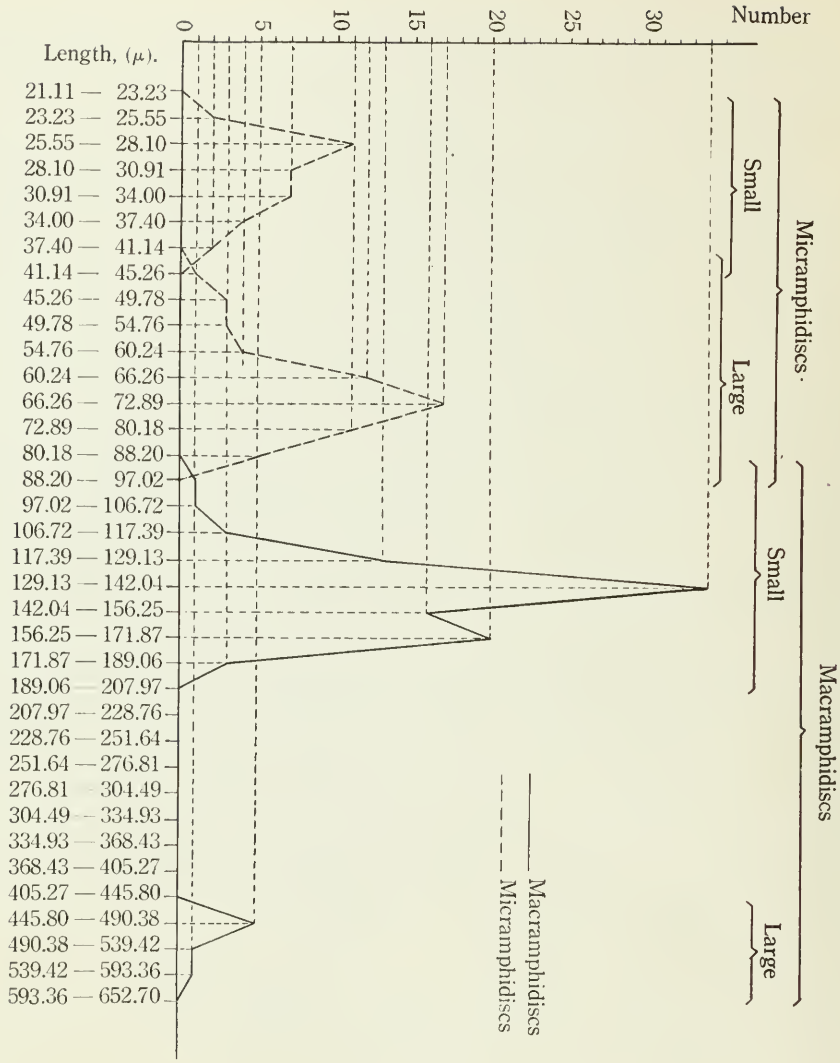

Fig. 22. — Amphidiscs.

four elevations coincide with the four morphological groups above referred to. There can be no doubt, therefore, that we have here to deal with four distinct kinds of amphidiscs. The group *A* is very clearly distinguished from all the others, both morphologically and biometrically. The group *B* is clearly distinguished morphologically from all other groups, but distinguished biometrically by a wide gap in the length frequency-curve only from group A. Groups C and D differ morphologically greatly from A and B but not nearly so much from each other. Biometrically, that is judging from the width of the depression separating the two elevations of the curve pertaining to them, they are also less clearly distinguished from each other than A is from B.

Thus C and D together form a main group, which is to be named micramphidiscs, as it comprises the smallest amphidiscs. Although separated by a wide gap in the curve, and differing also morphologically, I am inclined to combine A and B in a like manner in one main group, which is to be named macramphidiscs, as it comprises the largest amphidiscs. Within each of these main groups I distinguish two subgroups differing in size, and thus divide the amphidiscs into the four groups: — large macramphidiscs (morphological group A); small macramphidiscs (morphological group B); large micramphidiscs (morphological group C); and small micramphidiscs (morphological group D).

The *large macramphidiscs* (Plate **96**, figs. 8, 9, 14) are rare. They are 450–540 μ long, most frequently about 476 μ, and have a straight shaft, 21–29 μ thick. The shaft is either quite simple and cylindrical throughout (Plate **96**, fig. 9), or it bears a rounded protuberance or two, about 10 μ high, in its middle part (Plate **96**, figs. 8, 14). The terminal anchors are 125–140 μ long, less than a third of the whole spicule, and 190–230 μ broad. The proportion of length to breadth of the anchors is 100 to 145–174, on an average 100 : 162. The anchors are composed of eight teeth. The individual teeth are throughout curved fairly uniformly and sharply pointed at the end.

The *small macramphidiscs* (Plate **96**, figs. 1–7, 10–13) are present in fair numbers, but are not nearly so abundant as in the allied species. They are 90–184 μ long, most frequently about 135.6 μ. The shaft is straight, simply cylindrical, and 9–15 μ thick. The terminal anchors are 45–92 μ long, usually a little more than half the whole spicule. Their breadth is 60–136 μ. The proportion of anchor-length to anchor-breadth is 100 to 125–157, on an average 100 : 146.2. The anchors are usually composed of eight, more rarely of seven teeth. The teeth of the two anchors of the same spicule are usually situated so that those of the one anchor alternate regularly with those of the other. The individual teeth consist of an outer band-shaped part, up to 30 μ broad, and simply rounded at the end, and an inner keel, high at the base and uniformly narrowing distally. The outer contour is more strongly curved in its proximal and distal than in its middle-parts. At the end of the tooth it is always strongly bent inwards.

The *large micramphidiscs* (Plate **95**, figs. 5–8) are abundant. They are 44–86 μ long, most frequently about 69.5 μ. The shaft is straight, centrotyle, and 1.5–4 μ thick. The central tyle is 2–5 μ in transverse diameter, that is 0.5–2.5 μ more than the adjacent parts of the shaft. The shaft bears rather numerous scattered spines, the largest of which arise from the central tyle. These spines are 1–4 μ long and, if long, generally considerably curved. The terminal anchors are 13–31 μ long, usually about a third of the whole spicule, and 15–35 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 78–123, on an average 100 : 102.3. The individual teeth are curved rather strongly in their basal part. Distally the curvature decreases so that their ends are slightly divergent or nearly parallel.

The small *micramphidiscs* (Plate **95**, figs. 9, 10) are not numerous. They are 24–40 μ long, most frequently about 26.8 μ. The shaft is straight, usually distinctly centrotyle, and 1–1.7 μ thick. The tyle is 1.5–2.3 μ in transverse diameter, that is 0.2–1.2 μ more than the adjacent parts of the shaft. The terminal anchors are 7–16.5 μ long, usually less than a third of the whole spicule, and 7–14 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 75–143, on an average 100 : 97.8. The individual teeth arise vertically from the ends of the shaft, are straight in their basal part, curved through a quadrant in their middle-part, and straight again in their distal part. Their ends are parallel.

Among the small micramphidiscs I found several irregular ones with asymmetric anchors. One of these is 16 μ long, has a shaft 1.5 μ thick, and possesses apparently only two teeth, one in each anchor. These two teeth stand opposite each other and are not very much shorter than the whole spicule, which is consequently similar to a depressed S.

The nearest allies of the above sponge are the species *Hyalonema* (*Oonema*) *sequoia*, *H.* (*O.*) *crassipinulum*, and *H.* (*O.*) *henshawi* described in this Report. From these it differs by the smaller size, and the distinct curvature of the rays of its micramphidiscs; by the possession of acanthophores with terminally rounded spines; by differences in the dimensions of its pinules; and by the shape and general density of its body.

Hyalonema (Oonema) sequoia, sp. nov.

Plate 85, figs. 9–21; Plate 86, figs. 1–36; Plate 87, figs. 1–7; Plate 88, figs. 1–13; Plate 89, figs. 1–36; Plate 90, figs. 1–10; Plate 91, figs. 1–6.

One specimen of this species was trawled in the Central Tropical Pacific, at Station 4740 on 11 February, 1905; 9° 2.1′ S., 123° 20.1′ W.; depth 4429 m. (2422 f.); it grew on a bottom of dark gray Globigerina ooze; the bottom-temperature was 34.2°. Most of its superficial pinules attain a very large size, exceeding the ordinary pinules of other hexactinellids in dimension as *Sequoia gigantea* does the other conifers. To this the name refers.

Shape and size. The single specimen is much torn (Plate 86, fig. 8). It appears to be part of a wall, 4–6 mm. thick, of a wide tube or funnel. The specimen is without the stalk, and when laid down flat is 105 mm. long (high) and 116 mm. broad. A stalk, 84 mm. long and broken off at the end, arises from one end. The upper part of the specimen, that is the part opposite the stalk, is composed of lamellae, between the free margin of which remnants of reticulate pore-sieves are spread out.

The *colour* in spirit is light brownish yellow.

The *skeleton.* The pore-sieves (Plate 86, fig. 7) are supported by paratangential amphioxes, most of which are small, but a few are large. The latter obviously correspond to the tignules of other hexactinellids. The pore-sieves also contain microhexactines and micramphidiscs. Numerous small macramphidiscs and large pinules rest on the outer side of the amphioxes supporting the strands of these reticulate sieves. Although now partly irregularly disposed (Plate 86, fig. 7), I do not doubt that, in life, the axes of the shafts of these small macramphidiscs and of the distal rays of the pinules were vertical to the surface. In the few places where the outer surface of the sponge is intact I found the same spicules, with the exception of the large amphioxes (tignules), and in addition hypodermal pentactines. Numerous slender amphioxes, some hexactine megascleres, masses of microhexactines, and a few large macramphidiscs have been observed in the choanosome of the upper and middle-parts of the body. In the spicule-preparations of these parts have been observed also pinule-like microhexactines, with one ray longer than the other five, and large numbers of micramphidiscs. The pinule-like microhexactines doubtlessly line the canal-walls. The position of the micramphidiscs may be the same. Acanthophores with one to six stout and terminally interiorly spined rays occur in the basal part of the sponge-body, from which the stalk arises. The stalk consists of three thick and a number of slender spicules, all broken off distally.

Besides these spicules which will be described below, a number of others, chiefly amphidiscs (Plate 89, fig. 15c) and pinules, were found in the sponge. Since, however, some of these kinds of spicules are very rare, and since the other, more frequent ones are identical with spicules of *Hyalonema* (*Hyalonema*) *agassizi* and *Hyalonema* (*Prionema*) *fimbriatum* trawled at the same Station and contained in the same jar, I consider them as foreign.

The *superficial pinules* (Plate 86, figs. 8, 13–26; Plate 87, figs. 1–7; Plate 88, figs. 7–13; Plate 89, fig. 15c) are nearly all pentactine, hexactine forms being very rare. These pinules are very unequal in size, the largest attaining quite unusual dimensions. The distal ray is straight and 0.18–1.4 mm. long, most frequently about 0.9 mm. The length frequency-curve of the distal pinule-rays is simple, with a single elevation at 0.9 mm., which shows that these pinules form, in spite of their great dimensional differences, a simple, biometrically harmonious group. The distal ray is 5.5–55 μ thick at the base, and together with the spines is 19–160 μ thick at the thickest point. The maximum thickness is two to four times as great as the basal thickness. The point of maximum thickness lies rather far up, being usually three times as far from the base as from the tip of the ray. The distal ray ends in a terminal cone free from spines. This in the large pinules (Plate 87, figs. 3a, 5, 7; Plate 88, figs. 12a, 13a) is broad, rather blunt, and traversed by a remarkably thick axial thread; in the smaller (Plate 88, figs. 7–10, 11a) it is either stout or slender, and not infrequently sharp-pointed (Plate 88, fig. 10). In the large pinules the distal ray is covered with spines quite down to its base (Plate 87, fig. 3b; Plate 88, figs. 12b, 13b); in the smaller its basal part, for a short distance, is quite smooth (Plate 88, figs. 7–10, 11b). The length of this smooth basal zone is, on the whole, in inverse proportion to the size of the spicule. The basal spines of the distal rays of the large pinules are short, broad, conic, sharp-pointed, and vertical. Distally they become more and more inclined towards the tip of the ray. At the same time they increase in length up to the point of maximum thickness of the ray. From here up to the tip of the ray their length remains about the same. In typical large pinules the basal spines are up to 7 μ long, and 10–14 μ broad at the base. The upper spines are equally thick but attain 35 μ in length. Most of the inclined spines on the upper and middle-parts of the ray extend longitudinally, in planes passing through the axis of the distal ray. In a good many of the large pinules, however, irregularities occur in the position of the spines. Either the spines on part of the ray are all spirally twisted and directed obliquely to one side (Plate 87, fig. 2), or there is, somewhere near the tip, an umbilicus-like spot around which they are disposed quite irregularly (Plate **87**, figs. 4–7). Very frequently a difference in the position of the spines on opposite sides is observed in the distal part of the ray, which renders it asymmetrical in appearance (Plate **87**, fig. 3a; Plate **88**, fig. 13a). These irregularities are so frequent that they can hardly be considered as abnormities. In some places the spines are isolated and irregularly scattered; in others they are arranged in spiral rows and appear to rise from the crests of scale-like protuberances of the central solid part of the ray.

The lateral rays are conical, blunt, at the base slightly thinner than the distal ray, and 33–195 μ long; they are usually one tenth to one third of the distal ray in length. In the smaller pinules they are on the whole relatively much longer than in the larger ones. In the latter I have never found them more than a seventh of the distal ray in length. In the large pinules the lateral rays are spined more or less densely throughout their whole length. Their spines are vertical, and similar in shape and size to those on the basal part of the distal ray (Plate **87**, fig. 3b; Plate **88**, figs. 12b, 13b). The lateral rays of the smaller pinules are spined only in their distal part, and their spines are very small.

The proximal ray of the rare hexactine superficial pinules is similar in shape and size to the laterals. The proximal rays measured are 57–95 μ long.

The *hexactine megascleres* (Plate **85**, figs. 20, 21) have smooth, usually somewhat curved, rarely angularly bent, cylindroconical, terminally rounded rays. In the smaller forms the six rays are usually fairly equal in size, in the larger two opposite rays are generally considerably longer than the other four. The hexactine megascleres are usually 0.5–5.5 mm. in maximum diameter, and their rays are 20–140 μ thick at the base. But smaller forms with correspondingly thinner rays also occur.

The *hypodermal and hypogastral pentactines* have a straight, cylindroconical, terminally rounded proximal ray, usually 0.5–1.2 mm. long, and 20–40 μ thick at the base. The lateral rays are much shorter, usually only 0.3–0.6 mm. long.

The *amphioxes* are of three kinds: — 1, small and slender, 2, small and stout, and 3, large.

The *small and slender amphioxes* (Plate **89**, fig. 15a), which predominate in the interior, are centrotyle, straight or curved, sometimes very considerably bent, usually 0.6–2 mm. long, and 6–20 μ thick near the middle. The proportion of length to thickness is in these spicules 1000 : 7 to 1000 : 13. The central tyle is 10–21 μ thick, that is 1–4 μ more than the adjacent parts of the spicule.

The *small and stout amphioxes* (Plate **89**, fig. 15b) are centrotyle, fairly straight, 0.6–2.5 mm. long, and 22–70 μ thick near the middle. The proportion of length to thickness is in these spicules 1000 : 17 to 1000 : 31. The central tyle is 24–75 μ thick, that is 1–7 μ more than the adjacent parts of the spicule.

The *large amphioxes* (*tignules*) (Plate **89**, figs. 1–5) are slightly and irregularly curved, not centrotyle, and not exactly cylindrical in the middle or uniformly thickened toward it; the outline is slightly wavy. They are 5–8 mm. long and 100–140 μ thick. The proportion of length to thickness is in these spicules 1000 : 15 to 1000 : 20.

The *acanthophores* (Plate **85**, figs. 9–19) have one to six, most frequently four rays. The diactines are centrotyle. The forms with

5–6	rays are	140–224	μ in maximum diameter and have rays	10–28 μ thick,
3–4	" "	95–435	" " " " " " "	15–36 " "
2	" "	212–1050	" long and near the central tyle	14–18 " "
1	ray is	108–180	" " " " " terminal tyle	20–30 " "

The central tyle of the long diactines is usually 5–7 μ more in transverse diameter than the adjacent parts of the spicule. In the smaller tetractines the four rays are usually fairly equal; in the larger one ray, or two opposite rays, are often longer than the others. All the long-rayed (diactine) forms and a few of the short-rayed (mon- to hexactine) ones have rays smooth in their proximal and middle-parts and spined only in their end-parts. Most of the mon- to hexactine forms are spined throughout, the terminal spines being, as a rule, considerably larger than the more proximal ones. The spines are vertical, broad, low, conical, and pointed.

The *stalk-spicules* are all broken off at the distal end. The parts present have a maximum thickness of 0.2–1.2 mm.

The *microhexactines* (Plate **86**, figs. 9, 11, 12, 35, 36; Plate **88**, figs. 1–4) are 60–200 μ in diameter, generally 95–170 μ, and have equal, regularly arranged rays. The rays are perfectly straight, 4–6 μ thick at the base, conical, and sharp-pointed. Everywhere except at the extreme tip they bear spines. The spines on their proximal half arise vertically; beyond that they incline more and more backward, towards the centrum of the spicule. The largest spines are those arising at a distance of about a third of the length of the ray from the centrum. Here they are about 1.5 μ long, and from here they decrease in size, both distally and proximally.

In the centrifuge spicule-preparations (Plate 86, fig. 10) I found a few *monactine microhexactine-derivates.* This spicule appears as a tylostyle and is spined throughout. Its dimensions are: — length 167 μ, basal thickness of ray 6 μ, diameter of tyle 9 μ.

The true choanosomal microhexactines have, as above stated, equal rays. In the spicule-preparations, however, a large number of small spined hexactines are found, in which one ray is considerably larger than the other five. These spicules I consider as pinule-like derivates of the regular microhexactines, which line the canal-walls, and are therefore to be considered as canalaria.

These *pinule-like microhexactine-derivate canalaria* (Plate 88, figs. 5, 6) have a longer (distal) ray, 115–300 μ long, and 5–11 μ thick at the base, and five shorter (proximal and lateral) rays, 40–95 μ long. The proximal ray may be longer or slightly shorter than the laterals. All the rays are spined. The spines on the distal ray are longer than the spines on the other rays — the more so, the more the distal exceeds the other rays in length. They are also for the most part directed obliquely upwards towards the tip of the ray.

The *amphidiscs.* Morphologically two main kinds of amphidiscs can be distinguished: — amphidiscs with broad terminal anchors and a shaft which is either quite smooth or provided only with one or a few terminally rounded protuberances or spines, and amphidiscs with slender terminal anchors and generally spiny shaft. The former are large, 90–550 μ long; the latter are small, 17.5–122 μ long. I consider the former as macramphidiscs, the latter as micramphidiscs.

Among the macramphidiscs two subgroups can be distinguished both morphologically and biometrically. In one the anchors are much shorter than half the length of the whole spicule, and the anchor-teeth pointed; in the other the anchors are about half as long as the whole spicule, and the anchor-teeth terminally rounded. The former are larger, 370–550 μ long; the latter smaller, 90–195 μ long. The differences in their anchors, and the absence of intermediate forms between 195 and 370 μ in length, which finds its expression in a wide gap in the length frequency-curve, Figure 23, very clearly distinguish these two kinds of macramphidiscs from each other. I accordingly divide the macramphidiscs into two subgroups: — large and small macramphidiscs.

The length frequency-curve of the micramphidiscs also shows a great depression, which lies at about 57 μ and reaches down to the 0-line. Thus also among these spicules a larger and a smaller kind can be distinguished. The larger ones, to which the part of the curve to the right of this depression refers, and which are 63–122 μ long, have anchor-teeth distally rather divergent. The smaller ones, to which the part of the curve to the left of the depression refers, and which are 17.5–52 μ long, have anchor-teeth distally nearly parallel. I therefore also divide the micramphidiscs into two subgroups: — large and small micramphidiscs. It is to be noted that these two kinds of micramphidiscs do not differ so much from each other as the two kinds of macramphidiscs. I distin-

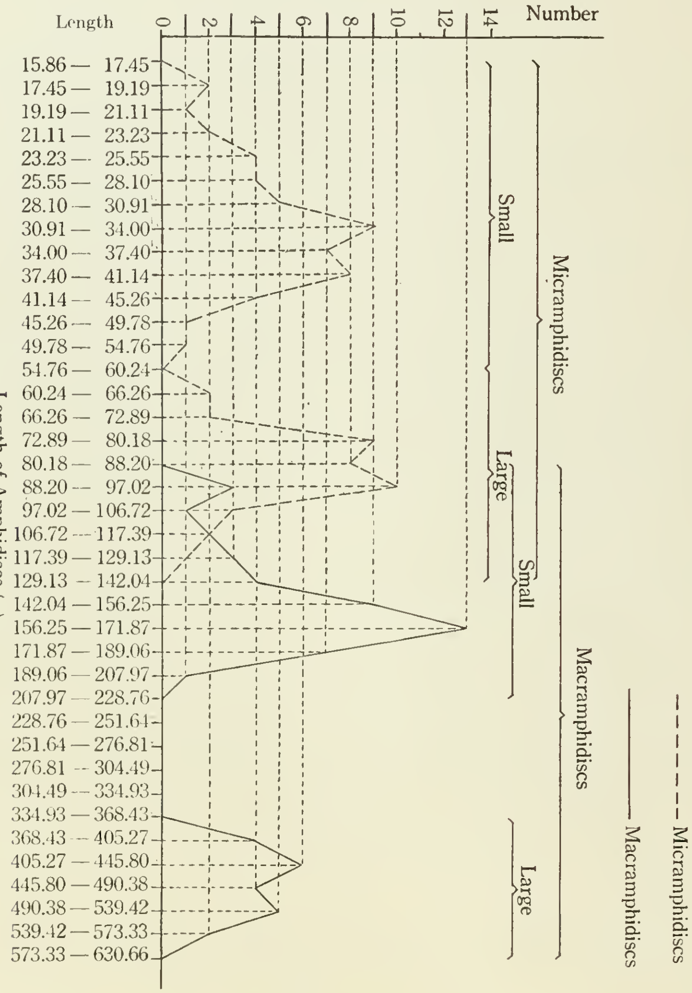

Fig. 23.— Amphidiscs.

guish four kinds of amphidiscs in this sponge: — 1, large macramphidiscs, 2, small macramphidiscs, 3, large micramphidiscs, and 4, small micramphidiscs.

Although the length frequency-curve of the large macramphidiscs has two summits, I do not distinguish two distinct groups among these spicules, because the depression between the two summits is but slight and because there are no notable morphological differences between the spicules to which the two parts of the curve on each side of the depression refer.

The *large macramphidiscs* (Plate **86**, figs. 1–6; Plate **89**, figs. 31, 32; Plate **91**, figs. 1–6) are 370–550 μ long, most frequently about 425 μ. The shaft is straight, cylindrical, and 19–27 μ thick. It usually bears a few broad and low quite insignificant tubercles. Some of these are often arranged in an irregular verticil situated in the middle-part of the shaft, which is, at this point, usually slightly thickened to an inconspicuous central tyle, only 1–3 μ, exceptionally as much as 6 μ, more than the adjacent parts in transverse diameter. Rarely the shaft bears a larger, cylindrical, terminally rounded spine, sometimes 28 μ long, and 10 μ thick (Plate **86**, fig. 4). I have never observed more than one such spine on the shaft of the large macramphidiscs.

The terminal anchors are 120–170 μ long and 200–256 μ broad. The proportion of their length to their breadth is 100 : 139 to 100 : 196, on an average 100 : 171.3. The proportion of the anchor-length to the total length of the spicule is 1 to 2.6–4.7, on an average 1 : 3.6. The anchors are usually composed of eight teeth. The teeth of the two anchors of the same spicule lie opposite each other in the same planes passing through the axis of the shaft. The individual teeth are about 25 μ broad near the base, and pointed at the end (Plate **89**, figs. 31, 32). Their curvature is usually greater at the base and at the end than in the middle. The tip of the tooth is sometimes abruptly bent either inward (Plate **91**, fig. 4) or, more rarely, outward (Plate **91**, fig. 1). The teeth occasionally bear conspicuous, somewhat branch-like protuberances on their convex outer (Plate **91**, fig. 3) or concave inner side (Plate **91**, fig. 2). A well-marked depression can be made out, sometimes very clearly, on the apex of the anchor (Plate **91**, fig. 4).

The length frequency-curve of the small macramphidiscs has two summits separated by a rather conspicuous gap. The smaller ones, to which the part of the curve to the left of the depression refers, have a larger number of anchor-teeth than the larger ones, to which the part of the curve to the right of the depression refers. Two kinds of small macramphidiscs could therefore be distinguished. Since, however, the differences between them are not great and since the extreme forms are connected by numerous transitions, I shall here describe both together.

The *small macramphidiscs* (Plate **86**, figs. 7, 27–34; Plate **89**, fig. 15d; Plate **90**, figs. 1–10) are 90–195 μ long, most frequently about 164 μ. The shaft is straight, smooth, cylindrical, and 5.5–16.5 μ thick. The terminal anchors are 39–100 μ long, and 55–174 μ broad, usually 70–150 μ. The proportion of anchor-length to anchor-breadth is 100 : 120 to 100 : 178, on an average 100 : 149. As has been stated above, these anchors are about half as long as the whole spicule, sometimes a little shorter than that, more frequently a little longer. Each anchor is composed of five to thirteen teeth. The larger amphidiscs of this kind, that is those to which the part of the length frequency-curve culminating at 164 μ refers, have five to ten, usually eight teeth; the smaller, to which the part of the curve culminating at 93 μ refers, have eight to thirteen, usually eleven teeth. The two terminal anchors of the same spicule are composed of the same number of teeth. The teeth of the terminal anchors extend in planes passing through the axis of the spicule. The anchor-teeth planes of one anchor enclose equal angles with their neighbours, each 360 degrees divided by the number of teeth. The anchor-teeth planes of the other anchor of the same spicule *alternate* regularly with these in such manner that they divide each angle into two equal parts (halves). Thus the tips of the teeth of the two opposite anchors are not opposite but alternate.

The individual anchor-teeth are curved, either uniformly or, more frequently, less in the middle-part than at the base and at the tip. The outer contour of each tooth is abruptly curved inwards at the distal end. The teeth are T-shaped in transverse section. Their outer (upper) part, which corresponds to the upper stroke of the T, has the shape of a curved band increasing in breadth distally to a point three quarters of the length of the tooth from its base. Here the tooth is 9–30 μ broad. The end-part of the tooth, lying beyond this point of maximum breadth, is simply rounded (Plate **90**, figs. 1, 3, 7, 9). The inner (lower) part of the tooth, which corresponds to the lower stroke of the T, is a thick keel, uniformly decreasing in height distally. The end-part of the upper (outer) band-shaped portion of the tooth bends down around the end-part of the keel on all sides except the axial, so that, viewed in profile, the end-part of the whole tooth becomes strikingly similar to a crow's beak (Plate **90**, figs. 4, 6, 8, 10).

Slightly *abnormal small macramphidiscs* with one or more somewhat irregular teeth, like the one represented (Plate **90**, figs. 5, 6), have repeatedly been met.

More strongly aberrant forms are much rarer. A small macramphidisc of this kind (Plate 89, figs. 35, 36) is 112 μ long, and has a shaft 14 μ thick. The terminal anchors are very irregular, spirally twisted, and on one side much longer than on the other. The chords of the longest anchor-teeth are more than three quarters of the whole spicule in length.

The length frequency-curve of the large micramphidiscs also has two summits, but as the depression separating them is slight, and as the spicules to which the two parts of the curve on the two sides of it refer, are very similar in shape, I do not consider this irregularity of the length frequency-curve sufficient for dividing the large micramphidiscs into two groups.

The *large micramphidiscs* (Plate 89, figs. 6–14) are 63–122 μ long, most frequently about 93 μ. The shaft is 2.5–4 μ thick, and generally thickened in its middle-part to a central tyle 5–6 μ in diameter. Rarely it is of uniform thickness throughout and without a tyle. With the exception of its end-parts, which are smooth, the whole of the shaft is covered with spines. The spines arising from the tyle are usually arranged in an irregular oblique verticil. These spines are larger than the others. The terminal anchors are 29–43 μ long and 25–40 μ broad. The proportion of their length to their breadth is 100 : 75 to 100 : 105, on an average 100 : 87.9. The proportion of the anchor-length to the length of the whole spicule is 1 to 2.4–3.6, on an average 1 : 2.7. The individual anchor-teeth are curved strongly at the base, but curved only slightly in their middle-part. The tip of the tooth is frequently abruptly bent inwards. Apart from this abruptly bent end-part, the distal half of the tooth diverges from the shaft at an angle of 6°–12°.

I found an *abnormal large micramphidisc* with strongly reduced terminal anchors. This spicule (Plate 89, figs. 16–19) is 100 μ long. Its shaft is straight, 8 μ thick, and covered with numerous scattered tubercles and a verticil of short, stout, cylindrical, terminally rounded spines. The terminal anchors are rudimentary, only 17 μ long and 23 μ broad, and composed of a terminal tyle enclosed by thin leaf-like teeth, most of which terminate with two terminal spines.

The length frequency-curve of the small micramphidiscs has three summits. The two depressions separating them are inconsiderable, and the small micramphidiscs of different sizes differ only in that the smallest generally have a smooth shaft, the larger generally a spiny one. Although the smallest of these amphidiscs, belonging to the elevation of the curve to the extreme left, might therefore be separated from the others, I think it best to consider them all as forming a single group, and describe them together.

The *small micramphidiscs* (Plate 89, figs. 20–30, 34) are 17.5–52 μ long, most frequently about 32.5 μ. The shaft is 0.8–2 μ thick, and thickened in the middle-part to a central tyle 2–3.3 μ in transverse diameter, that is 0.5–1.3 μ more than the adjacent parts of the shaft. In most of the larger and some of the smaller forms the shaft is spined. In most of the small and a few of the larger it is smooth. The terminal anchors are 5–20 μ long and 5.5–15 μ broad. The proportion of anchor-length to anchor-breadth is 100 : 75 to 100 : 110, on an average 100 : 90. The proportion of the anchor-length to the total length of the spicule is 1 to 2.5–4.5, on an average 1 : 3.1. The anchor-teeth are strongly curved in their proximal and nearly straight in their distal part. Their straight distal parts are slightly divergent, or nearly parallel to the shaft.

The nearest allies of this sponge are *Hyalonema* (*Oonema*) *henshawi*, *H.* (*O.*) *densum*, and *H.* (*O.*) *crassipinulum*. From all of them it differs by its superficial pinules attaining a much larger size; *H.* (*O.*) *densum* is further distinguished from it by having slightly curved microhexactine rays; *H.* (*O.*) *henshawi* by apparently being destitute of the large macramphidiscs; and *H.* (*O.*) *crassipinulum* by having smaller spicules, by being destitute of the smaller small macramphidiscs with numerous anchor-teeth, and by possessing small narrow-anchored macramphidiscs and pinules with large, strongly divergent spines on the proximal part of the distal ray.

PHIALONEMA, subgen. nov.

Species of Hyalonema, whose amphidiscs of one kind (the largest) have small, very short, and relatively broad terminal anchors.

The collection contains four specimens and two fragments of this subgenus. These belong to two species, one of which is new.

Hyalonema (Phialonema) brevancora, sp. nov.

Plate 55, figs. 1–37.

There are in the collection two fragments of this species, both from the Central Tropical Pacific, Station 3684 (A.A. 17), on 10 September, 1899; 0° 50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); they grew on a bottom of light yellow-gray Globigerina ooze.

The large macramphidiscs have small, particularly low terminal anchors. To this the name refers.

Shape and size. The larger fragment (Plate 55, fig. 1) is an irregular, porous, flattened mass measuring 47 by 38 by 8 mm. The smaller one is only 22 mm. long.

The *colour* in spirit is dirty white.

The *skeleton* consists of pinules; hexactine, pentactine, and rhabd megascleres; microhexactines; and amphidiscs. In most of the pinules in the preparation the distal ray bears relatively very long spines; these pinules are probably hypodermal or hypogastral. In some pinules these spines are very short; these may be canalar. The hexactine megascleres are found in the innermost part of the specimens; the pentactines are no doubt hypodermal or hypogastral. The rhabd megascleres for the most part form bundles. The microhexactines are numerous, and all of the same kind. Macramphidiscs and large and small micramphidiscs can be distinguished among the amphidiscs. The small micramphidiscs are abundant, the other amphidisc-forms rare.

The (probably dermal and gastral) *pinules with long-spined distal ray* (Plate 55, figs. 19–28, 30, 32, 33) are nearly always pentactine, very rarely hexactine. The distal ray is straight, 70–89 μ long, and 3–4 μ thick at the base. It bears spines along its whole length. The spines on the proximal third or so of its length are very small, straight, and directed obliquely upwards. The distal and middle-parts of the ray are covered with spines very unequal in length and in curvature, the large and the small ones being here irregularly intermingled (Plate 55, fig. 19). Some of these spines attain a relatively very considerable size, the largest being 18–54 μ long and about 2 μ thick at the base. The lower spines, both large and small, are usually nearly straight, and very divergent (Plate 55, figs. 22, 25, 28). Farther up the short spines only are like this, most of the longer ones being curved, concave to the ray. This curvature is not infrequently so great that their ends become inclined towards the distal part of the ray (Plate 55, figs. 19, 21, 23). The spines are conic and sharp-pointed. Some of the larger ones bear one or two, rarely more, secondary spinelets, usually 2–3 μ long, and inclined towards the end of the spines from which they arise. The maximum thickness of the distal ray, together with the spines, generally is 22–37 μ, rarely as much as 54 μ. The lateral rays are usually 22–37 μ long, sometimes longer. They are cylindrical proximally, conic distally, pointed, and beset with numerous oblique spines inclined towards the end of the ray. These spines attain a very considerable size, particularly in the distal and middle-parts of the ray. The lateral spines of these rays seem to be larger than the others; they give to the contour of the ray, when seen from above, a markedly serrated appearance (Plate 55, figs. 32, 33). The proximal ray, when present, is similar to the laterals, and attains a length of 27 μ (Plate 55, fig. 30).

The (probably canalar) *pinules with short-spined distal ray* (Plate 55, fig. 29) observed by me were all pentactines. The distal ray is 66–85 μ long, and about 5 μ thick at the base. Its spines are straight, conic, small, and directed obliquely upwards towards the tip of the ray. They are largest in the middle of the ray and decrease in size both distally and proximally. The distal end-part of the ray is often, for a considerable distance, quite free from spines. The maximum diameter of the distal ray, together with the spines, is usually about 14 μ. The lateral rays are pointed, spiny, and usually 28–45 μ long.

The *pentactine megasclcres* (Plate 55, figs. 2, 3) have straight, conic rays, 20–40 μ thick at the base, and rounded at the end. The proximal ray is usually 0.8–1.1 mm. long; the laterals are 0.25–0.6 mm. long, and slightly inclined towards the proximal, with which they enclose angles of 78°–84°.

The *hexactine megascleres* (Plate 55, fig. 31) observed measured 0.4–0.9 mm. in diameter, and had somewhat unequal, straight, conic, and blunt rays 7–16 μ thick at the base.

The *rhabd megascleres* (Plate 55, figs. 4, 6) observed are for the most part more or less curved centrotyle amphioxes. These spicules are 0.4–4.5 mm. long and 4–20 μ thick near the centre. The proportion of the thickness of the spicule to the diameter of the tyle is 100 : 125 to 100 : 225, most frequently about 100 : 150. There are besides these spicules centrotyle amphioxes angularly bent in the middle (Plate 55, fig. 4) and centrotyle rhabds with one of the actines reduced in length and thickened at the end to a terminal tyle. In some of the latter a kind of terminal spine arises, from the thickened end (Plate 55, fig. 6).

The *microhexactines* (Plate 55, figs. 34, 37) measure 85–184 μ in diameter, most frequently about 150 μ, and have six equal, perfectly straight, conic, sharp-pointed rays, usually 2–3 μ thick at the base. The rays bear oblique, outwardly directed spines. These are numerous and very small, usually under 0.5 μ in length.

Of *amphidiscs* three kinds are to be distinguished: — macramphidiscs, large micramphidiscs, and small micramphidiscs.

The *macramphidiscs* (Plate 55, figs. 5, 14–18) are 285–349 μ long, most frequently about 315 μ. The shaft is straight and near the centre, where it is thinnest, 6–9 μ in transverse diameter. It is generally thickened abruptly in the middle to a central tyle 10–13 μ in diameter. Toward the ends it is always gradually thickened to about double its minimum thickness near the middle. The central thickening bears a verticil of conic, truncate spines, 5–10 μ long, and 3–4 μ thick at the base. The truncate ends of these spines bear clusters of very minute, short, secondary spinelets. One of the large macramphidiscs observed was destitute alike of the central tyle and the central spine-verticil. Apart from this spine-verticil, the shaft is, in all the large macramphidiscs observed, entirely smooth. The terminal anchors are 25–41 μ long, about a tenth of the whole spicule, and 5.3–72 μ broad. The proportion of the length to the breadth of these anchors is 100 : 145 to 100 : 240, on an average 100 : 203. The anchor usually consists of eight teeth. The individual teeth are either uniformly curved, concave to the shaft throughout, or thus curved only in their basal and middle-part, and abruptly bent down at the end. The end-parts of the teeth enclose angles of about 25° with the axis of the shaft. The basal parts of the teeth appear to be massive; distally they thin out to rounded, spoon-like lamellae about 15 μ broad.

The *micramphidiscs* range from 18 to 38 μ in length. In the frequency-curve pertaining to this dimension there is a marked depression at about 33 μ. The micramphidiscs shorter than this have, as a rule, nearly smooth shafts; those as large or larger than this, very spiny shafts. I consider the former as small, the latter as large micramphidiscs.

The *large micramphidiscs* (Plate 55, figs. 10–12) are 33–38 μ long, most frequently about 36 μ. The shaft is cylindrical, 1.6–1.8 μ thick, and covered with numerous irregularly scattered spines. The terminal anchors are 7–11 μ long, a sixth to a fourth of the whole spicule, and 8–10.5 μ broad. The proportion of anchor-length to anchor-breadth is 100 : 90 to 100 : 114, on an average 100 : 104. The individual teeth are rather strongly and uniformly curved in their basal part; distally the radius of curvature increases. Their nearly straight end-parts are approximately parallel to the shaft.

The *small micramphidiscs* (Plate 55, figs. 7–9, 13) are 18–32 μ long, most frequently about 26 μ. The shaft is straight, cylindrical, and 1.2–1.6 μ thick. It is smooth, or bears a few small spines in its middle-part. The anchors are 4–8 μ long, a sixth to nearly a third of the whole spicule, and 7–9.5 μ broad. The proportion of anchor-length to anchor-breadth is 100 : 100 to 100 : 180, on an average 100 : 131. The anchor-teeth of the small micramphidiscs are, in respect to their curvature, similar to those of the large micramphidiscs above described.

Although the fragmentary condition of the specimens renders it difficult to decide to which genus of Amphidiscophora they belong, the probability is that they are Hyalonemas, and if so they must be placed in the subgenus Phialonema.

Of the known species of Hyalonema *H. globus* F. E. Schulze[1] appears to be most nearly allied to the sponges above described. With this species they agree fairly well in respect to the pinules, the shape of the shaft, and the shortness and breadth of the anchor-teeth of the large macramphidiscs. They differ, however, from *H. globus* by having secondary spinelets on some of the primary spines of the distal rays of their pinules, by their small micramphidiscs being much larger and by the anchors of their large macramphidiscs having an altogether different shape.

Hyalonema (Phialonema) pateriferum Wilson.

Plate 50, figs. 6–15; Plate 51, figs. 1–28; Plate 52, figs. 1–29.

Mem. M. C. Z., 1904, **30**, p. 28, Plate 1, figs. 1–13.

Six specimens of this species were collected during the expeditions of 1899–1900 and 1904–1905 in the Central and Eastern parts of the Tropical Pacific. Two of these, found at Station 3684 (A.A. 17), together with two other specimens and three fragments of the same species previously collected in the Gulf of Panama at Stations 3363 and 3376, were described by Wilson as *Hyalonema pateriferum*. Among the sponges of the expeditions of 1899–1900 and 1904–1905 placed at my disposal for description, there are four specimens, all from different stations, which belong to this species. Two of these were trawled off the coast of northern Peru at Stations 4651 and 4656, and two in the Eastern Tropical Pacific at Stations 4721 and 4742.

For the reasons given below I distinguish six forms within this species: —

the two specimens and three fragments described by Wilson from Stations 3363 and 3376	*A*
the two specimens described by Wilson from Station 3684 (A.A. 17)	*B*
the specimen examined by me from Station 4651	*C*
the specimen examined by me from Station 4656	*D*
the specimen examined by me from Station 4721	*E*
and the specimen examined by me from Station 4742	*F*

Shape and size. One of the specimens of form *A* is, according to Wilson (*loc. cit.*), obconical, irregular, 65 mm. high, 90 mm. broad, and provided with a

[1] *F. E. Schulze.* Rept. Voy. Challenger, 1887, **21**, p. 221, pl. 40, figs. 1–16.

stalk 330 mm. long, and 6 mm. thick at the base. Another is saucer-shaped, 40 mm. deep, 85 mm. long, and 65 mm. broad. The dermal membrane and the central part of the gastral membrane are reticulate. The marginal part of the latter is perforated by efferent pores 1.5 mm. wide. The specimens of form *B* are, according to the same author (*loc. cit.*), flattened. One is saucer-shaped, 15 mm. deep, 80 mm. long, and 60 mm. broad; the other a fragment, probably of a similar sponge. The surface is continuous and smooth, not reticulate. The specimen of form *C* (Plate 52, fig. 20) appears as a broad and low, conic cup. It is 52 mm. high, 61 mm. long, and 54 mm. broad. The central part of the cup-wall is very thick. Distally it thins out to a sharp margin. The lower truncate end, from which in life the stalk probably arose, is lacerated. No trace of a stalk or a gastral cone can now be detected in the specimen. The outer (dermal) surface of the cup-wall is much damaged, and appears irregular and very porous. The inner (gastral) surface is, for a considerable extent, still covered by the gastral membrane. This is perforated by rather large broad-oval apertures. The specimen of form *D* (Plate 52, fig. 21) is a slightly curved lamella with rounded margin, 45 mm. long, 36 mm. broad, and uniformly 10 mm. thick. The larger part of the surface is smooth. On the concave (gastral) face the superficial (gastral) membrane is preserved. There is no gastral cone. A portion of the margin of the sponge is much lacerated. From this part the now missing stalk probably arose. The specimen of form *E* (Plate 51, fig. 1) is a porous, lacerated, lamellar fragment, and measures 60 by 32 by 8 mm. The specimen of form *F* is likewise very fragmentary. It appears as an irregular, porous lamella and measures 33 by 29 by 4 mm.

The *colour* of the specimens of forms *C* and *D* in spirit is brown with a greenish tinge, that of form *E* reddish brown, and that of form *F* whitish.

Canal-system. The efferent canal-systems are, according to Wilson (*loc. cit.*), in form *A* 5–10 mm. wide, and traceable quite down to the basal part of the sponge. In form *D* the flagellate chambers appear to be elongated, sac-shaped, irregularly curved, and 70–90 μ broad.

The *skeleton.* The surface of the body is covered with a dense pinule-fur (Plate 52, figs. 22, 23). In the forms *A* and *B* examined by Wilson (*loc. cit.*) the fur of the dermal face is composed of pinules with distal rays of moderate and fairly equal length. On the gastral face pinules with much longer distal rays lie scattered between the masses of pinules with moderately long distal rays. In the forms *C* and *D*, pinules with long distal rays are scattered among the ordinary ones also in the fur of the dermal face. So far as the fragmentary state of the specimens allows one to judge, this is also the case in the forms *E* and *F*. It is certainly true in some forms, probably in all, that from the margins which mark the boundary between the dermal and the gastral faces there arise centrotyle amphioxes, diactine pinules, and spicules transitional between these forms. Besides the lateral rays of the pinules, amphidiscs, paratangentially extending centrotyle amphioxes, and the lateral rays of pentactine megascleres are found in the dermal and gastral membranes. According to Wilson (*loc. cit.*) the amphidiscs of the superficial membranes are large macramphidiscs, and he says that these spicules are very abundant in these membranes of the forms (*A* and *B*) studied by him. In the specimens of forms *D* and *E*, examined by me, where the superficial membranes are more or less preserved, I found them occupied by micramphidiscs in places very abundant, but nearly destitute of macramphidiscs. Below the superficial membranes, the apical (proximal rays of the pentactines, centrotyle amphioxes, and a few transitions between them and diactine pinules, occur. All these spicules (spicule-rays) are situated radially.

Hexactine megascleres, canalar pinules, microhexactines, transitions between these and the pinules, and amphidiscs are met in the interior of the body rhabds, which are, for the most part, centrotyle amphioxes. In the vicinity of the point of origin of the stalk stout-rayed acanthophores occur. Many of the rhabds of the interior form bundles which traverse the choanosome. The hexactine megascleres appear to increase in size toward the central part of the sponge. In the forms *C*, *D*, *E*, and *F* the canalar pinules are scarce, and irregularly and sparsely scattered over the walls of some of the canals only, the walls of other canals appearing to be destitute of these spicules. The microhexactines vary considerably in respect to their size, their spinulation, and the curvature of their rays. Wilson (*loc. cit.*) considers the large, straight-rayed, and strongly spined ones (in the forms *A* and *B*) as canalaria. In the forms *D*, *E*, and *F* these spicules do not appear to be restricted to the canal-walls. In form *C* I failed to find any of the large, straighter-rayed microhexactines. The hexactine and pentactine transitions between the microhexactines and the pinules are, in the forms *D*, *E*, and *F* true canalaria. The amphidiscs, among which four forms can be distinguished, are exceedingly abundant. Micramphidiscs, chiefly large ones, clothe the walls of the efferent canals of form *D* in dense masses. In the forms *C*, *D*, *E*, and *F* macramphidiscs are scattered in very large numbers through the choanosome. According to Wilson (*loc. cit.*) only few macramphidiscs occur in the interior of forms *A* and *B*. The large macramphidiscs are much more numerous than the small ones. The stout-rayed acanthophores were chiefly observed by Wilson (*loc. cit.*) in one of the specimens of form *A*, and by me in the specimen of form *F*. They probably occur in equal abundance also in the others, and in all they envelop the parts of the stalk-spicules lying just below the surface, within the body of the sponge. The stalk is preserved only in one of the specimens of form *A*. It consists here, according to Wilson (*loc. cit.*), of about fifty spicules, broken off below.

The marginal *pinules* are diactine; the dermal, gastral, and canalar mostly pentactine, more rarely hexactine, and still more rarely diactine. I was unable to find any marked difference between the dermal, gastral, and canalar pinules. The slight difference in the length of the distal ray of the canalar and the other pinules, noticed by Wilson (*loc. cit.*) in the forms *A* and *B*, is not pronounced in the forms examined by me. I shall, therefore, in describing the pinules, not take their position into account.

By far the most frequent form of pinule is a pentactine with rays of moderate length. In the other, much less frequent forms, a sixth (proximal) ray is developed, or the distal or lateral rays are elongated, or the latter reduced to mere rounded knobs. The pentactine (and hexactine) pinules are connected by transitions with each other and with the large straight-rayed microhexactines. The pinules with well-developed proximal and reduced lateral rays appear as diactines. These are connected by transitional forms with the centrotyle amphioxes but hardly at all with the other pinule-forms.

The *pentactine* or (rarely) *hexactine pinules* with a distal ray of moderate length (Plate 50, figs. 6–8; Plate 52, figs. 11–14) and well-developed laterals have a conical distal ray, very gradually attenuated to an exceedingly slender and sharp-pointed terminal cone. The distal ray is, in the pinules with moderate laterals, generally straight; in those with long laterals, which usually also have a long sixth proximal, and which appear as transitions to the microhexactines, often curved. The basal and terminal parts of the distal ray are smooth; its central part bears small spines. The distal spines are always rather strongly inclined towards the tip of the ray. The proximal spines are either also so inclined (Plate 50, figs. 6–8), or more divergent, often even vertical, or inclined slightly in the opposite direction (Plate 52, figs. 11–13). The distal ray is in forms *A* and *B*, according to Wilson (*loc. cit.*), 100–220 μ long, in form *C* 65–217 μ, in form *D* 85–240 μ, in form *E* 85–137 μ, and in form *F* 93–220 μ. The basal and maximum thicknesses (together with the spines) of the distal ray are in forms *A* and *B*, according to Wilson (*loc. cit.*), base 5 μ, maximum ?; in form *C* base 3–5 μ, maximum 7–20 μ; in form *D* base 2.5–5 μ, maximum 3–22 μ; in form *E* base 4–6 μ, maximum 8–27 μ; and in form *F* base 3.5–6 μ, maximum 7–16 μ. The maximum thickness of the distal ray, together with the spines, is in the ordinary pinules with laterals of moderate length usually 8–16 μ; distal rays with a maximum thickness of only 6 μ or less are found only among those forms with long laterals, which pass into the microhexactines. The lateral rays are in the forms *A* and *B*, according to Wilson (*loc. cit.*), pointed and nearly or quite smooth. In the forms *C*, *D*, *E*, and *F* they are also usually pointed, but smooth only exceptionally; as a rule they are provided with sparse, but rather large and conspicuous spines. Sometimes I observed lateral rays with much larger and more numerous spines which, in respect to spinulation, resembled the distal ray. The lateral rays are in the forms *A* and *B*, according to Wilson (*loc. cit.*), 30–40 μ long, in form *C* 13–44 μ, in form *D* 16–100 μ, in form *E* 24–54 μ, and in form *F* 26–63 μ. The pinules with lateral rays more than 50 μ long are mostly transitions to the microhexactines. In the ordinary pinules a sixth proximal ray is present only quite exceptionally, and here hardly ever more than 30 μ long; in the pinules transitional to the microhexactines a proximal ray is generally met, and in these it attains a length of 50–100 μ. In regard to the spinulation, the proximal rays usually resembles the laterals. In some of the forms transitional to the microhexactines, the proximal ray is spined in a similar way to the distal.

The *pentactine pinules with elongated distal ray* (Plate 52, fig. 15). The distal ray of these spicules is in the forms *A* and *B* examined by Wilson (*loc. cit.*) 300–400 μ long, in form *D* 240–315 μ. In forms *C* and *F* I observed only very few pinules of this kind. In these the distal ray was 350 μ long. In form *E* I failed to find any pinules of this kind. I ascribe the absence of these spicules in this form and their scarcity in the preparations of forms *C* and *F* to the fragmentary condition of the specimen of these forms. In the forms *C*, *D*, and *F* the distal ray is 4.5–6.5 μ thick at the base, conic, and generally somewhat curved. It terminates in an exceedingly long and slender, spineless terminal cone. Its middle-part bears small spines inclined towards the tip. Its maximum transverse diameter, together with the spines, is 5–14 μ. In forms *A* and *B*, examined by Wilson (*loc. cit.*), the distal ray is similar. The lateral rays are pointed or, more rarely, rounded at the end. In the forms *A* and *B*, examined by Wilson (*loc. cit.*), they are 40 μ long, in the forms *C*, *D*, and *F*, 15–38 μ.

The *diactine pinules* (Plate 52, fig. 16) appear as anisoactine, centrotyle amphioxes with numerous spines on their distal ray, and occasionally also a few spines on their proximal ray. Wilson (*loc. cit.*) gives the length of one of these spicules (of form *A* or *B*) as 700 μ, and the thickness of its tyle as 12 μ. The diactine pinules of the forms examined by me are shorter, not more than 470 μ long. In form *D*, where I found the largest number of them, the distal ray is 140–200 μ long, 4–5 μ thick at the base, conic, and attenuated distally to a very slender terminal cone. This terminal cone and a small region at the base of the ray are free from spines; the remaining parts bear small spines strongly inclined towards the tip of the ray. The proximal ray in the diactine pinules of this form (*D*) is 80–125 μ long. The tyle, which consists of four knob-like protuberances (the rudiments of the four reduced lateral rays), measures 9–17 μ in transverse diameter. A diactine pinule of form *C*, which I measured, had a distal ray 350 μ long, and 5 μ thick at the base, a proximal ray 120 μ long, and a central tyle 15 μ in transverse diameter.

The lateral rays of the (*hypodermal and hypogastral*) *pentactines* are, according to Wilson (*loc. cit.*), in the forms *A* and *B* 150–600 μ long, and 12–48 μ thick at the base. In form *D*, where alone I could measure a large number of these spicules, their lateral rays are 120–360 μ long and 12–30 μ thick. The proximal ray is generally longer than the lateral rays. The lateral rays are straight, smooth, and pointed; the proximal ray is similar, or, rarely, reduced in length, and thickened and rounded at the end.

The *hexactine megascleres*. Wilson (*loc. cit.*) gives the measurements of one of these spicules (of form *A* or *B*) thus: — length of rays 700 μ, basal thickness 48 μ. In form *D* these hexactines have rays 25–41 μ thick at the base. One of the intact ones of this form was 1.2 mm. in diameter.

The *choanosomal rhabds* are usually centrotyle amphioxes. In the forms *A* and *B* they measure, according to Wilson (*loc. cit.*), 0.5–3 mm. by 8–28 μ. In the forms examined by me they appear to be similar.

The *paratangential superficial* and the *radial subdermal and subgastral centrotyle amphioxes* are in form *D* 320–520 μ long and, near the middle, 3–10 μ thick. The central tyle is 11–13 μ in diameter.

The *stalk-spicules* are in form *A*, where alone they have been observed, according to Wilson (*loc. cit.*), 0.13–1 mm. thick, attenuated below, and provided with "the well-known annular ridges."

The *acanthophores* (Plate 52, figs. 17–19) are, according to Wilson (*loc. cit.*), in form *A* di- to hexactines, tetractines with unequal rays being most frequent. The measurements given by him are 900 μ for the length of a diactine, and 250 μ for the length of a ray of a tetractine. In form *F* I found di- to pentactine acanthophores with rays 15–30 μ thick at the base. The diactines are here 550–720 μ long, the tri- to pentactines 290–720 μ in maximum diameter. The rays of these spicules are somewhat irregular, wavy in outline, and often slightly curved. They usually taper distally. The end itself is frequently slightly thickened and terminally rounded. The basal and middle-parts of the rays are smooth, their end-parts, for a short distance, densely spined.

Among the *microhexactines* (Plate **50**, figs. 9, 10; Plate **51**, figs. 23–28; Plate **52**, figs. 1, 2) forms with small spines and strongly curved rays, and forms with larger spines and only slightly curved or straight rays, can be distinguished. The former are usually much smaller than the latter. The larger forms with straight rays are connected by transitions with the pinules. The rays of the microhexactines are in the forms *A* and *B*, according to Wilson (*loc. cit.*), 30–80 μ long, and in the small ones with curved rays 2 μ thick. In the forms *C*, *D*, *E*, and *F* the rays of the microhexactines are, at the base, 1–3.5 μ thick, usually 1.5–2.5 μ. Those measured of form *C* were 55–80 μ in diameter, of form *D* 64–128 μ, of form *E* 55–150 μ, and of form *F* 59–138 μ. The small microhexactines with curved rays are regular, the six rays of the same spicule being equal in size and curvature, all straight at the base, and uniformly curved in their distal part through an angle of 45°–135°. The direction of curvature in opposite rays is usually opposite (Plate **51**, figs. 23, 24, 26, 28). In the rare, large microhexactines with curved rays, the curvature is irregular, and different in the different rays of the same spicule (Plate **51**, fig. 25). In the large microhexactines with nearly straight rays, the six rays are generally equal. Any curvature observable in them is restricted to their distal part.

Of *amphidiscs* four forms can be distinguished: — large macramphidiscs, small macramphidiscs, large micramphidiscs, and small micramphidiscs. The large and small macramphidiscs are not clearly separated biometrically (according to their length frequency) or morphologically. Nevertheless there is, in all the four forms examined by me, a deep depression at about 100 μ in the frequency-curve pertaining to these spicules, which renders it advisable to distinguish them. The macramphidiscs shorter than 100 μ I consider as small, those longer as large ones. The macramphidiscs under 100 μ in length, that is the small ones, have relatively longer anchors and fewer anchor-teeth than those over 100 μ in length, that is the large ones. The small macramphidiscs are clearly distinguished from the large micramphidiscs morphologically, the former having stout and smooth or nearly smooth shafts and broad terminal anchors; the latter slender and strongly spined shafts and narrow terminal anchors. The large and small micramphidiscs are distinguished biometrically by gaps in the frequency-curves pertaining to their length. These gaps lie in the different forms in different places, between lengths of 24 and 49 μ. Wilson also distinguishes four forms of amphidiscs: — macramphidiscs (= large macramphidiscs), amphidiscs (Wilson, *loc. cit.*, Plate 1, figs. 10 and 11) (= small macramphidiscs), mesamphidiscs (= large micramphidiscs), and micramphidiscs (=small micramphidiscs). He thinks it possible that the small macramphidiscs (with 4–6 teeth in each anchor) represent young stages of the large macramphidiscs (with 8 teeth in each anchor). I do not think this is so.

The *large macramphidiscs* (Plate **50**, fig. 15; Plate **51**, figs. 2, 16–22; Plate **52**, figs. 3, 4, 9, 10) have a shaft either cylindrical, and of uniform thickness throughout (Plate **52**, fig. 10) or thickened towards the ends (Plate **51**, fig. 18). In the smaller and medium-sized large macramphidiscs the shaft is usually nearly quite smooth (Plate **51**, figs. 17, 19; Plate **52**, fig. 4); in the larger ones it often bears a smaller or a larger number of very low and broad, rounded protuberances which are scattered irregularly over its central part. In the large macramphidiscs (Plate **51**, fig. 18) these protuberances are 6 μ broad and 2 μ high. The axial thread is perfectly simple, not thickened in the centre of the spicule, and there is no trace of an axial cross (Plate **50**, fig. 15). The anchors are remarkably low and composed of from five to twelve teeth, most frequently eight. The individual teeth arise nearly vertically from the end of the shaft, and are curved concave towards it. The curvature is slight at the base, but increases distally, so that the axes of the end-parts of the teeth enclose angles of 30°–45° with the shaft-axis. The teeth of the same anchors are usually similar (Plate **51**, fig. 22); sometimes, however, particularly in the large macramphidiscs with more than eight teeth, one (Plate **51**, fig. 21) or more of them are abnormally small. The teeth are T-shaped in transverse section. The upper part (of the T) is band-shaped, distally widened, at its broadest point 19–24 μ in transverse diameter, and abruptly pointed; seen from above the teeth appear mitre-shaped. The lower part (of the T) is broad, low, and rounded below. It terminates some distance below the end of the teeth.

The large macramphidiscs of form *A* and *B* are, according to Wilson (*loc. cit.*), 100–200 μ long. In those of form *A* the shaft is 8–16 μ thick. Their anchors are composed of eight teeth. In the large macramphidiscs of form *A* the anchors are about one fifth of the whole spicule in length. Those of form *B* are about one seventh. In form *C* the large macramphidiscs are 106–186 μ long, most frequently about 137 μ, and have shafts 14–22 μ thick, exceptionally only

8 μ. Their anchors are 17–30 μ long, usually one seventh to one fourth of the whole spicule, 68–101 μ broad, and composed of from seven to eight teeth. The proportion of anchor-length to anchor-breadth is 100 to 273–429, on an average 100 : 339. The large macramphidiscs of form *D* (Plate **52**, figs. 3, 4, 9, 10) are 100–318 μ long, most frequently about 200 μ, and have shafts 10–22 μ thick, rarely only 8 μ. Their anchors are 19–47 μ long, usually one ninth to one seventh of the spicule, 55–122 μ broad, and composed of from six to nine, usually eight teeth. The proportion of anchor-length to anchor-breadth is 100 to 222–420, on an average 100 : 298. The large macramphidiscs of form *E* are mostly regular, but irregular forms also occur among them. The regular ones (Plate **50**, fig. 15; Plate **51**, figs. 2, 17–22) are 105–265 μ long, rarely as much as 334 μ, most frequently about 200 μ, and have shafts 14–23 μ thick. Their anchors are 17–35 μ long, usually one tenth to one seventh of the whole spicule, 62–109 μ broad, and composed of from eight to eleven teeth. The proportion of anchor-length to anchor-breadth is 100 to 276–500, on an average 100 : 361. The rare irregular large macramphidiscs of this form (Plate **51**, fig. 16) differ from the regular by their anchors being longer and composed of less numerous and spirally twisted teeth. The irregular large macramphidisc (Plate **51**, fig. 16) is 116 μ long and has a shaft 20 μ thick and anchors 42 μ long and 54 μ broad. The large macramphidiscs of form *F* are 103–188 μ long, rarely as much as 235 μ. The frequency-curve pertaining to their length has two summits, a higher one at about 136.5 μ, and a lower one at about 164 μ. The shafts of these spicules are 11–18 μ thick, rarely as much as 22 μ. Their anchors are 17–30 μ long, usually one eighth of the whole spicule, 66–105 μ broad, and composed of from five to twelve teeth. The proportion of anchor-length to anchor-breadth is 100 to 320–430, on an average 100 : 363.

The *small macramphidiscs* (Plate **51**, fig. 15; Plate **52**, figs. 5–8) are similar to the large ones and have, like them, a shaft which is cylindrical and of uniform thickness throughout (Plate **51**, fig. 15) or thickened towards the ends (Plate **52**, figs. 5, 7). The shaft is either smooth (Plate **52**, fig. 6), or it bears a few low tubercles scattered irregularly over its central part (Plate **52**, fig. 8). The anchors are generally one sixth to one third of the whole spicule in length, and composed of from four to seven teeth; in the smallest forms there are four or five teeth. The number of teeth in the two anchors of the same spicule is often different. The teeth are similar to those of the large macramphidiscs above described, but, particularly in the smallest form, more slender, relatively longer, and more strongly curved.

The small macramphidiscs are in the forms *A* and *B*, according to Wilson (*loc. cit.*), 60–100 μ long; in form *C* 68–100 μ, most frequently about 76 μ; in form *D* 63–96 μ long, most frequently about 80 μ; in form *E* 87–100 μ long, most frequently about 95 μ; and in form *F* 75–100 μ long, most frequently about 93 μ. The thickness of their shafts are in form *C* 9–13 μ, in form *D* 5–9 μ, in form *E* 11–17 μ, and in form *F* 9–13 μ. The anchors of these spicules are:—in form *C* 18–28 μ long and 40–65 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 143–333, on an average 100 : 258; in form *D* (Plate **52**, figs. 5–8) 25–31 μ long and 35–60 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 120–200, on an average 100 : 162; in form *E* (Plate **51**, fig. 15) 18–25 μ long and 52–70 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 256–340, on an average 100 : 306; and in form *F* 14–20 μ long and 30–58 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 210–330, on an average 100 : 286.

The *large micramphidiscs* (Plate **50**, fig. 14; Plate **51**, figs. 9–14; Plate **52**, figs. 27–29) have a shaft 1–3 μ thick and cylindrical throughout or slightly and gradually thickened in or near the middle. The shaft is beset with irregular obtuse spines 0.5–2 μ long. These are generally very numerous, and usually occupy all parts of the shaft with the exception of its ends. The terminal anchors are long, rather narrow, and very obtuse. Sometimes their length is sufficient to bring the teeth of the two opposite anchors of the same spicule nearly into contact with each other (Plate **50**, fig. 14; Plate **51**, fig. 9). The individual teeth arise steeply from the shaft. They are curved only slightly in their basal part, but strongly and more or less abruptly bent down a short distance from their origin. Their distal and middle-parts, beyond this bend, are only slightly curved or straight and enclose a small angle, 20° or less, with the shaft-axis. Sometimes this angle is 0 (Plate **52**, fig. 8); then they are parallel to the shaft.

The large micramphidiscs of forms *A* and *B* are generally simple. Exceptionally, however, they have more than two anchor-crowned rays. The ordinary simple ones are, according to Wilson (*loc. cit.*), 50–80 μ long, and have anchors which are slightly more than a third of the whole spicule in length and composed of eight teeth. One of the large micramphidiscs with more than two anchor-crowned rays, measured by Wilson (*loc. cit.*), was 72 μ in maximum diameter, and had five rays, three of which bore terminal anchors. The large micramphidiscs of form *C* are 49–66 μ long, most frequently about 57 μ, and have anchors 15–28 μ long, less than a third to nearly half of the whole spicule, and 15.5–28 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 76–100, on an average 100 : 92. Those of form *D* (Plate 52, figs. 27–29) are 35–77 μ long, most frequently about 52 μ, and have anchors 11–27 μ long, one third to nearly a half of the whole spicule, and 9.5–22 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 62–91, on an average 100 : 76. Those of form *E* (Plate 50, fig. 14; Plate 51, figs. 7–14) are 47–86, most frequently about 73 μ long, and have anchors 18–33 μ, two fifths to nearly half of the whole spicule, and 14–29 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 57–87, on an average 100 : 72. Those of form *F* are 35–68 μ long, most frequently about 53 μ, and have anchors 10–25 μ long, a quarter to nearly half of the whole spicule, and 7–19 μ broad. The proportion of anchor-length to anchor-breadth is 100 to 63–88, on an average 100 : 73.

The *small micramphidiscs* (Plate 50, figs. 11–13; Plate 51, figs. 3–6; Plate 52, figs. 24–26) have a straight shaft, 0.7–1.5 μ thick, which is either cylindrical and of uniform thickness throughout, or slightly and gradually thickened in or near the middle. It usually bears a few scattered spines up to 1 μ in length in its middle-part. The terminal anchors are from under a third to two fifths of the whole spicule in length. They are obtuse in shape and composed of about eighteen teeth. The individual teeth arise vertically from the shaft, are nearly straight in their basal part, and then curve downwards. This curvature decreases distally. The ends of the teeth are nearly straight and enclose only small angles with the shaft-axis, or are parallel to it.

The small micramphidiscs are in forms *A* and *B*, according to Wilson (*loc. cit.*), 20–25 μ long. In form *C* they are 22–31 μ long, most frequently about 26 μ; in form *D* 18–31 μ, most frequently about 24 μ; in form *E*, 15–30 μ, most frequently about 21 μ; and in form *F* 14–24 μ, most frequently about 20 μ long. Their anchors are in form *C* 4–1 μ long and 5.5–12.5 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 95–178, on an average 100 : 140; in form *D* (Plate 52, figs. 24–26) 4–9 μ long and 7–9.5 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 100–200, on an average 100 : 153; in form *E* (Plate 50, figs. 11–13; Plate 51, figs. 3–6) 4.5–9.5 μ long and 5–10 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 87–150, on an average 100 : 114; and in form *F* 3–6 μ long and 4–8 μ broad, the proportion of anchor-length to anchor-breadth being 100 to 100–175, on an average 100 : 140.

Eight specimens and three fragments of this species were collected in the central and eastern part of the Tropical Pacific. One specimen and three fragments of form *A* were trawled off Panama at Station 3363, on 26 February, 1891; 5° 43′ N., 85° 50′ W.; depth 1788 m. (978 f.); they grew on white Globigerina ooze; the bottom-temperature was 37.5°. One specimen of form *A* was trawled off Panama, at Station 3376, on 4 March, 1891; 3° 9′ N., 82° 8′ W.; depth 2070 m. (1132 f.); it grew on gray Globigerina ooze; the bottom-temperature was 36.3°. The two specimens of form *B* were trawled in the Central Tropical Pacific at Station 3684 (A.A. 17) on 10 September, 1899; 0° 50′ N., 137° 54′ W.; depth 4504 m. (2463 f.); they grew on light yellow-gray Globigerina ooze. The single specimen of form *C* was trawled off northern Peru at Station 4651, on 11 November, 1904; 5° 41.7′ S., 82° 59.7′ W., Aguja Point S. 83° E., 206 km. (111 miles); depth 4063 m. (2222 f.); it grew on sticky, fine, gray sand; the bottom-temperature was 35.4°. The single specimen of form *D* was trawled off northern Peru W. S. W. of Aguja Point, at Station 4656 on 13 November, 1904; 6° 54.6′ S., 83° 34.3′ W.; depth 4063 m. (2222 f.); it grew on fine, green mud mixed with gray ooze; the bottom-temperature was 35.2°. The specimen of form *E* was trawled in the Eastern Tropical Pacific, at Station 4721, on 15 January, 1905; 8° 7.5′ S., 104° 10.5′ W.; depth 3811 m. (2084 f.); it grew on light brown Globigerina ooze. The single specimen of form *F* was trawled in the Eastern Tropical Pacific at Station 4742, on 15 February, 1905; 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); it grew on very light, fine Globigerina ooze; the bottom-temperature was 34.3°.

There can, I think, be no doubt that the four sponges described above all belong to Wilson's *Hyalonema pateriferum*. The specimens of this species studied by Wilson from the Stations 3363 and 3376 appear to be fairly identical with each other, but differ from all the rest. The specimens described by him from Station 3684 (A.A. 17) are likewise identical with each other and different from all the rest. The four specimens examined by me, which all come from different stations, differ from each other and from the specimens described by Wilson.

The following are the fourteen more important spicule-dimensions, of which the averages and the nature of the variation have been ascertained: — *a*, the length of the distal ray of the ordinary pinules; *b*, the basal thickness of this ray; *c*, the length of the lateral rays of the ordinary pinules; *d*, the diameter of the microhexactines; *e*, the length of the large macramphidiscs; *f*, the thickness of the shafts of these spicules; *g*, the average proportion of the length to the breadth of the anchors of these spicules; *h*, the length of the small macramphidiscs; *i*, the thickness of the shafts of these spicules; *k*, the average proportion of the length to the breadth of the anchors of these spicules; *l*, the length of the large micramphidiscs; *m*, the average proportion of the length to the breadth of the anchors of these spicules; *n*, the length of the small micramphidiscs; and *o*, the average proportion of the length to the breadth of the anchors of these spicules.

a, The length of the distal ray of the ordinary pinules varies in the forms *A*, *B*, and *F* between about the same limits. The other forms differ, in respect to this dimension, from these and from each other. *b*, The distal rays of the ordinary pinules are, in the forms *A*, *B*, *E*, and *F*, usually about 5 μ thick at the base, in forms *C* and *D* considerably thinner. *c*, The shortest lateral rays of the ordinary pinules are in the forms *A* and *B* 30 μ long, in the forms *E* and *F* 24–26 μ, in form *D* 16 μ, and in form *C* only 13 μ. *d*, The diameter [1] of the microhexactines varies in the forms *A*, *B*, and *E* between fairly equal limits (55–160 μ). In the forms *D* and *F* the largest microhexactines are smaller, only 128 μ in diameter in the former and 138 μ in diameter in the latter. In form *C* these spicules are much smaller still. *e*, The length of the large macramphidiscs varies between similar limits (100–235 μ) in the forms *A*, *B*, *C*, and *F*. In the forms *D* and *E* the largest large macramphidiscs are 300 μ or more long, and also have a much greater average size. *f*, The shafts of the large macramphidiscs are thickest in forms *C* and *E*, thinner in form *D* and *F*, and still thinner in form *A*. In form *B* this dimension is not known. *g*, The average proportion of anchor-length to anchor-breadth is in the forms *E* and *F* 100 : 361 and 100 : 363 respectively; in form *C* 100 : 339, and in form *D* only 100 : 298. In the forms *A* and *B* studied by Wilson it is not known. Since, however, Wilson (*loc. cit.*) states that in the former the anchor-length is one seventh and in the latter one fifth of the length of the whole spicule, which is said to be the same in both, it may be assumed that these two forms differ in respect to this anchor-proportion from each other. *h*, The small macramphidiscs are in the forms *A*, *B*, *C*, and *D* fairly equally long, in the forms *E* and *F* they are longer. *i*, The thickness of the shafts of the small macramphidiscs is greatest in form *E*, equal and smaller in form *C* and *F*, and still smaller in form *D*. In forms *A* and *B* this dimension is not known. *k*, The average proportion of anchor-length to anchor-breadth of the small macramphidiscs is in the forms *C*, *E*, and *F* 100 to over 250, in form *D* only 100 to 162. In the forms *A* and *B* this anchor-proportion is not known. *l*, The length of the large micramphidiscs varies in the forms *A*, *B*, and *E* between nearly equal limits (47–80 μ), and is in form *E* most frequently about 73 μ. In form *C* these spicules are not so large, most frequently 57 μ long, and in forms *D* and *F* nearly equal and still shorter, most frequently 52 and 53 μ

[1] In the forms *A* and *B*, where only the ray-length is given, the double ray-length is taken as the diameter.

respectively. *m*, The average proportion of the anchor-length to the anchor-breadth of the large micramphidises is in form *C* 100 to 92, in the forms *D*, *E*, and *F* 100 to 72–76. According to Wilson (*loc. cit.*), the length of the anchors of these spicules is, both in forms *A* and *B*, a third of the length of the whole amphidise; the anchors of these spicules are in these two forms therefore probably also about equal in respect to the proportion between length and breadth. *n*, In forms *A* and *B* the length (20–25 μ) of the small micramphidises is equal. In forms *C* and *D* these spicules are larger, most frequently about 26 and 24 μ long respectively. In forms *E* and *F* they are smaller, most frequently about 20 and 21 μ long respectively. *o*, The average proportion of anchor-length to anchor-breadth of the small micramphidises is in form *D* 100 to 153, in form *C* and *F* 100 to 140, and in form *E* 100 to 114. In the forms *A* and *B* this proportion is not known.

The affinities of the six different forms in respect to these further qualities are tabulated below:—

The specimens from Station	agree with the specimens from Station	in respect to the	characters
3363 and 3376 (form A)	3684 (A.A. 17) (form B)	9	a b c d e h l m n
	4651 (form C)	2	e h
	4656 (form D)	1	h
	4721 (form E)	3	b d l
	4742 (form F)	3	a b c
3684 (A.A. 17) (form B)	4651 (form C)	2	e h
	4656 (form D)	1	h
	4721 (form E)	3	b d l
	4742 (form F)	3	a b c
4651 (form C)	4656 (form D)	3	b h n
	4721 (form E)	2	i k
	4742 (form F)	4	e i k o
4656 (form D)	4721 (form E)	2	e m
	4742 (form F)	4	d f l m
4721 (form E)	4742 (form F)	7	b c g h k m n

According to this table the units of all the fifteen possible pairs of forms, with the exception of those of two, coincide with respect to only 1–4 of the fourteen qualities here discussed, and must therefore, I think, be kept distinct. The two pairs *A–B* and *E–F* are more similar. The units of the first coincide in respect to nine, the units of the second in respect to seven of these fourteen qualities. The pair *A–B* consists of the two forms described by Wilson, and it must, in comparing these, be kept in mind that this author does not give the measurements of all the dimensions and proportions (*a–o*) here discussed, and of the dimensions he does give mentions only to limits, but states neither the biometric character of the variation nor the averages of the individual measurements. As his measurements are insufficient for this comparison it is probable that these two forms do not coincide in the manner indicated by the figures given in the above table. However this may be, there doubtlessly exists a considerable difference between the large macramphidiscs of these forms, the length of the anchors being one seventh of the length of the whole spicule in the one, and one fifth in the other. I think this difference by itself sufficient to keep the forms *A* and *B* distinct.

The forms *E* and *F* are certainly very similar. The chief differences between them are that the large macramphidiscs and large micramphidiscs are larger, and that the breadth of the anchors of the small micramphidiscs is relatively smaller in the former than in the latter. The specimens of both these forms are very fragmentary, which renders it doubly difficult to decide whether the observed differences between them should be considered sufficient to keep them distinct or not. In doubtful cases like this, it is, I think, better to keep similar specimens distinct rather than to unite them.

The differences between these six lots of sponges are slight, not correlated to the distance between the stations where they were obtained, and in my opinion insufficient for varietal distinction. They render it however advisable to describe them as different forms of *Hyalonema pateriferum*. These forms are not equivalent, *E* and *F* being much more similar than any other pair, with the exception possibly of *A* and *B*.

SKIANEMA, subgen. nov.

Species of Hyalonema of which the amphidiscs of one kind have relatively rather large, broad and low, umbrella-shaped terminal anchors.

The collection contains three specimens of this subgenus, which belong to two species, both of which are new.

Hyalonema (Skianema) aequatoriale, sp. nov.

Plate 99, figs. 1–37; Plate 100, figs. 1–12; Plate 101, figs. 1–3.

A single specimen of this species was trawled in the Eastern Tropical Pacific at Station 4742 on 15 February, 1905; 0° 3.4′ N., 117° 15.8′ W.; depth 4243 m. (2320 f.); it grew on a bottom of very light, fine Globigerina ooze; the bottom-temperature was 34.3°.

The locality where it was found lies nearly under the equator and to this the name refers.

Shape and size. The single specimen is somewhat lacerated and fragmentary. It now appears (Plate **99**, fig. 17) flattened and elongate. One end is rounded. At the other it terminates with a nearly straight margin vertical to the two longer sides. It is 71 mm. long, 45 mm. broad, and has a maximum thickness of 15 mm. In life it was probably not much thinner than broad. The straight terminus is the upper gastral face. It is slightly depressed in its middle-part, from which a gastral cone arises. This cone is surrounded by thin, more or less vertical, radiating lamellae, between which extend extensive cavities, now much compressed. The rounded end is the lower, and from it doubtlessly arose in life a stalk, which has, however, been completely lost.

The *colour* in spirit is whitish brown.

Traces of elongate *flagellate chambers* about 75 μ broad can be made out here and there in the sections.

The *skeleton.* A dense spicule-fur covers all intact parts of the surface (Plate **101**, figs. 1, 2a, 3). Between the basal parts of the distal rays of the superficial pinules forming this fur are met small macramphidiscs, generally with the shaft vertical to the surface of the sponge (Plate **101**, fig. 2c). The superficial membranes are supported by the lateral rays of the (dermal and gastral) pinules, and the (hypodermal and hypogastral) pentactines; paratangential rhabds also occur in it in considerable numbers (Plate **101**, fig. 3). Just below the surface numerous large macramphidiscs are found (Plate **101**, fig. 2d). A loose bundle of large amphioxes occupies the axial part of the sponge. This bundle extends completely into the gastral cone. More or less radially extending rhabds occur in the choanosome. Most of the rhabds in the superficial membranes and in these bundles are amphioxes; some diactine styles or tylostyles, however, also occur. Microhexactines are scattered throughout the choanosome in large numbers. Large and small micramphidiscs are also found in it. These spicules are, however, rather rare. In the interior of the gastral cone a good many spheres have been observed.

Foreign skeletal elements are always met in the deep-sea hexactinellids which have, like the specimen here described, been somewhat injured in capture. I do not remember, however, ever having seen a sponge so rich in foreign spicules as this one. The spicules in question could be determined as foreign because they are identical with the pentactines, pinules, hexasters, amphidiscs, etc., of *Holascella euonyx*, *Hyalonema* (*Hyalonema*) *agassizi*, *Hyalonema* (*Prionema*) *fimbriatum*, *Hyalonema* (*Phialonema*) *pateriferum*, and *Hyalonema* (*Prionema*) *spinosum* brought up in the same haul together with the sponge here under discussion.

The *dermal pinules* (Plate **99**, figs. 29–31) are generally pentactine, rarely hexactine. The distal ray is straight, 200–260 μ long, and 5–8 μ thick at the base. It ends in a rather slender sharp-pointed terminal cone, and bears everywhere, except at the base and at the tip, rather slender straight or slightly curved spines, which are all strongly inclined towards its tip. The maximum thickness of the distal ray, together with the spines, is 25–42 μ. The lateral rays are cylindroconical, pointed, spiny, and 30–45 μ long. The proximal ray of the rare hexactine forms (Plate **99**, fig. 29) is 9–42 μ long.

The *gastral pinules* (Plate **99**, figs. 25–28, 36) are a little larger than the dermals and appear always to be pentactine. Their straight distal ray is 212–275 μ long, and 6–9 μ thick at the base. It ends with a long and slender sharp-pointed terminal cone and bears everywhere, except at the tip and at the base, remarkably sparse spines. These spines are long, slender, straight or slightly curved, and strongly inclined towards the tip of the ray. The maximum thickness of the distal ray, together with the spines, is 23–39 μ. The lateral rays are 35–48 μ long and, like those of the dermal pinules, cylindroconical and spined.

The *hypodermal and hypogastral pentactines* seem to be quite similar. Their rays are conical, straight, and blunt. The proximal ray is generally 0.4–1 mm. long, and 16–50 μ thick at the base. The lateral rays are 140–800 μ.

The *hexactine megascleres* are mostly 360–850 μ in diameter, and have conical, blunt, and straight rays 9–31 μ thick at the base. A few fragments observed in the preparations indicate that some of these spicules attain a larger size.

The *ordinary superficial and choanosomal amphioxes* are straight or slightly curved and usually more or less centrotyle. In some no trace of a central thickening could be made out. These spicules are 0.25 μ–1.9 mm. long, and 7–26 μ thick near the middle. The central tyle is sometimes 6 μ in transverse diameter, usually about 0.3 μ more than the adjacent parts of the spicule. The "central" tyle is often situated a considerable distance away from the middle of the length of the spicule, many of these centrotyle amphioxes being markedly anisoactine.

The *styles and tylostyles* are, like the amphioxes above described, centrotyle diactine rhabds. One of their rays is similar to an amphiox-ray, the other is reduced in length and rounded, and generally also thickened at the end. These spicules are 0.5–2 mm. long. They are slightly thickened at the morphological centre, in which the axial cross can always be made out, and are here 8–25 μ thick. The rounded end (terminal tyle) is 8–40 μ in diameter and usually separated from the remaining part of the spicule by an attenuation. In this attenuation, or neck, the spicule is 1–11 μ thinner, usually 3–6 μ, than the rounded end (terminal tyle).

The *large amphioxes* of the rhabd-bundle which forms the skeletal axis of the sponge-body and terminates in the gastral cone are 2 mm. and more (the long ones are broken) long and 30–60 μ thick.

The *spheres* are regularly spherical, oval, or irregular, potato-shaped. They measure 17–170 μ in maximum diameter, most frequently about 30 μ. All contain a granular centrum round which silica-layers of somewhat varying refractory index have been deposited. The surface is in the smaller spheres regular, smooth, and continuous, in the larger it is usually irregular. As an example I shall describe a typical large sphere. This spicule is 168 μ long and 157 μ broad. It has an oval granular centrum 12 μ long and 7 μ broad. The granules in it are numerous, and about 1 μ in diameter. In the silica, which is perfectly hyaline, a concentric stratification around the centrum can be made out very clearly. In one place a watchglass-shaped granular body, which appears sickle-shaped in profile (optical section), is interpolated between two successive layers of ordinary hyaline silica. A number of groove-like indentures, sometimes 2 μ deep, are visible on the surface of the sphere. Several of these radiate from one point.

The *microhexactines* (Plate 99, figs. 3–10, 32–35) are 60–96 μ in maximum diameter. In some all the rays are fairly equal; in others two opposite rays are considerably longer than the other four. The latter are sometimes nearly twice as long as broad. The rays are 1.8–2.4 μ thick at the base. They are conical, finely pointed, and covered with very minute spines. The basal part, usually about half of the total length of the whole ray, is nearly straight, the distal part curved. This curvature is usually greater at the point where the basal straight part passes into the distal curved part than farther on. The whole curvature is such that the directions (tangents) of the proximal and distal end-parts of the ray generally enclose an angle of 105°–130°. The tips of opposite rays point in opposite directions.

From a morphological point of view four kinds of *amphidiscs* are to be distinguished: — *A*, larger forms with low (short) and very broad anchors, about a third of the length of the whole spicule; *B*, forms intermediate in size with relatively large anchors, about half as long as the whole spicule; *C*, forms intermediate in size with small, relatively broad anchors, a fourth to a fifth of the whole spicule in length; and *D*, small forms with more slender anchors.

As the length frequency-curves in Figure 24 show, these four morphologically different kinds of amphidiscs are by no means all clearly separated also biometrically. In fact the curve pertaining to the amphidiscs of the groups *B* and *C* overlap to a large extent, and only the curve pertaining to group *D* is clearly distinct from the others.

In view of the great morphological difference between the groups *B* and *C* and the total absence of intermediate forms connecting these two groups, I do not hesitate to consider them as different kinds of amphidiscs. I distinguish altogether four different kinds of amphidiscs in this sponge: — large (group *A*) and small (group *B*) macramphidiscs, and large (group *C*) and small (group *D*) micramphidiscs. The length frequency-curves pertaining to the first three forms are quite simple and without deep depressions; these groups are biometrically homogeneous. The curve pertaining to the small micramphidiscs (group *D*) is complicated, however, by two deep depressions descending to the 0-line, which divide it into three parts. Since, however, the larger, the medium, and the smaller small micramphidiscs pertaining to the three distinct elevations of this curve are quite similar in shape, I do not think it advisable to distinguish subgroups within this amphidisc-group.

The regular *large macramphidiscs* (Plate **99**, figs. 1, 2, 37; Plate **100**, figs. 5–11; Plate **101**, fig. 2d) are 105–298 μ long, usually 122–257 μ, most frequently about 180 μ. The shaft is straight, cylindrical, perfectly smooth, and 14–27 μ thick, generally 19–27 μ. The terminal anchors are 42–87 μ long, about a third of the whole spicule, and 90–195 μ broad. The proportion of the length to the breadth of the anchors is 100 to 191–288, on an average 100 : 236.8. Each anchor consists of from eight to eleven teeth. The teeth of the two anchors of the same spicule are generally situated alternately. The teeth arise nearly vertically from the ends of the shaft, are curved very slightly in their proximal part, but very strongly in their distal part, and their tips converge

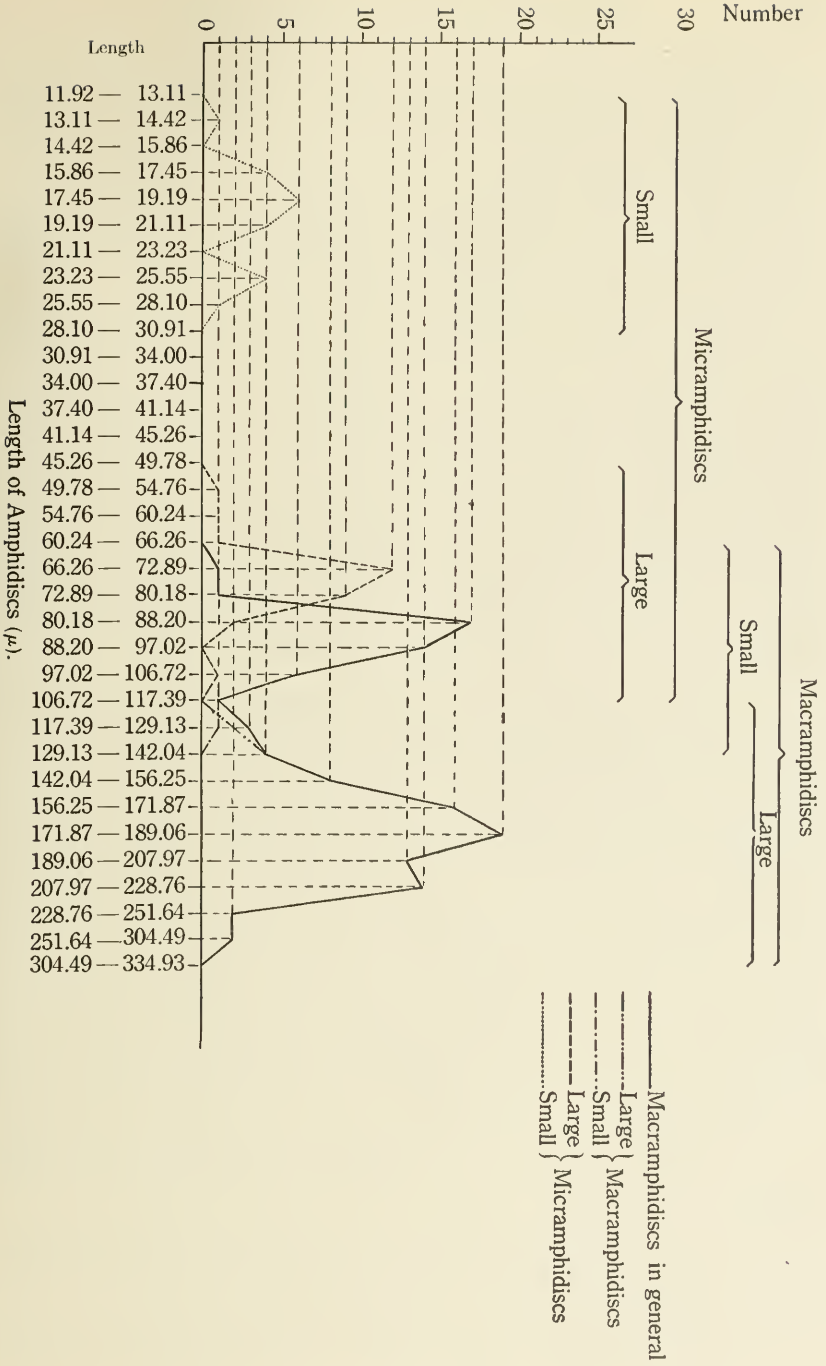

Fig. 24.— Amphidiscs

very markedly. The distances between the ends of opposite teeth are therefore smaller than the breadth of the anchor. While the latter is, as above stated, 90–195 μ, the former is only 83–164 μ, that is 7–20 μ less. The outer band-shaped part of the tooth attains its maximum width of 17–29 μ about two thirds of its length from its base. Distally it is simply rounded off. The keel in the larger forms is, at the base of the tooth, about 30 μ high, decreases in height distally, and terminates some distance within the tip of the tooth.

Besides the regular large macramphidises above described, a good many *irregular large macramphidiscs* (Plate **99**, figs. 18–20) have been observed. The irregularity most frequently observed is an inequality of the two anchors of the same spicule. These may differ in size, in the proportion of their length to their breadth, and in the number of teeth composing them. The irregular large macramphidises of this kind are about as large as the regular ones. Much more rarely smaller forms are met, in which either a large conic protuberance arises from the apex of one of the anchors (Plate **99**, fig. 18) or the anchors are quite irregular. The teeth composing such anchors are exceedingly unequal, some being hypertrophied, twisted, or otherwise deformed, others rudimentary (Plate **99**, figs. 19, 20).

The *small macramphidiscs* (Plate **100**, figs. 1–4, 12; Plate **101**, fig. 2e) are 70–120 μ long, most frequently about 84.2 μ. The shaft is straight, cylindrical, perfectly smooth, and 6.5–13 μ thick. The terminal anchors are 38–50 μ long, about half the whole spicule, and 37–84 μ broad. The proportion of the length to the breadth of the anchors is 100 to 120–175, on an average 100 : 146.6. Each anchor is composed of from ten to twelve teeth. The teeth of the two anchors of the same spicule are generally situated alternately, but this alternation is only exceptionally regular, usually it is more or less irregular. The individual teeth are curved quite uniformly for the greater part of their length through about a quarter of a circle, so that the whole anchor is more or less hemispherical in shape. Their extreme tips are strongly bent inward and converge, so that the distance between the ends of opposite teeth is usually about 6 μ less than the breadth of the anchor. The outer band-shaped part of the tooth attains its maximum breadth of 10–14 μ in its distal half, and is rounded or, more rarely, blunt-pointed at the end.

Differences in the number of teeth of the two anchors of the same spicule, differences in the size of the teeth of the same anchor (Plate **100**, fig. 3), and other irregularities often occur.

The *large micramphidiscs* (Plate **99**, figs. 11–16) are 54–84 μ long, most frequently about 69.5 μ. The shaft is straight or slightly curved, and of a uniform thickness of 2.5–5 μ throughout or slightly centrotyle. It bears very low and broad, tubercle-like, scattered protuberances (spines). The terminal anchors are 12–18 μ long, a fifth to a fourth of the whole spicule, and 19–25 μ broad. The proportion of the length to the breadth of the anchors is 100 to 134–167, on an average 100 : 148.1. Each terminal anchor consists of from twelve to sixteen teeth. The individual teeth are curved only slightly in their proximal and distal parts, but rather strongly in their middle-part. Their total curvature is such that their nearly straight ends diverge. The anchor-teeth are rather slender and pointed at the end.

The *small micramphidiscs* (Plate 99, figs. 21–24) are 14–25.5 μ long, most frequently about 18.3 μ. The shaft is straight or slightly curved, generally of a fairly uniform thickness of 0.7–1.2 μ throughout, and covered with minute scattered spines. The terminal anchors are 3.5–8 μ long, a quarter to a third of the whole spicule, and 4.5–8 μ broad. The proportion of the length to the breadth of the anchors is 100 to 81–143, on an average 100 : 98. The individual teeth are rather strongly and uniformly curved in their proximal part, and nearly straight in their distal part. The straight distal parts of the teeth of the same anchor are more or less parallel.

The nearest allies of the above sponge are *Hyalonema* (*Skianema*) *umbraculum* and *H.* (*Thallonema*) *geminatum*. From *H.* (*S*). *umbraculum* it differs by having smaller large micramphidiscs, from *H.* (*T.*) *geminatum* by being destitute of the geminate amphidiscs and the different shape of the pinules, and from both by the possession of spheres.

Hyalonema (Skianema) umbraculum, sp. nov.

Plate 101, figs. 4–17; Plate 102, figs. 1–8; Plate 103, figs. 1–36.

Two fragmentary specimens of this species were trawled in the Central Tropical Pacific at Station 4740 on 11 February, 1905; 9° 2.1′ S., 123° 20.1′ W.; depth 4429 m. (2422 f.); they grew on a bottom of dark gray Globigerina ooze; the bottom-temperature was 34.2°.

The terminal anchors of the large macramphidiscs are very broad and low, umbrella-shaped. To this the name refers.

Shape and size. The larger specimen is an irregular oval lamella with lacerated margin, from one of the narrow ends of which a couple of stout stalk-spicules protrude. The lamella is 62 mm. long, 39 mm. broad, and about

2 mm. thick. It has obviously been strongly compressed during or after capture, and I do not think that the living sponge, of which it once formed a part, was at all lamellar. The other specimen (fragment) is similar but much smaller.

The *colour* in spirit is light brown.

The *skeleton* is composed of superficial pinules, hypodermal and hypogastral pentactines, hexactine megascleres, choanosomal and superficial rhabds, acanthophores, axial amphioxes forming an upper continuation of the stalk in the sponge-body, stalk-spicules proper, microhexactines, diactine microhexactine-derivates, and amphidiscs. The hexactine megascleres are exceedingly scarce. The superficial and choanosomal rhabds are for the most part centrotyle amphioxes, but diactine tylostyles also occur among them. The microhexactines are abundant, their diactine-derivates very rare. The amphidiscs are of four kinds:— large and small macramphidiscs, and large and small micramphidiscs. The small micramphidiscs are remarkably scarce.

The dermal and gastral *superficial pinules* (Plate **103**, figs. 9–13) appear to be quite similar. All the pinules observed were pentactine. The distal ray is straight, 178–290 μ long, most frequently about 240 μ, and 4–11 μ thick at the base. It ends with a rather long and slender spineless terminal cone, and its basal part is also free from spines. The middle-part of the distal ray is, for about two thirds of its length, covered with straight or slightly curved spines, which are strongly inclined towards its tip. The spines situated half way up the ray are the largest. The maximum thickness of the distal ray, together with the spines, is 27–40 μ. The lateral rays are cylindroconical, blunt, spiny, and 28–48 μ long.

The rays of the *hypodermal and hypogastral pentactines* are cylindroconical and very blunt. In the intact pentactines observed the proximal ray is 370–480 μ long, and 14–18 μ thick at the base, while the lateral rays attain a length of 120–240 μ; however, judging from the fragments of larger ones found in the preparations, the rays of these pentactines must frequently attain a much larger size. The largest lateral rays of fragmentary pentactines observed attain 1 mm. in length and 70 μ in thickness at the base. These very large fragments may, however, be parts of foreign spicules.

One of the very rare *hexactine megascleres* measured is 480 μ in maximum diameter, and has terminally rounded, cylindroconical rays 12 μ thick at the base. One of the rays of this spicule is considerably longer than the other four.

The *choanosomal and superficial amphioxes* are centrotyle, 0.5–2.5 mm. long, usually 1–1.5 mm., and 11–26 μ thick near the centre. The central tyle is 14–

28 μ in transverse diameter, that is 1–3 μ more than the adjacent parts of the spicule.

The *diactine tylostyles* are much more frequent in the smaller specimen than in the larger. They are about 1 mm. long, and at the morphological centrum, where a slight thickening is to be noticed, are 9–16 μ in transverse diameter. The rounded end is 20–28 μ, and the attenuated "neck," separating it from the rest of the spicule, is 11–15 μ thick.

The *rhabds of the axial skeleton*, which form the upper continuation of the stalk within the body of the sponge, are 50–100 μ thick. As nearly all these spicules found in the preparations are broken, I could not determine their length.

The few large *spicules of the stalk proper* are 540–630 μ thick.

The *acanthophores* of the basal part of the sponge (Plate 101, figs. 15–17) have from two to four rays. The tri- and tetractines are 340–580 μ in maximum diameter, their rays being 14–40 μ thick at the base. The extreme tips of the rays are generally spineless, smooth, simply rounded, and dome-shaped. On this smooth end-part follows a spiny belt, usually occupying from a quarter to a half of the whole ray. Proximally the spines in these belts become smaller and smaller until they disappear altogether, leaving from half to three quarters of the ray entirely smooth.

The *microhexactines* (Plate 101, figs. 4–7, 11–14) are 40–100 μ in diameter, on an average 64.3 μ. The rays are either equal, or two opposite ones exceed the other four in length. The basal part of the rays is quite straight, the distal part, usually a little less than half of the ray, uniformly curved and so strongly that the directions (tangents) of the basal half and the tip of the ray enclose an angle often as small as 90° or even smaller. The rays are conical, 1.1–1.8 μ thick at the base, and end in fine points. They are fairly smooth or only slightly roughened by barely visible spines.

Besides these regular microhexactines a few *diactine microhexactine-derivates* (Plate 101, fig. 14) have been observed. These spicules appear as centrotyle amphioxes with fine, curved end-parts. Their surface is more rough (spiny) than that of the regular microhexactines.

The measurements of a typical spicule of this kind are: — length 91 μ, diameter of central tyle 3 μ, basal thickness of rays 1.5 μ.

Morphologically two main kinds of *amphidiscs* can be distinguished: — those with relatively large and broad terminal anchors and those with intermediate or relatively small, not particularly broad anchors. The former, which are 78–280 μ long, I consider as macramphidiscs; the latter, which are 16–99 μ long, as micramphidiscs.

The larger macramphidiscs have very broad and rather short anchors, usually about a third of the whole spicule in length. The smaller have relatively much longer anchors, usually about half the whole spicule in length. Forms intermediate in respect to the proportion of the length to the breadth of the anchors connect the larger, shorter- and the smaller, longer-anchored kinds of these spicules. These intermediate forms are, however, far from numerous.

The length frequency-curve in Figure 25 shows that the larger (short-anchored) and the smaller (long-anchored) macramphidiscs are very clearly distinguished biometrically. This biometrical distinction, together with the rarity of the forms transitional between the two morphologically, makes a subdivision of the macramphidiscs into two subgroups necessary; namely:— large macramphidiscs, larger forms with anchors usually about a third of the length of the whole spicule; and small macramphidiscs, smaller forms with anchors usually about half of the whole spicule in length.

The part of the length frequency-curve pertaining to the micramphidiscs is divided, by a deep depression extending quite down to the 0-line, into two parts, one comprising the larger forms, 54–99 μ in length, the other comprising the smaller forms, 16–38.7 μ in length. Although the larger and the smaller of these spicules differ morphologically only in so far as the anchors are on the whole relatively broader in the former than in the latter; nevertheless I think it advisable to distinguish also in this main amphidisc-group two subgroups, namely, large micramphidiscs, comprising the larger forms with broader anchors, and small micramphidiscs, comprising the smaller forms with narrower anchors.

The length frequency-curves pertaining to the large and small macramphidiscs are quite simple and have, each, only one summit; these two amphidisc-groups are obviously homogeneous. The curves pertaining to the micramphidiscs on the other hand have, each, two depressions, dividing each into three parts. Although this division is very well-marked, particularly in the small micramphidiscs, I do not propose further to subdivide these subgroups of amphidiscs because I was unable to detect any morphological differences between the respective amphidiscs to which the different elevations of the curves pertain. Thus I distinguish four kinds of amphidiscs in this sponge:—large and small macramphidiscs, and large and small micramphidiscs.

The *regular large macramphidiscs* (Plate **102**, figs. 1, 2, 7, 8; Plate **103**, figs. 1–8, 14–23) are 110–280 μ long, most frequently about 268.4 μ long. The shaft is straight, cylindrical, smooth, and 17–26.5 μ thick. The terminal anchors

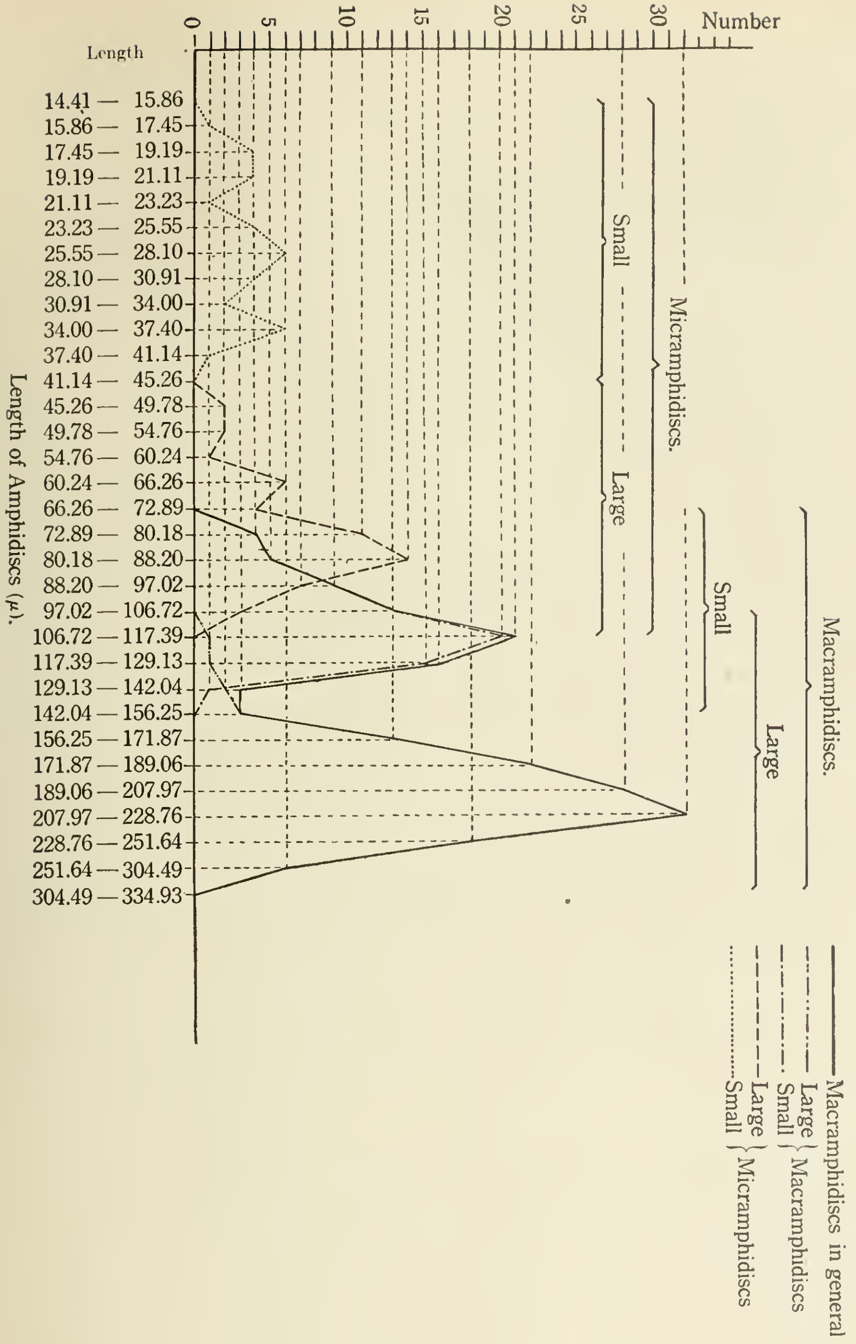

Fig. 25.— Amphidiscs.

are 51–93 μ long, usually about a third of the whole spicule, and 105–190 μ broad. The proportion of the length to the breadth of the anchors is 100 to 141–316, on an average 100 : 225.3. The number of teeth in the anchor is from eight to ten. The two anchors of the same spicule are usually composed of the same number of teeth, and in this case the teeth of two anchors are generally regularly alternate. Sometimes the number of teeth is not the same in the two anchors of the same amphidisc, and in that case they of course do not alternate regularly. The individual teeth arise nearly vertically from the ends of the shaft, and are curved only slightly in their proximal half, but strongly in their distal half. This curvature is so great, that the tips of the teeth become strongly convergent, and the distance between the ends of opposite teeth is 12–32 μ less than the (maximum) breadth of the anchor. The outer band-shaped part of the tooth attains its maximum breadth a little distance distally from the middle of its length, and is here sometimes 32 μ broad. At its distal end the tooth is simply rounded off.

Besides these regular forms several *irregular large macramphidiscs* (Plate **101**, figs. 8–10) have been observed. In these spicules one or both of the terminal anchors are irregular, and the shaft bears, besides the terminal anchor-teeth, other protuberances which arise — usually in a verticil — from its middle-part. All these supernumerary protuberances terminate at the (hypothetical) oval wall of the amphidisc-cell, and are here abruptly bent or slightly extended to terminal discs.

The *small macramphidiscs* (Plate **102**, figs. 3–6; Plate **103**, figs. 24–26) are 78–128 μ long, most frequently about 112 μ. The shaft is straight, cylindrical, smooth, and 6–11.5 μ thick. The terminal anchors are 37–67 μ long, about half the whole spicule, and 53–104 μ broad. The proportion of the length to the breadth of the anchors is 100 to 138–176, on an average 100 : 150.6. The terminal anchors consist of ten to thirteen teeth. The number of teeth is, as in the large macramphidiscs, not always the same in the two anchors of the same spicule. When it is the same the teeth of opposite anchors are usually situated alternately; when it is not the same, there is no regular alternation of teeth. The teeth arise nearly vertically from the ends of the shaft and are curved quite uniformly, approximately through a quarter of a circle, to within a short distance of the tip. The anchors are therefore nearly hemispherical in shape. The outer band-shaped part of the tooth attains its maximum width of 15–20 μ some distance distally from the middle of its length. Sometimes its broadest part lies quite close to the distal end, and in this case this end is broad and rounded (Plate **102**, fig. 3); sometimes it lies some distance from the end, and then the end is attenuated and bluntly pointed (Plate **102**, fig. 5). The distal end-parts of the outer band-shaped portions of the teeth are abruptly bent inward and strongly convergent, so that the distances between the ends of opposite teeth are 5–15 μ less than the (maximum) breadth of the anchor. The keel retains a considerable height to within a short distance of the end of the tooth, and then terminates more or less abruptly. Seen in profile the tip of the tooth therefore resembles an eagle's beak.

The *large micramphidiscs* (Plate **103**, figs. 31–36) are 54–99 μ long, most frequently about 84.2 μ. The shaft is 2.6–4.5 μ thick, straight, or, rarely, curved. Sometimes it is slightly thickened at or near the middle, sometimes no trace of a central tyle can be detected. The tyle is, when present, sometimes 1.4 μ more than the adjacent parts of the shaft in transverse diameter. The surface of the shaft is somewhat undulating and spiny. The spines are usually very minute; sometimes a few larger ones arise from the central tyle. The terminal anchors are 10–23 μ long, one fifth to one fourth of the whole spicule, and 14–36 μ broad. The proportion of the length to the breadth of the anchors is 100 to 107–200, on an average 100 : 150.9. The anchor-teeth arise vertically from the ends of the shaft, are either strongly bent a short distance from their base and slightly curved in their distal and middle-parts, or curved with a radius increasing distally in a uniform manner. Their tips diverge. The teeth are sharp-pointed at the end, and attain a maximum breadth of about 4 μ.

The *small micramphidiscs* (Plate **103**, figs. 27–29) are 16–38.7 μ long, most frequently about 19.2, 26.8, and 34.2 μ.[1] The shaft is straight or, rarely, somewhat curved, 1.2–1.9 μ thick, spiny, and sometimes slightly thickened in or near the centre to a small tyle. The spines are generally very minute; exceptionally one or two of the central ones attain a length of 1 μ. The terminal anchors are similar to those of the large micramphidiscs, but narrower. They are 4.5–10 μ long, usually a little less than a third of the whole spicule, and 5.3–14 μ broad. The proportion of the length to the breadth of the anchors is 100 to 96–157, on an average 100 : 128.1.

The nearest allies of the above sponge are *Hyalonema* (*Skianema*) *aequatoriale* and *H.* (*Thallonema*) *geminatum* described in this Report. From *H.* (*S.*) *aequatoriale* it differs chiefly by the absence of spheres and the smaller average size of the microhexactines and large micramphidiscs; from *H.* (*T.*) *geminatum* by the absence of geminate macramphidiscs and differences in the shape of the small macramphidiscs, the micramphidiscs, and the pinules.

[1] I give these three numbers because the length frequency-curve pertaining to these spicules has three nearly equally important elevations.

THALLONEMA, subgen. nov.

Species of Hyalonema of which the amphidiscs of one kind (the largest) have anchors which appear as if they were double, because some or most of their teeth bear from one to three simple branches.

The collection contains one fragment of this subgenus. This belongs to a new species.

Hyalonema (Thallonema) geminatum, sp. nov.

Plate 103, figs. 37–62; Plate 104, figs. 1–14; Plate 105, figs. 1–14.

There is in the collection one small fragment of this species. It was trawled in the Central Tropical Pacific at Station 4740 on 11 February, 1905; 9° 2.1′ S., 123° 20.1′ W.; depth 4429 m. (2422 f.); it grew on a bottom of dark gray Globigerina ooze; the bottom-temperature was 34.2°.

Many of the anchor-teeth of the largest amphidiscs are provided with from one to three branches, which makes the anchors of these spicules appear doubled. To this the name refers.

Shape and size. The fragment is an oval lamella, 50 mm. long, 34 mm. broad, and has a maximum thickness of 3 mm.

The *colour* in spirit is light dirty brown.

The *skeleton.* A dense fur, composed of the distal rays of superficial pinules, covers the intact parts of both faces of the lamella. Much smaller, probably canalar pinules are found in the interior. Besides the lateral rays of the superficial pinules the lateral rays of pentactine megascleres and paratangentially extending amphioxes are found in the superficial membrane. Amphioxes similar to the superficial ones, hexactine megascleres, and microhexactines occur in large numbers in the choanosome. The sponge possesses four kinds of amphidiscs: — large geminate macramphidiscs, ordinary large macramphidiscs, small macramphidiscs, and micramphidiscs. All these kinds of amphidiscs are abundant.

Superficial *pinules* are, as above stated, found on both sides of the lamella. Those on the one side are very similar to those on the other. The only difference between them which I could detect is that the basal thickness of the distal ray appears to be in those of the one face (the dermal ?) on the whole slightly greater than in those on the other (the gastral ?).

The dermal and gastral *superficial pinules* (Plate **103**, figs. 58–62) are pentactine. The distal ray is straight and 178–270 μ long, most frequently about 250 μ. It usually ends in a rather stout and sharp-pointed terminal cone (Plate **103**, figs. 59–62). Exceptionally the tip is rounded (Plate **103**, fig. 58). The basal thickness of the ray is 7–11 μ. Apart from small parts of it at the basal and distal ends, the ray is quite densely spined. The spines are for the most part nearly straight. Those arising from the middle-part of the ray are of considerable size, up to 30 μ and more long. The maximum thickness of the distal ray, together with the spines, is 32–46 μ. The lateral rays are conical, blunt-pointed, spined, and 28–43 μ long.

The small, probably *canalar pinules* are pentactine. The distal ray is straight, usually 90–110 μ long, and 4–6 μ thick at the base. Its base and its sharp-pointed distal end-part are smooth; its middle-part bears very large, strongly divergent, sparse spines, which are curved, concave towards the tip of the ray. The largest spines are found in the proximal part of the spine-bearing region. The lateral rays are conical and 32–60 μ long, generally 40–50 μ.

The hypodermal and hypogastral *pentactines* have smooth, straight, and very blunt, conical rays. The proximal ray is 0.2–1 mm. long, and 7–22 μ thick at the base. The lateral rays are 160–450 μ long.

The *hexactine megascleres* are generally 0.8–1.8 mm. in diameter and have smooth, blunt, conical rays 15–45 μ thick at the base.

The superficial and choanosomal *amphioxes* are usually fairly straight, rarely markedly curved, and 0.4–2.6 mm. long. The shorter ones, that is those under 1 mm. in length, are distinctly centrotyle with a tyle 1–4 μ more than the adjacent parts of the spicule in transverse diameter. The medium ones, that is those 1–1.5 mm. in length, have only a very insignificant tyle, not more than 1.5 μ thicker than the adjacent parts of the spicule. In the large ones, that is those over 1.5 mm. in length, there is hardly a trace of a central tyle.

The *microhexactines* (Plate **103**, figs. 39–48) are 37–120, usually 53–100 μ in diameter (maximum diameter). Most of them have equal rays; in some two opposite rays are longer than the other four. The rays are 1.8–2.2 μ thick at the base, conical, and finely pointed. The proximal part, about the half of the ray, is straight, the distal part curved. This curvature is either uniform, or, more frequently, at the point where the proximal straight part passes into the distal curved part greater than elsewhere. The total curvature is such that the directions (tangents) of the proximal and distal end-parts of the ray usually enclose an angle of about 120°. The rays bear very numerous, exceedingly minute spines, which give them the appearance of being rough.

Among the *amphidiscs* two main kinds can be distinguished morphologically: — larger ones with relatively large anchors, and smaller ones with relatively medium-sized or small anchors. I consider the former as macramphidiscs, the latter as micramphidiscs.

Among the macramphidiscs three subgroups can be distinguished morphologically: — *a*, large ones with short and broad anchors, some to most of the teeth of which are branched; *b*, middle-sized ones with short and broad anchors, and simple teeth; and *c*, smaller ones with long and broad anchors and simple teeth. These three macramphidisc groups are connected by transitional forms both morphologically and biometrically. The morphological connections between *b* and *c* are macramphidiscs under middle size with anchors of medium length. The morphological connections between *a* and *b* are large macramphidiscs in which only one or two anchor-teeth are branched.

As the length frequency-curve pertaining to the macramphidiscs in Figure 26 shows, there is a conspicuous enough depression separating biometrically the bulk of *b* from *c*; on the other hand the depression between the bulk of *a* and the bulk of *b* is very insignificant. Although the three subgroups of macramphidiscs are thus rather closely connected both morphologically and biometrically, I think the difference between them sufficient for a separate description.

The micramphidiscs are very various in size, their length ranging from 16–92 μ. They are, however, morphologically all very much alike. The length frequency-curve pertaining to them is, as the figure shows, exceedingly irregular and has no less than six low elevations in its left part (which pertains to the smaller forms) and one high elevation in its right end-part (which pertains to the largest forms). According to this one might divide these amphidiscs into two subgroups: — large micramphidiscs for those to which the simple high elevation in the right-hand end-part of the curve pertains, and small micramphidiscs for those to which the irregular left-hand and central parts of the curve pertain. Since, however, there is but very little morphological difference between the former and the latter, I refrain from doing so.

I accordingly distinguish four kinds of amphidiscs in this species: — 1, geminate, 2, large, and 3, small macramphidiscs; and 4, micramphidiscs.

The *geminate macramphidiscs* (Plate **104**, figs. 1–5, 8, 11, 12; Plate **105**, figs. 1–14) are 210–360 μ long, most frequently about 278 μ. The shaft is 21–31 μ thick, straight or slightly curved, and usually quite smooth and simply cylindrical. Sometimes a large, terminally rounded spine or branch, 20–30 μ long, arises from the middle-part of the shaft (Plate **105**, fig. 3). When such a spine is present

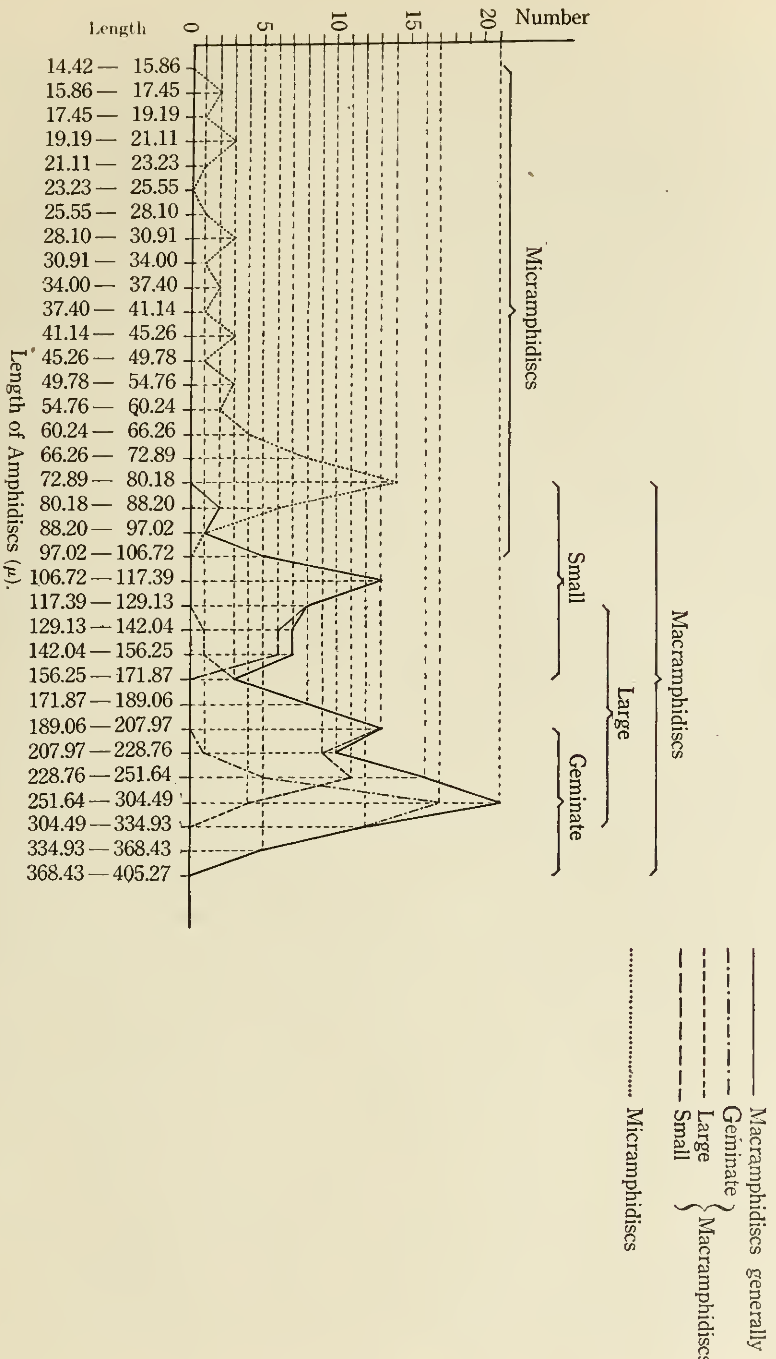

Fig. 26.— Amphidiscs.

the shaft is particularly strongly bent, convex towards the spine. The terminal anchors are 72–100 μ long, a fourth to a third of the whole spicule, and 175–200 μ broad. The proportion of the length to the breadth of the anchors is 100 to 182–257, on an average 100 : 223. The anchor is composed of from ten to fifteen teeth. The individual teeth are usually more strongly curved in their distal than in their proximal part. The extreme tips of the teeth are, if not widened to terminal discs (*vide infra*), generally abruptly bent inward and convergent. A larger or a smaller number, most frequently about half, rarely all, of these teeth bear from one to three branches. Generally one anchor of the spicule is richer in branched teeth than the other. The branched teeth consist of a stem similar to an ordinary unbranched anchor-tooth, from the outer convex side of which from one to three branches arise. These branches are curved conformly with the stem from which they arise, concave towards the shaft, and usually end in oval flattened extensions, which appear as terminal discs. The end of the stem or main tooth, from which these branch-teeth arise, often also terminates with such an extension. The outer faces of the simple teeth and of the end-parts or terminal discs of the stem and the branches of the branched ones lie in a continuous surface ovoid in shape, which I take to be the inner face of the limit or wall of the living unit — in my opinion a single cell — within and by which the amphidisc is formed. As stated above, transitional forms with only one or two branched anchor-teeth (Plate **105**, fig. 14) connect these geminate with the ordinary large macramphidiscs described below.

The ordinary *large macramphidiscs* (Plate **104**, figs. 6, 7) are 133–271 μ long, most frequently about 198.5 and 204.2 μ. The shaft is 15–26 μ thick, generally straight, cylindrical, and smooth, sometimes slightly bent, and occasionally provided with one stout blunt spine about 20 μ long. When such a spine is present the shaft is always bent as in the geminate macramphidiscs. The terminal anchors are 48–105 μ long, a third to two fifths of the whole spicule, and 115–203 μ broad. The proportion of the length to the breadth of the anchors is 100 to 169–274, on an average 100 : 225.5. The anchor is composed of from eight to eleven teeth. The number of teeth in the two anchors of the same spicule is not always the same. The teeth of the opposite anchors often, but by no means always, alternate. The individual teeth arise nearly vertically from the ends of the shaft, are straight or only slightly curved in their basal part, but strongly curved in their distal part. The outer band-shaped portion of the tooth attains, in the larger forms, a maximum breadth of 25–29 μ. Its distal end is rounded and abruptly bent inward so that the tips of the teeth become strongly convergent, the distance between opposite teeth being 6–20 μ, rarely as much as 32 μ, less than the (maximum) breadth of the anchor.

The *small macramphidiscs* (Plate 104, figs. 9, 10, 13, 14) are 88–153 μ long, most frequently about 112 μ. A good many of the largest, that is of those 136–153 μ long, have anchors of only medium length and are consequently transitional to the large macramphidiscs above described. The shaft is straight, cylindrical, and 6–12 μ thick. The terminal anchors are 50–72 μ long, a third to half of the whole spicule, and 70–130 μ broad. The proportion of the length to the breadth of the anchors is 100 to 146–183, on an average 100 : 161.8. The anchors are composed of from ten to sixteen teeth. Roughly speaking, the number of teeth is in inverse proportion to the size of the spicule. The teeth of the two anchors of the same spicule are often, but by no means always, situated alternately. The individual teeth are generally quite uniformly curved through a quarter of a circle and abruptly bent inward at the end, so that their tips are strongly convergent. The outer band-shaped part of the tooth attains its maximum breadth in its distal portion, and is here 12–18 μ broad. The end is broad, rounded off, sometimes nearly truncate.

The *micramphidiscs* (Plate 103, figs. 37, 38, 49–57) are 16–92 μ long, the larger ones, to which the conspicuous elevation near the right-hand end of the curve pertains, most frequently about 76.5 μ long. The shaft is straight or only very slightly curved, and 0.7–5 μ thick. It is simply cylindrical or slightly thickened at or near the middle to a central tyle, 0.3–0.6 μ, rarely as much as 1.5 μ, more than the adjacent parts of the shaft in transverse diameter. Centrotyle forms are more frequent among the larger than among the smaller micramphidiscs. A larger or smaller number of small spines are scattered over the whole of the shaft. In the centrotyle forms the spines arising from the central tyle are usually larger than the others. The terminal anchors are 3.5–24 μ long, that is one fifth to two fifths of the whole spicule, and 5.5–30 μ broad. The proportion of the length to the breadth of the anchors is 100 to 100–200, on an average 100 : 150.5. The anchors of the larger forms are on the whole relatively broader than those of the smaller. The anchor is composed of a considerable number of teeth; in one 24 μ broad I counted eighteen. The individual teeth are, in the larger micramphidiscs, up to 5 μ broad, and pointed at the end.

Besides the regular micramphidiscs above described I observed a few *irregular micramphidiscs* with terminal anchors on one side much longer than on the other. In these anchors the tips of the anchor-teeth lie in an oblique plane enclosing an angle of about 45° with the axis of the shaft. The longest part of one anchor lies on the same side of the shaft as the shortest side of the other. The dimensions of a typical amphidisc of this kind are: — total length 22 μ; thickness of shaft 1.5 μ; length of the longest and shortest parts (sides) of the anchors respectively 7.5 μ and 4 μ; breadth of anchors 9 μ.

The nearest allies of the above sponge are *Hyalonema* (*Skianema*) *aequatoriale* and *H.* (*S.*) *umbraculum* described in this Report. From both it is distinguished by the possession of large geminate macramphidiscs and small, long-spined canalar pinules, and by other differences in the spiculation.

IV. LIST OF STATIONS.

Station	Date	Position Lat.	Position Long.	Temperature Surface	Temperature Bottom	Depth (fathoms)	Bottom
		° ′	° ′				
3363	26 Feb., 1891	N. 5 43	W. 85 50	83	37.5	978	White Globigerina ooze.
3376	4 March, 1891	N. 3 9	W. 82 8	78	36.3	1132	Gray Globigerina ooze.
3681 (A.A. 2)	27 Aug., 1899	N. 28 23	W. 126 57	66	34.6	2368	Red clay, light brown volcanic ooze.
3684 (A.A. 17)	10 Sept., 1899	N. 0 50	W. 137 54	79	—	2463	Light yellow-gray Globigerina ooze.
3685 (A.A. 25)	14 Sept., 1899	S. 8 48	W. 139 48	80	38	830	Globigerina and volcanic mud and fragments.
3689 (A.A 134)	28 Oct., 1899	S. 18 06	W. 142 24	79	37.6	807	Fine coral-sand and manganese nodules.
4621	21 Oct., 1904	N. 6 36	W. 81 44	79	40.5	581	Green mud and rock.
4622	21 Oct., 1904	N. 6 31	W. 81 44	81	—	581	Green sand and rock.
4630	3 Nov., 1904	N. 6 53	W. 81 42.5	81	40.5	556	Green sand, large Globigerina.
4631	3 Nov., 1904	N. 6 26	W. 81 49	82	38.0	774	Green sand.
4641	7 Nov., 1904	S. 1 34.4	W. 89 30.2	74	39.5	633	Light gray Globigerina ooze.
4642	7 Nov., 1904	S. 1 30.5	W. 89 35	74	48.6	300	Broken shells and Globigerina.
4649	10 Nov., 1904	S. 5 17	W. 85 19.5	70	35.4	2235	Sticky gray mud. Very few Globigerina.
4651	11 Nov., 1904	S. 5 41.7	W. 82 59.7	66	35.4	2222	Sticky fine gray sand.
4656	13 Nov., 1904	S. 6 54.6	W. 83 34.3	69	35.2	2222	Fine green mud mixed with gray ooze, mineral particles. Sponge spicules, many diatoms.
4662	16 Nov., 1904	S. 11 13.8	W. 89 35	69	35.2	2439	Brown Radiolaria ooze, manganese nodules.
4672	21 Nov., 1904	S. 13 11.6	W. 78 18.3	65	35.2	2845	Fine green clay; infusorial earth full of diatoms.
4685	10 Dec., 1904	S. 21 36.2	W. 94 56	72	35.3	2205	Dark brown clay.
4695	23 Dec., 1904	S. 25 22.4	W. 107 45	74	—	2020	Fine light brown ooze.
4701	26 Dec., 1904	S. 19 11.5	W. 102 24	72	35.3	2265	Dark brown chocolate clay.
4709	30 Dec., 1904	S. 10 15.2	W. 95 40.8	72	35.3	2035	Light gray Globigerina ooze.
4711	31 Dec., 1904	S. 7 47.5	W. 94 5.5	75	35.3	2240	do.
4721	15 Jan., 1905	S. 8 7.5	W. 104 10.5	75	—	2084	Light brown Globigerina ooze.
4732	21 Jan., 1905	S. 16 32.5	W. 119 59	79	34.8	2012	Light gray Globigerina ooze.
4736	23 Jan., 1905	S. 19 0.4	W. 125 5.4	81	34.8	2289	Dark brown chocolate mud.
4740	11 Feb., 1905	S. 9 2.1	W. 123 20.1	81	34.2	2422	Dark gray Globigerina ooze.
4742	15 Feb., 1905	N. 0 3.4	W. 117 15.8	77	34.3	2320	Very light fine Globigerina ooze.

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REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUT. COMMANDER L. M. GARRETT, U. S. N., COMMANDING, AND OF OTHER EXPEDITIONS OF THE "ALBATROSS," 1891–1899.

XXIX.

THE SPONGES.

3. HEXACTINELLIDA.

By ROBERT VON LENDENFELD.

WITH ONE HUNDRED AND NINE PLATES.

PLATES.

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June, 1915.

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PLATE 1.

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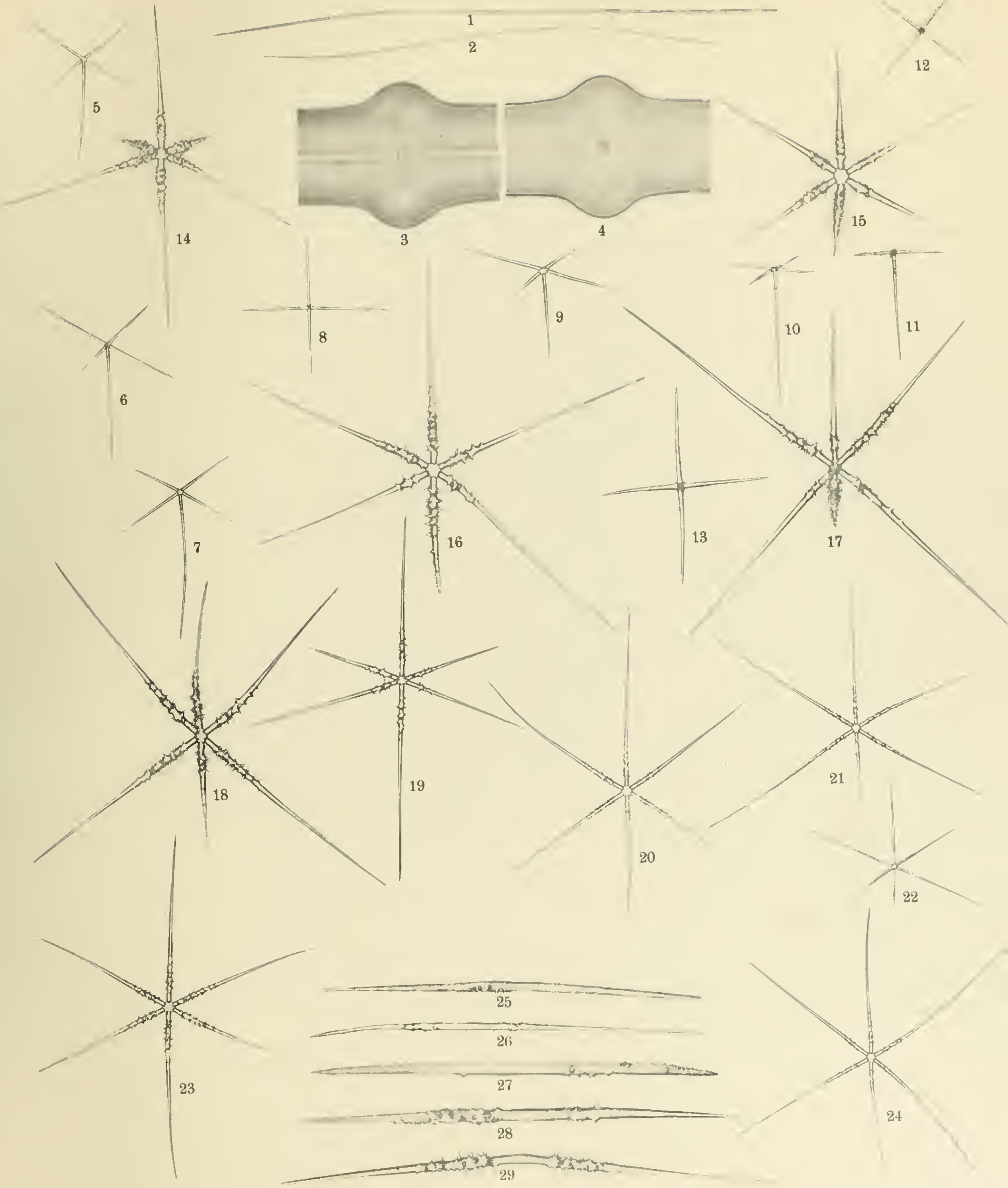

Fig. 1-29 Calycosilva cantharellus n. sp.
1-8, 20-24 C. c. var. helix; 9-19, 26, 29 C. c. var. simplex (A); 25, 27, 28 C. c. var. simplex (B).

Lendenfeld photographed

PLATE 2.

PLATE 2.

Calycosilva cantharellus Lendenfeld.

Figs. 1–2, 4–6, 14, 16 — var. (A) **simplex** Lendenfeld.
Figs. 3, 7–13, 15 — var. **helix** Lendenfeld.

1.— Part of an axial, longitudinal section through the upper end of the stalk and the adjacent (central) part of the body of var. *simplex* (A); magnified 20; phot. Zeiss, planar 20 mm.:
a, dermal pinule-fur; b, dense subdermal masses of longitudinal rhabds.

2.— Part of the surface of a shortened and very strongly spined hexactine ray of var. *simplex* (A); magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

3.— Part of a radial section through the choanosome of var. *helix;* magnified 120; phot. Zeiss, apochr. 8, compens. oc. 6:
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5.— Central part of a large spined rhabd from the junction of the stalk to the body of var. *simplex* (A); magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

6.— Central part of a large hexactine of var. *simplex* (A); magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

7.— Part of a radial section through the choanosome of var. *helix;* haematoxylin; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
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8.— Part of the surface of the stalk of var. *helix;* magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, dermal (peduncular) pinules; b, hypodermal (peduncular) oxypentactines.

9.— Central part of a large hexactine with one ray reduced in length, of var. *helix;* magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

10.— Apical view of a hypogastral oxypentactine of var. *helix;* magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

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16.— Portion of the central part of a large hexactine of var. *simplex* (A); magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

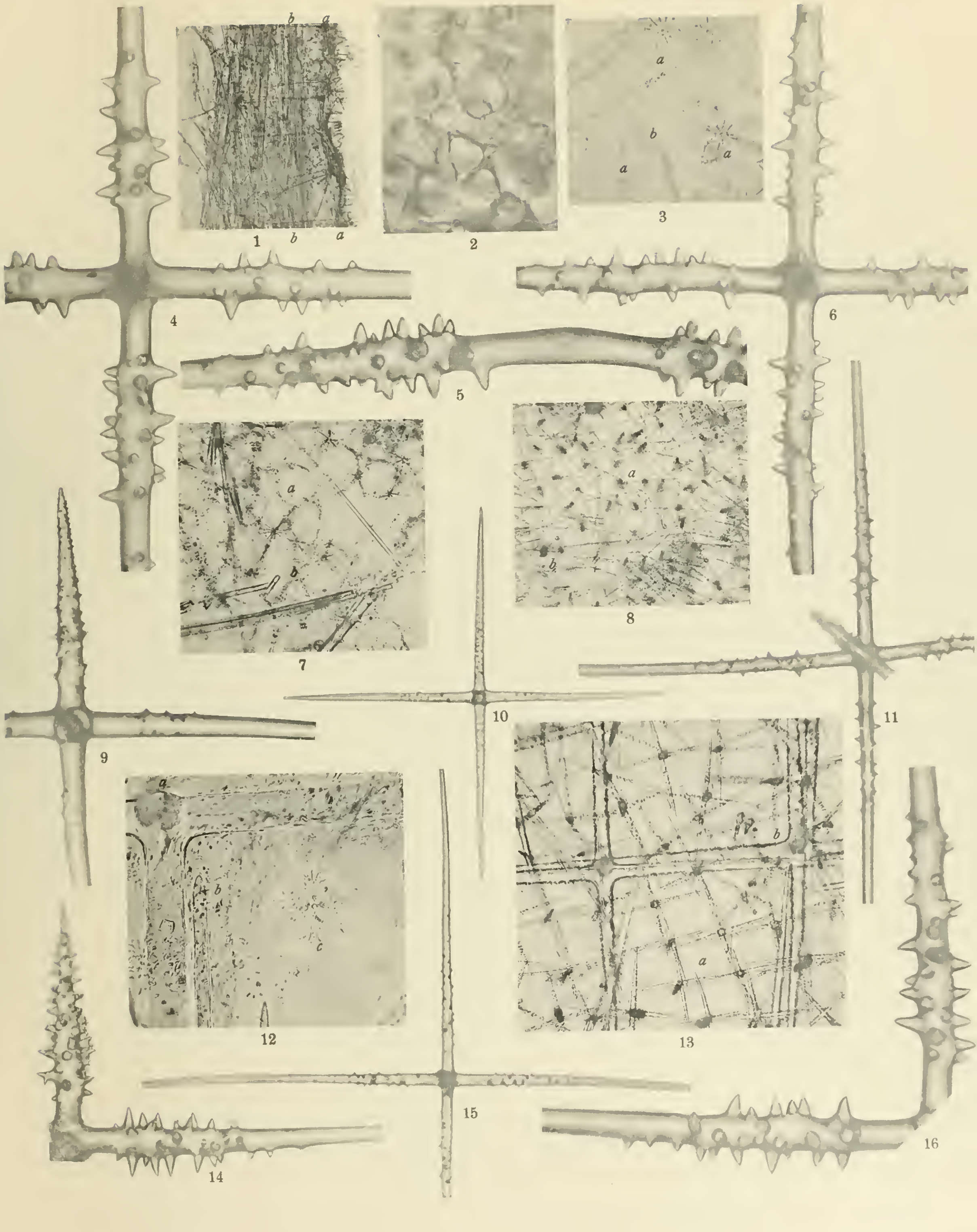

Fig. 1-16 Calycosilva cantharellus n. sp.
1, 2, 4-6, 14, 16 C. c. var. simplex (A); 3, 7-13, 15 C. c. var. helix.

Lendenfeld photographed

PLATE 3.

PLATE 3.

Calycosilva cantharellus LENDENFELD.

Figs. 1–5, 8–30 — var. **helix** Lendenfeld.
Figs. 6, 7 — var. (A) **simplex** Lendenfeld.

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2, 3.— Irregular elongated onychhexaster of var. *helix;* magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
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4, 5.— Onychhexaster-derivate oxyhexaster of var. *helix;* magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
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6, 7.— Irregular onychhexaster of var. *simplex* (A); magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
6, focussed higher; 7, focussed lower.

8–20.— Helonychhexaster of var. *helix;* magnified 600; phot. Zeiss, H. I. 1/12, compens. oc. 6:
8, 9, side-view of a helonychhexaster with the lateral end-rays uniformly and strongly curved throughout:
8, focussed higher; 9, focussed lower;
10, 11, side-view of a helonychhexaster with the larger proximal parts of the lateral end-rays strongly curved in one direction and their smaller distal parts slightly curved in the opposite direction;
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14, apical view of a helonychhexaster with the proximal parts of the lateral end-rays curved for a greater or smaller extent and the distal parts fairly straight;
15, 16, apical view of a helonychhexaster with the larger proximal parts of the lateral end-rays strongly curved in one, and their smaller distal parts slightly curved in the opposite direction;
15, focussed higher; 16, focussed lower;
17, apical view of a helonychhexaster with the larger proximal parts of the lateral end-rays strongly curved in one, and their smaller distal parts slightly curved in the opposite direction;
18, apical view of a helonychhexaster with the proximal parts of the lateral end-rays strongly curved, the distal parts fairly straight;
19, apical view of a helonychhexaster with the larger proximal parts of the lateral end-rays strongly curved in one direction and their smaller distal parts slightly curved in the opposite direction;
20, oblique view of a helonychhexaster with the proximal parts of the lateral end-rays strongly curved in one direction, their distal parts slightly curved in the opposite direction.

21–27.— Onychhexasters of var. *helix;* magnified 600:
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21, 22, small onychhexasters with a small number of stout end-rays;
23, small onychhexasters with a larger number of end-rays;
24, 25, larger onychhexasters with a larger number of end-rays;
24, focussed higher; 25, focussed lower;
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28–30.— The distal parts of three end-rays of onychhexasters of var. *helix;* magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
28, 29, with three or four terminal lateral spines;
30, with one terminal lateral spine.

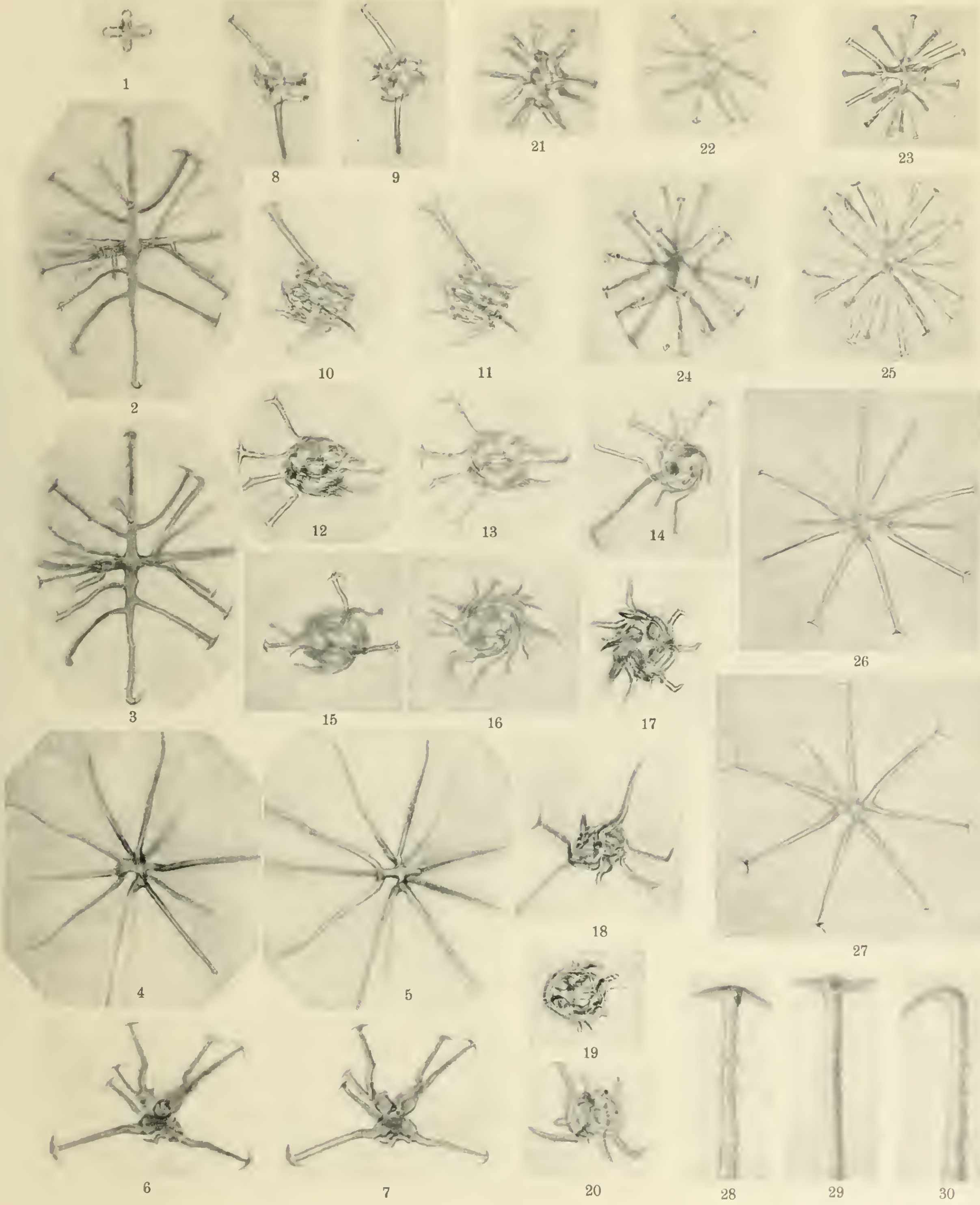


Fig. 1-30 Calycosilva cantharellus n. sp.
1-5, 8-30 C. c. var. helix; 6, 7 C. c. var. simplex (A).

Lendenfeld photographed

PLATE 4.

PLATE 4.

Calycosilva cantharellus Lendenfeld.

Figs. 1–20 — var. **megonychia** Lendenfeld.
Figs. 21, 22 — var. (A) **simplex** Lendenfeld.
Figs. 23, 24 — var. **helix** Lendenfeld.

1.— Onychhexaster-derivate oxyhexaster of var. *megonychia;* magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

2.— Onychhexaster of var. *megonychia;* magnified 600; u. v. phot. Zeiss, q. monochr. 6, q. oc. 10.

3, 4.— Onychhexasters of var. *megonychia;* magnified 600; u. v. phot. Zeiss, q. monochr. 6; q. oc. 10:
3, focussed lower; 4, focussed higher.

5, 6.— Group of onychhexasters of var. *megonychia;* magnified 300; u. v. phot. Zeiss, q. monochr. 6, q. oc. 5:
5, focussed lower; 6, focussed higher.

7.— Group of onychhexasters of var. *megonychia;* magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

8–12.— Ends of end-rays of onychhexasters of var. *megonychia;* magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
8, one with all the spines directed obliquely outward;
9, 10, one with nearly straight spines, two of which are nearly vertical and one directed obliquely outward;
9, focussed lower; 10, focussed higher.
11, 12, a similar one, one of the spines of which is curved in an S-shaped manner;
11, focussed lower; 12, focussed higher.

13–19.— End-rays of onychhexasters and onychhexaster-derivate oxyhexasters of var. *megonychia;* magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
13–15, with two or three terminal spines;
16–18, with one clearly distinguished terminal spine;
19, with one terminal spine which appears as the tip of a simple oxyhexastrose end-ray.

20.— The largest of the fragments of var. *megonychia;* magnified 1.85; phot. Zeiss, anastig. 480/412 mm.

21–24.— Parts of radial sections vertical to the surface, showing the pinule-fur; magnified 75; phot. Zeiss, apochr. 16, compens. oc. 6:
21, the gastral pinule-fur of var. *simplex* (A);
22, the dermal pinule-fur of var. *simplex* (A);
23, the gastral pinule-fur of var. *helix;*
24, the dermal pinule-fur of var. *helix.*

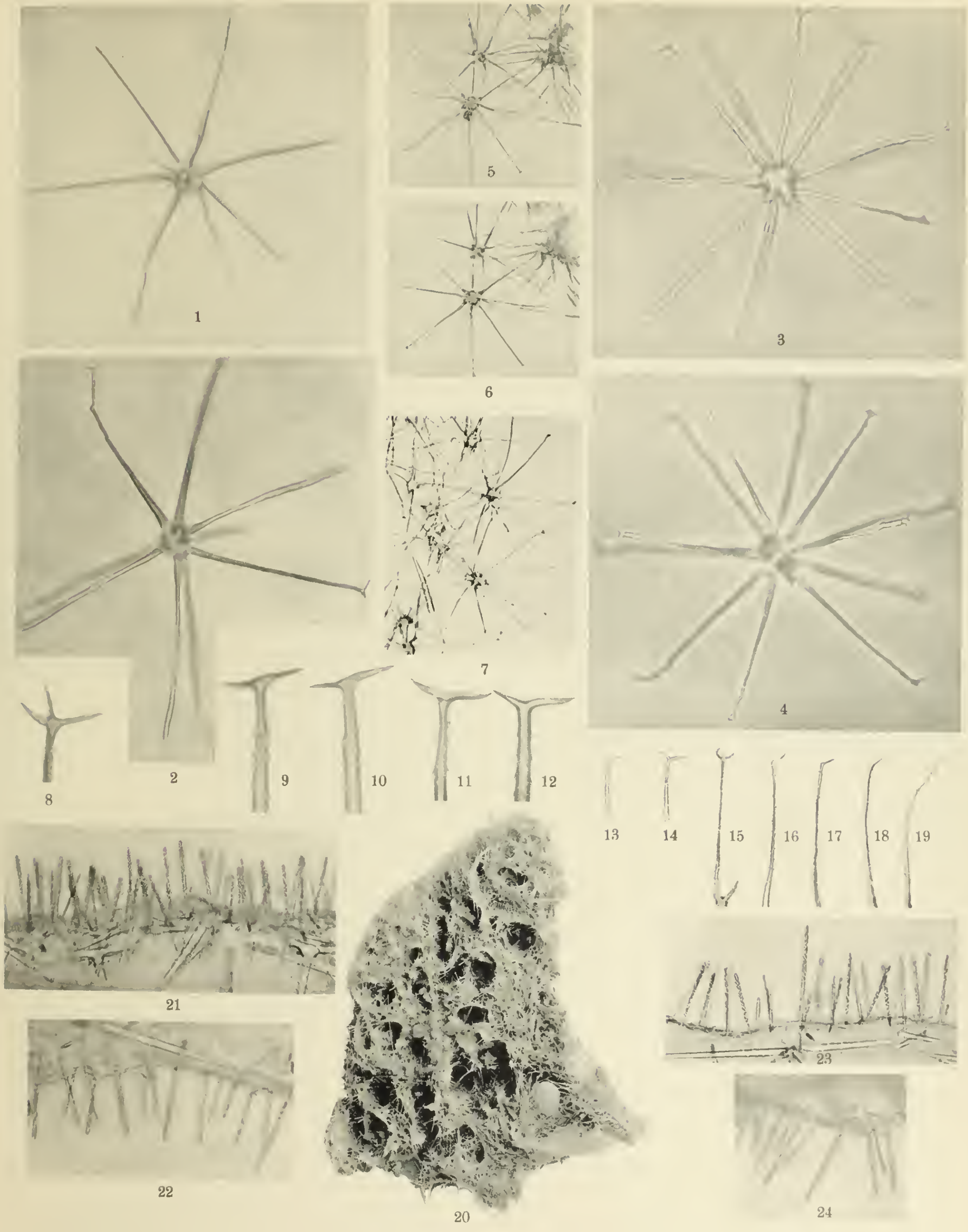


Fig. 1-24 Calycosilva cantharellus n. sp.
1-20 C. c. var. megonychia; 21, 22 C. c. var. simplex (A); 23, 24 C. c. var. helix.

Lendenfeld photographed

PLATE 5.

PLATE 5.

Calycosilva cantharellus Lendenfeld.

Figs. 1, 2, 4, 5, 7–9, 11–15, 18–20 — var. **helix** Lendenfeld.
Figs. 3, 6, 10 — var. (B) **simplex** Lendenfeld.
Figs. 16, 17 — var. (A) **simplex** Lendenfeld.
Fig. 21 — var. **megonychia** Lendenfeld.

1.— Radial section through a part of the body near the margin, of var. *helix;* magnified 20; phot. Zeiss, planar 20 mm.:
 a, gastral pinule-fur; b, hypogastral oxypentactines; c, subgastral rhabd-bundles; d, choanosomal rhabds and oxyhexactines; e, subdermal rhabd-bundles; f, hypodermal oxypentactines; g, dermal pinule-fur.

2.— The end of a rhabd of var. *helix;* magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

3.— The skeleton of the basal end of var. *simplex* (B); magnified 6; phot. Zeiss, planar 50 mm.:
 a, fragment of a spicule, probably a root-spicule, of Hyalonema sp., to which the Calycosilva is attached; b, the basal part of the skeleton of the Calycosilva.

4.— Radial section through part of the body of var. *helix;* magenta; magnified 20; phot. Zeiss, planar 20 mm.:
 a, gastral pinule-fur; b, hypogastral oxypentactines; c, subgastral rhabd-bundles; d, choanosomal rhabds and oxyhexactines; e, subdermal rhabd-bundles; f, hypodermal oxypentactines; g, dermal pinule-fur.

5–7.— Parts of the basal skeleton-net; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
 5, 7, from the stalk of var. *helix;*
 6, from the lattice-work which surrounds the spicule-fragment forming the base of attachment of var. *simplex* (B).

8, 9.— The central part of two rhabds of var. *helix;* magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
 8, of a simple rhabd;
 9, of a centrotyle rhabd.

10.— The sectioned face of var. *simplex* (B), longitudinally cut in two; magnified 1.7; phot. Zeiss, anastig. 480/412 mm.:
 a, fragment of a spicule, probably a root-spicule, of a Hyalonema sp., to which the Calycosilva is attached; b, the Calycosilva.

11.— Radial section through the margin of the body of var. *helix;* magnified 20; phot. Zeiss, planar 20 mm.:
 a, gastral pinule-fur; g, dermal pinule-fur; h, margin.

12–15.— Ends of rhabds of var. *helix;* magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
 12, 13, the two ends of a nearly isoactine amphistrongyle rhabd;
 14, 15, the two ends of a tylostyle rhabd.

16.— Axial, longitudinal section through the upper end of the stalk and the adjacent (central) part of the body of var. *simplex* (A); magnified 6; phot. Zeiss, planar 50 mm.:
 a, gastral pinule-fur; b, choanosome; c, stalk; g, dermal pinule-fur.

17.— Onychhexaster of var. *simplex* (A); magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

18, 19.— Onychhexasters of var. *helix;* magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

20.— The central part of a diactine the two actines of which enclose nearly a right angle, of var. *helix;* magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

21.— The central part of a triactine of var. *megonychia;* magnified 200; phot. Zeiss. apochr. 8, compens. oc. 6.

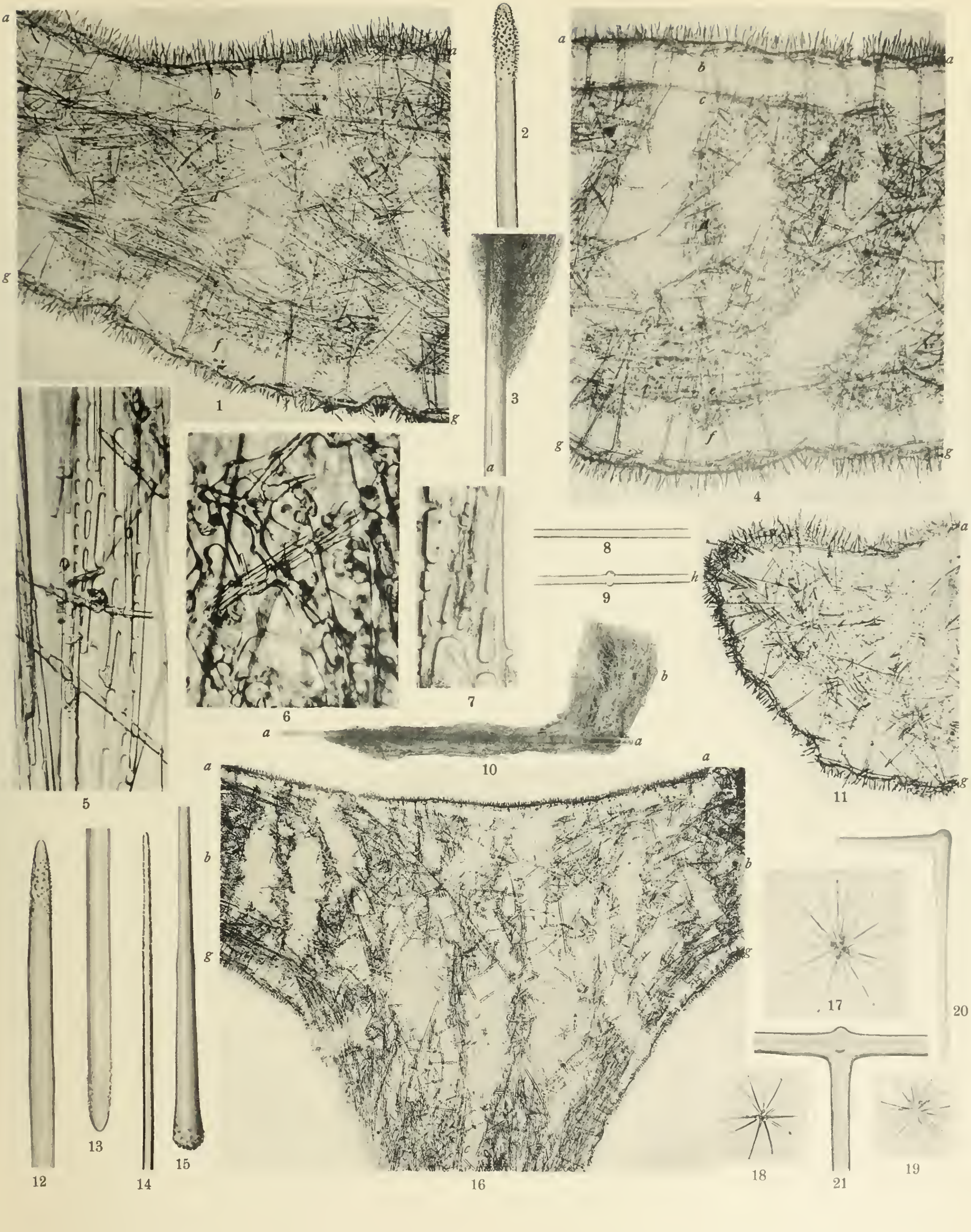


Fig. 1-21 Calycosilva cantharellus n. sp.
1, 2, 4, 5, 7-9, 11-15, 18-20 C. c. var. helix; 3, 6, 10 C. c. var. simplex (B); 16, 17 C. c. var. simplex (A); 21 C. c. var. megonychia.

Lendenfeld photographed

PLATE 6.

PLATE 6.

Calycosilva cantharellus Lendenfeld.

Figs. 1–4, 22, 23 — var. (A) **simplex** Lendenfeld.
Figs. 5–21, 24–34 — var. **helix** Lendenfeld.

1–12.— Hypodermal pentactines; magnified 30; phot. Zeiss, planar 20 mm.:
1–4, oblique and side-views of hypodermal oxypentactines of the body of var. *simplex* (A);
5, 7, 8, oblique views of hypodermal oxypentactines of the body of var. *helix;*
6, apical view of a hypodermal oxypentactine of the body of var. *helix;*
9, 10, 12, oblique views of hypodermal pentactines of the lower part of the stalk of var. *helix;*
11, apical view of a hypodermal oxypentactine of the lower part of the stalk of var. *helix.*

13.— Group of spicules from the lower part of the stalk of var. *helix;* magnified 30; phot. Zeiss, planar 20 mm.:
a, hypodermal pentactines; b, part of the skeleton-net of the stalk.

14, 15.— The outer end of a distal pinule-ray of var. *helix;* magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
14, focussed higher; 15, focussed lower.

16, 17.— The outer end of a distal pinule-ray of var. *helix;* magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
16, focussed higher; 17, focussed lower.

18.— Side-view of var. *helix;* magnified 1.1; phot. Zeiss, anastig. 480/412 mm.

19–25.— Dermal pinules of the body; magnified 200; phot. Zeiss, apochr. 16, compens. oc. 6:
19–21, 24, 25, of var. *helix;*
22, 23, var. *simplex* (A);
19–22, 24, 25, side-views;
23, apical view.

26–34.— Dermal pinules of the lower part of the stalk of var. *helix;* magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
26, 28, 33, 34, side-views;
27, 29–32, apical views;
(30 and 31 are the same view of the same spicule, 30, focussed high, 31, focussed low).

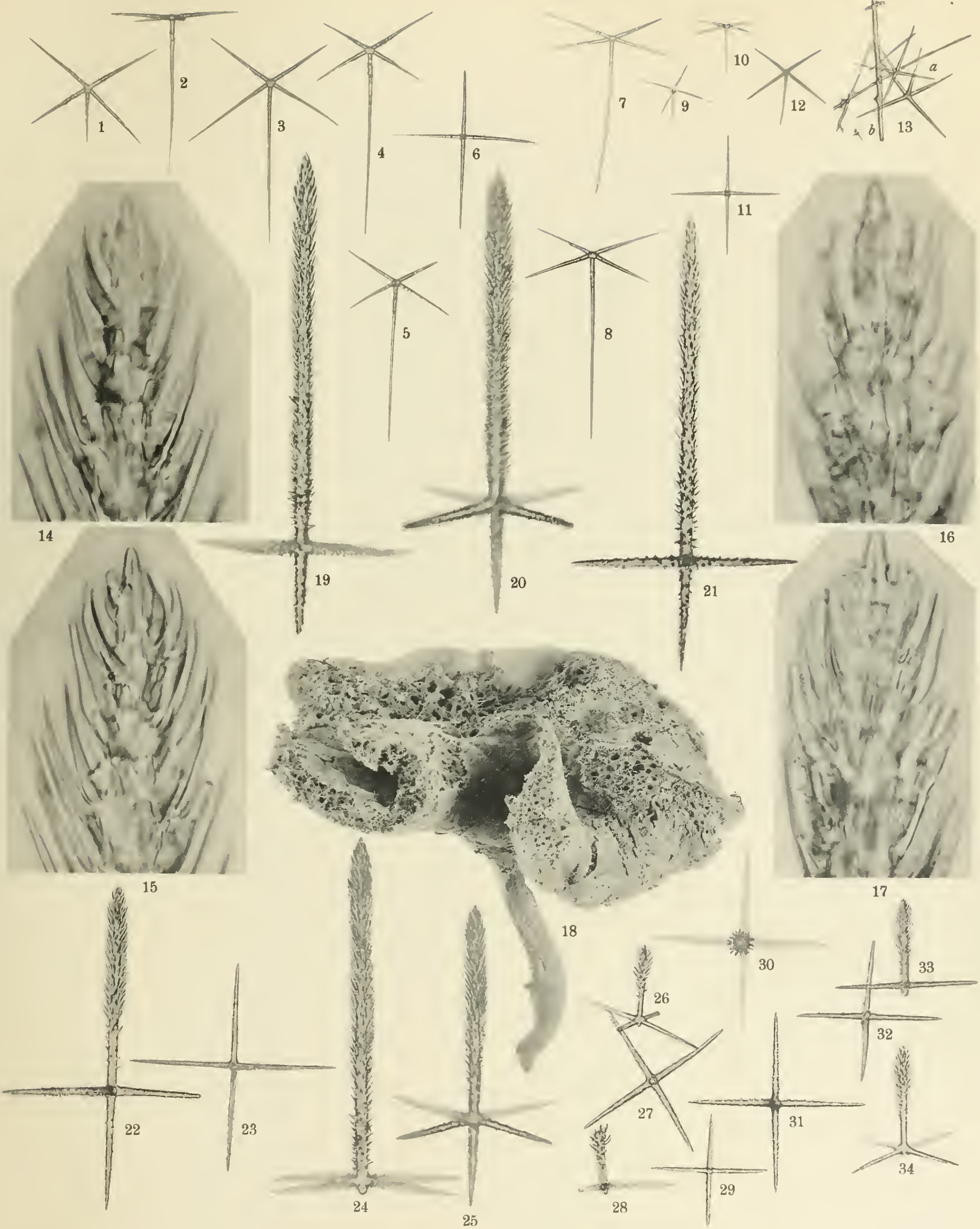


Fig. 1-34 Calycosilva cantharellus n. sp.
1-4, 22, 23 C. c. var. simplex (A); 5-21, 24-34 C. c. var. helix.

Lendenfeld photographed

PLATE 7.

PLATE 7.

Calycosilva cantharellus Lendenfeld.

Figs. 1–10, 12–14, 16, 17 — var. **helix** Lendenfeld.
Figs. 11, 15, 18 — var. (A) **simplex** Lendenfeld.
Fig. 19 — var. **megonychia** Lendenfeld.

1–3.— Plumicomes of *helix;* magnified 600:
1, u. v. phot. Zeiss, q. monochr. 6, q. oc. 10; 2, 3, phot. Zeiss, H. I. 1/12, compens. oc. 6.
4, 5.— Part of a plumicome of var. *helix;* magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
4, focussed higher; 5, focussed lower.
6–19.— Gastral pinules; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
6–10, 12–14, 16, 17, of var. *helix;*
11, 15, 18, of var. *simplex* (A);
19, of var. *megonychia;*
6–15, 19, side-views; 16–18, apical views.

Caulophacus schulzei Wilson.

Figs. 20–22, 24–28 — specimen E.
Figs. 23, 29 — specimen B.
Figs. 30, 31 — specimen D.

20–31.— Hexactines; magnified 30; phot. Zeiss, planar 20 mm.:
20, 22, 24, 25, 27, with rather smooth, pointed, unequal rays, of specimen E;
21, with one strongly reduced, pointed, and very spiny ray, of specimen E;
23, with rather smooth, pointed, nearly equal rays, of specimen B;
26, with rather smooth, pointed, nearly equal rays, of specimen E;
28, with one ray angularly bent, of specimen E;
29, with one ray reduced in length, terminally thickened, and smooth, of specimen B;
30, with smooth, pointed, unequal rays, of specimen D;
31, with rather smooth, pointed, nearly equal rays, of specimen D.

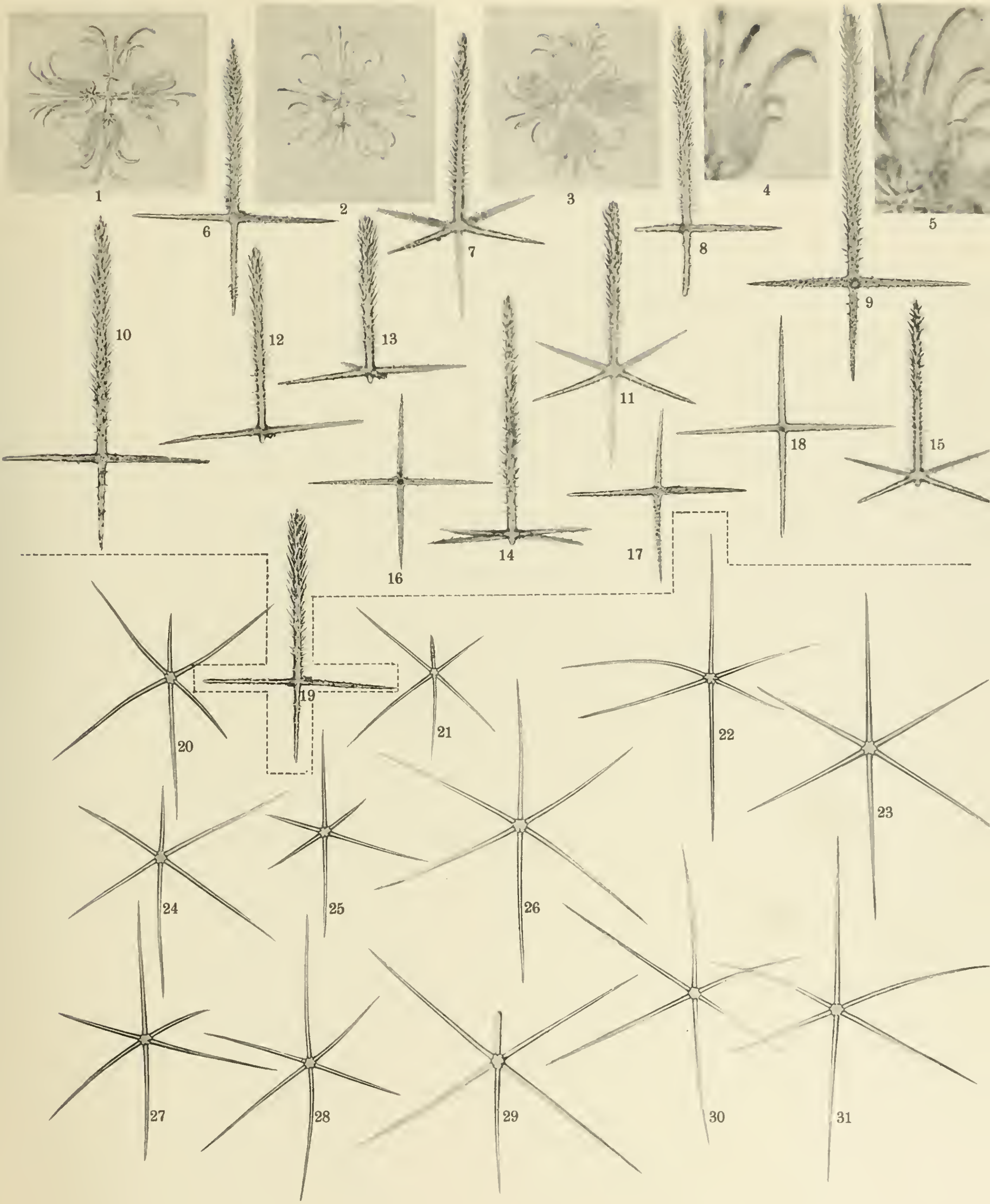


Fig. 1-19 Calycosilva cantharellus n. sp.
1-10, 12-14, 16, 17 C. c. var. helix; 11, 15, 18 C. c. var. simplex (A); 19 C. c. var. megonychia.
Fig. 20-31 Caulophacus schulzei Wilson.
20-22, 24-28 (E); 23, 29 (B); 30, 31 (D).

Lendenfeld photographed

PLATE 8.

PLATE 8.

Caulophacus schulzei Wilson.

Figs. 1, 5, 6, 8–12, 15, 21, 22, 27	— specimen E.
Figs. 2–4, 13, 16, 18–20, 24	— specimen B.
Figs. 7, 17, 23, 25, 26	— specimen D.
Figs. 14, 28, 29	— specimen C.

1–7.— Side-views of hypodermal and hypogastral pentactines; magnified 30; phot. Zeiss, planar 20 mm.:

1, 5, 6, of hypodermal or hypogastral pentactines of specimen E;

2–4, of hypogastral pentactines of specimen B; 7, of a hypogastral pentactine of specimen D.

8–12.— Group of spicules from a spicule-preparation of specimen E; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

8, 9, pinules;

10, a discohexactine;

11, a hemidiscohexaster;

12, a hypodermal or hypogastral pentactine with one lateral ray reduced in length and terminally thickened.

13–17.— Hypodermal and hypogastral pentactines and parts of such; magnified 100; phot. Zeiss apochr. 16, compens. oc. 6:

13, the lateral rays of a hypogastral pentactine of specimen B;

14, the lateral rays of a hypogastral pentactine of specimen C;

15, part of the lateral rays of a hypodermal or hypogastral pentactine of specimen E;

16, side-view of the central part of a hypogastral pentactine of specimen B;

17, side-view of a hypodermal pentactine of specimen D.

18–27.— Apical views of the lateral rays of pentactines; magnified 30; phot. Zeiss, planar 20 mm.:

18–20, of hypodermal pentactines of specimen B;

21, 22, 27, of hypodermal or hypogastral pentactines of specimen E;

23, of a large hexactine-derivate pentactine of specimen D;

24, of a large hexactine-derivate pentactine of specimen B;

25, 26, of hypogastral pentactines of specimen D.

28, 29.— Radial section through the marginal part of the body of specimen C; magnified 10; phot. Zeiss, planar 50 mm.:

28, stained with magenta;

29, stained with azur;

a, gastral face; b, margin of sponge-body; c, dermal face.

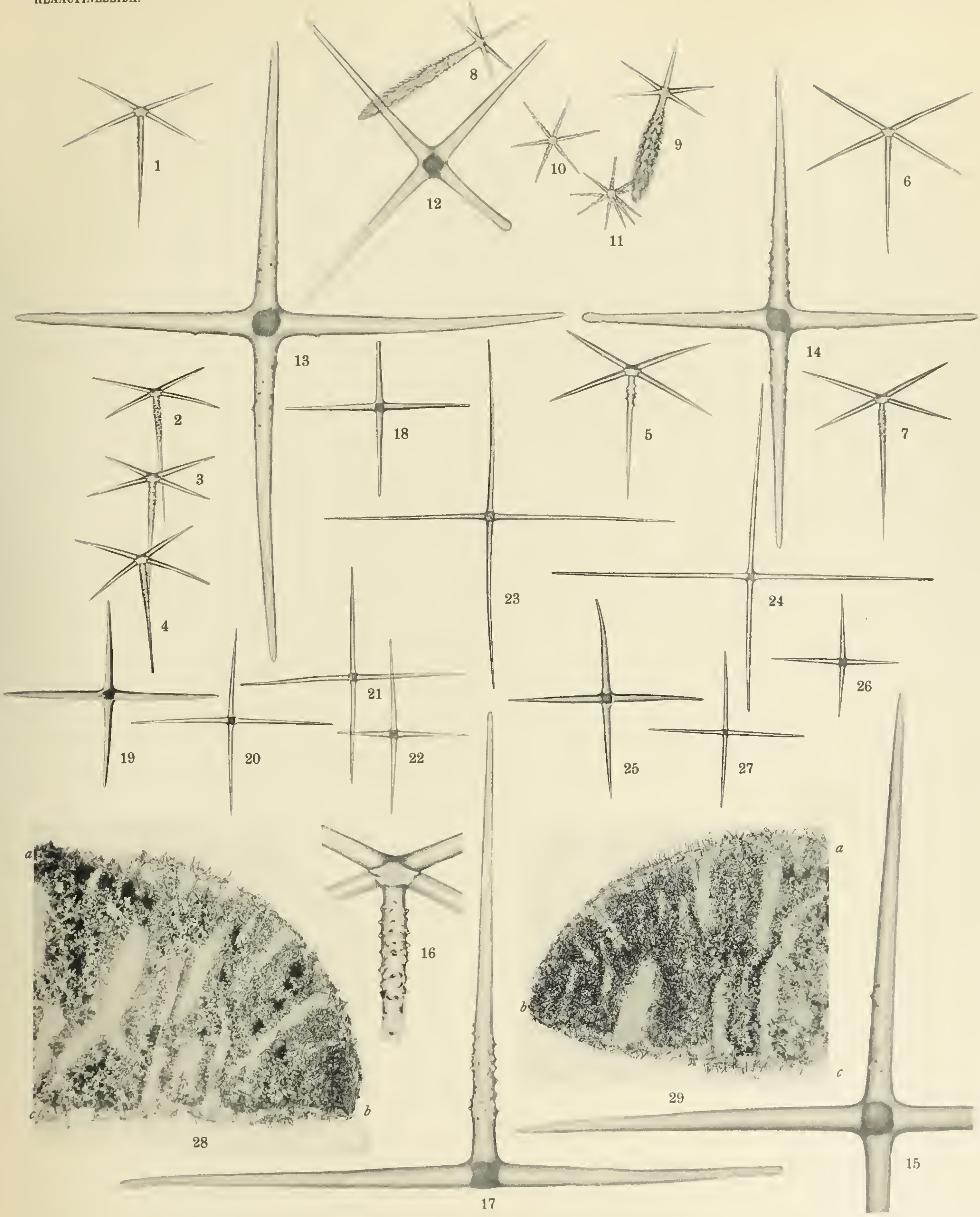


Fig. 1-29 Caulophacus schulzei Wilson.
1, 5, 6, 8-12, 15, 21, 22, 27 (E); 2-4, 13, 16, 18-20, 24 (B); 7, 17, 23, 25, 26 (D); 14, 28, 29 (C).

Lendenfeld photographed

PLATE 9.

PLATE 9.

Caulophacus schulzei Wilson.

Figs. 1–22, 24, 26, 32 — specimen E.
Figs. 23, 25, 28, 33 — specimen D.
Fig. 27 — specimen F.
Figs. 29, 31 — specimen C.
Fig. 30 — specimen A.

1–7.— Rays and end-parts of such of discohexasters, hemidiscohexasters, or discohexactines of specimen E; magnified 600:
 1, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
 2–7, u. v. phot. Zeiss, q. monochr. 6, q. oc. 10.

8.— The fragmentary specimen E from above; magnified 1.85; phot. Zeiss, anastig. 480/412 mm.

9–13.— Ends of rays of discohexasters, hemidiscohexasters, or discohexactines of specimen E; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

14–16.— Oxyhexaster- and hemioxyhexaster-like young stages of discohexasters and hemidiscohexasters of specimen E; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

17–22.— Discohexasters and hemidiscohexasters of specimen E; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

23–26.— Discohexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
 23, 25, of specimen D;
 24, 26, of specimen E.

27.— Longitudinal section of the peduncle of specimen F; magnified 2.5; phot. Zeiss, planar 100 mm.

28.— Side-view of specimen D; magnified 1.2; phot. Zeiss, anastig. 480/412 mm.

29.— Specimen C seen from above; magnified 1.2; phot. Zeiss, anastig. 480/412 mm.

30.— Specimen A seen from above; magnified 1.2; phot. Zeiss, anastig. 480/412 mm.

31.— Part of the gastral surface of specimen C; magnified 4.2; phot. Zeiss, anastig. 167 mm.

32.— Axial section of specimen E; magnified 2.5; phot. Zeiss, planar 100 mm.:
 a, peduncle.

33.— Axial section of specimen D; magnified 2.5; phot. Zeiss, planar 100 mm.:
 a, peduncle.

Fig. 1—33 Caulophacus schulzei Wilson;
1—22, 24, 26, 32 (E); 23, 25, 28, 33 (D); 27 (F); 29, 31 (C); 30 (A).

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 10.

PLATE 10.

Caulophacus schulzei Wilson.

Figs. 1–3, 5, 6, 9, 10, 15–26, 28, 29	— specimen E
Fig. 4	— specimen B.
Fig. 7	— specimen D.
Figs. 8, 11–14	— specimen F.
Fig. 27	— specimen C.

1–7.— Parts of rhabds of the body; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
1 and 2, the ends, and 3 the central part, of a rhabd of specimen E;
4, an end of a rhabd of specimen B;
5, 6, ends of rhabds of specimen E;
7, end of a rhabd of specimen D.

8.— Part of the skeleton-net of the peduncle of specimen F; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
a, pinules embodied in the skeleton-net.

9, 10.— Rhabds of the body of specimen E; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.

11, 12.— Free ends of rhabds of the skeleton-net of the peduncle of specimen F; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

13, 14.— Parts of the skeleton-net of the peduncle of specimen F; magnified 30; phot. Zeiss, planar 20 mm.

15, 16.— The distal end of a main-ray and the proximal parts of the end-rays arising from it, of a large discocome of specimen E; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
15, focussed lower; 16, focussed higher.

17–19.— Discocomes of specimen E; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
17, 18, small ones with short, strongly divergent end-rays;
19, a large one with long, more upright end-rays.

20–25.— Parts of discocomes of specimen E; magnified 600:
20, 22, 23, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
21, phot. Zeiss, apochr. 4, compens. oc. 12;
24, 25, u. v. phot. Zeiss, q. monochr. 6, q. oc. 10;
20, 21, of large ones with long, more upright end-rays;
22, 23, of intermediate ones;
24, 25, of small ones with short, strongly divergent end-rays.

26.— The distal part of an end-ray of a discocome of specimen E; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

27–29.— Groups of microscleres from spicule-preparations:
27, of specimen C; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6;
28, 29, of specimen E; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6;
a, discohexasters, hemidiscohexasters, and discohexactines; b, discocomes.

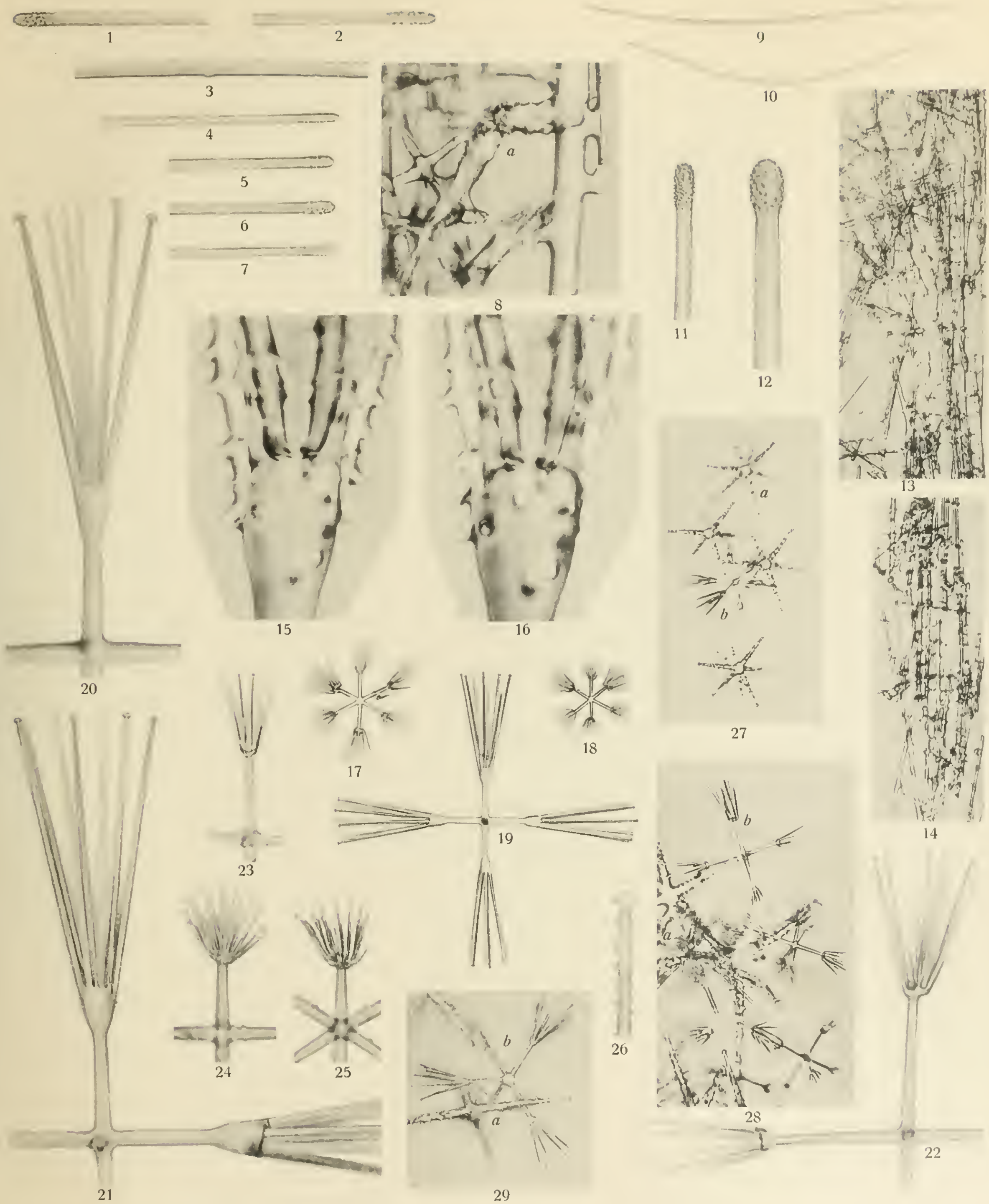


Fig. 1—29 Caulophacus schulzei Wilson; 1—3, 5, 6, 9, 10, 15—26, 28, 29 (E); 4 (B); 7 (D); 8, 11—14, (F); 27 (C).

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 11.

PLATE 11.

Caulophacus schulzei Wilson.

Fig. 1 — specimen B.
Figs. 2–6, 13–16 — specimen E.
Figs. 7–9, 11, 12 — specimen D.
Figs. 10, 17 — specimen C.

1–12.— Side-views of normal pinules; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
1, a dermal pinule of specimen B;
2–6, pinules of specimen E;
7, 8, gastral pinules of specimen D;
9, 11, 12, dermal pinules of specimen D;
10, a dermal pinule of specimen C.

13.— Side-view of an abnormal pinule with hypertroph proximal ray of specimen E; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

14.— The proximal ray of a pinule of specimen E; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

15, 16.— The distal part of a distal pinule-ray of specimen E; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
15, focussed higher; 16, focussed lower.

17.— Part of a radial section of specimen C; eosin; magnified 30; phot. Zeiss, planar 20 mm.:
a, gastral pinule-fur; b, subgastral cavities; c, choanosome.

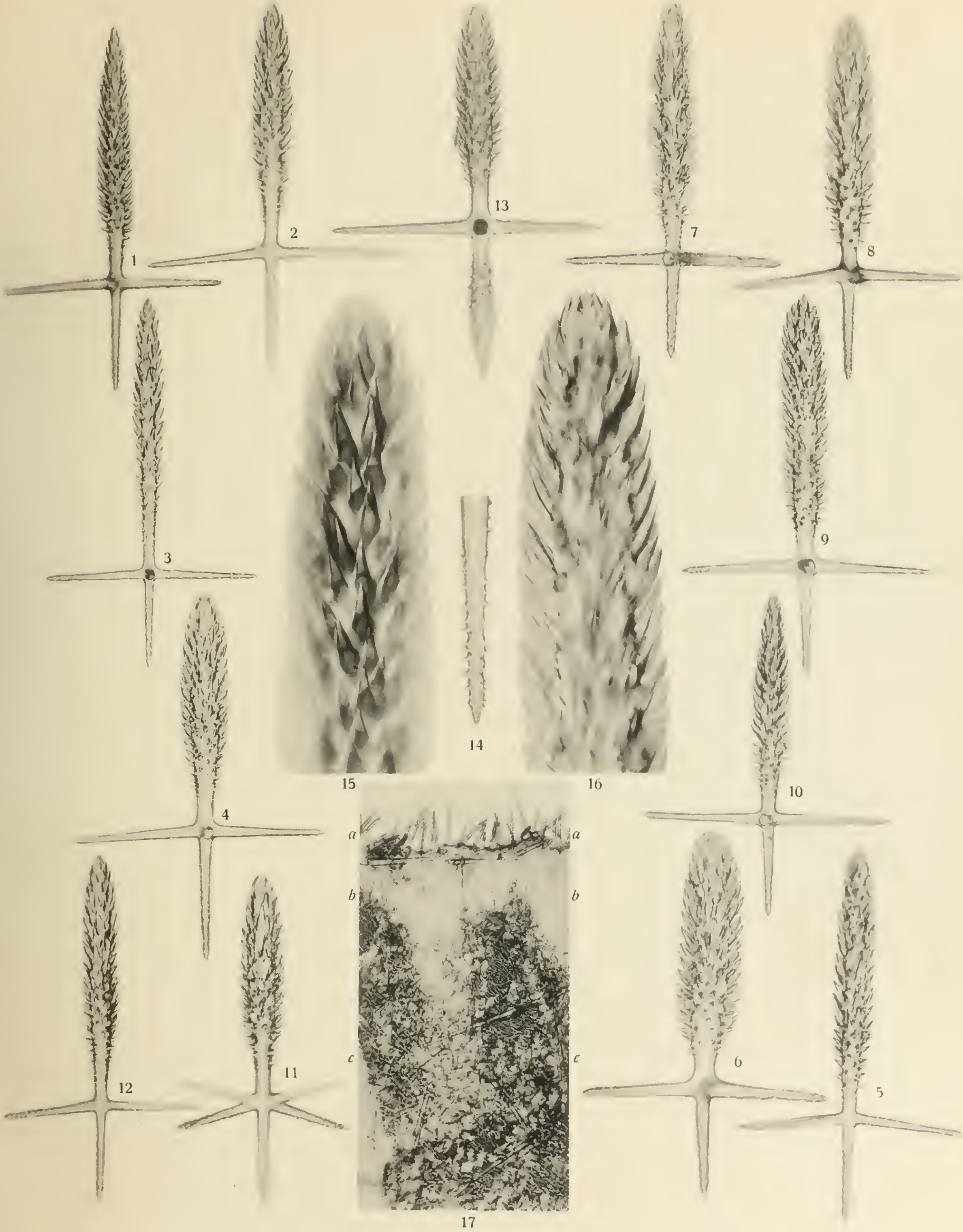


Fig. 1—17 Caulophacus schulzei Wilson;
1 (B); 2—6, 13—16 (E); 7—9, 11, 12 (D); 10, 17 (C).

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 12.

PLATE 12.

Caulophacella tenuis Lendenfeld.

Figures 1–19.

1–8.— Distal parts of distal rays of pinules; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
- 1, 2, of a large dermal pinule;
  - 1, focussed higher; 2, focussed lower;
- 3, 4, of a small gastral pinule with stout distal ray;
  - 3, focussed higher; 4, focussed lower;
- 5, 6, of a small gastral pinule with spirally twisted spines;
  - 5, focussed higher; 6, focussed lower;
- 7, 8, of a small gastral pinule with slender distal ray;
  - 7, focussed higher; 8, focussed lower.

9.— Oxyhexaster: magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

10–12.— Parts of end-rays of oxyhexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 10, the tip of an end-ray;
- 11, 12, central part of an end-ray;
  - 11, focussed higher; 12, focussed lower.

13.— Surface-view of part of the sponge-lamella, after removal of the soft parts with nitric acid; magnified 30; phot. Zeiss, planar 20 mm.

14, 15.— Apical views (the lateral rays) of pinules; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
- 14, of a large dermal pinule;
- 15, of a small gastral pinule.

16–18.— Oxyhexasters; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

19.— Side-view of a large dermal pinule; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

Lanugonychia flabellum Lendenfeld.

Figures 20–34.

20.— Part of an irregular discohexaster with primary and secondary end-rays; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

21.— A main-ray and adjacent parts of a plumicome; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

22, 23.— The main-rays and basal parts of end-rays of plumicomes; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

24–34.— Hexactines and hexactine-derivates with fewer than six fully developed rays; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
- 24, 25, with one fully developed ray;
- 26–29, with two fully developed rays;
- 30–34, with three to six fully developed rays.

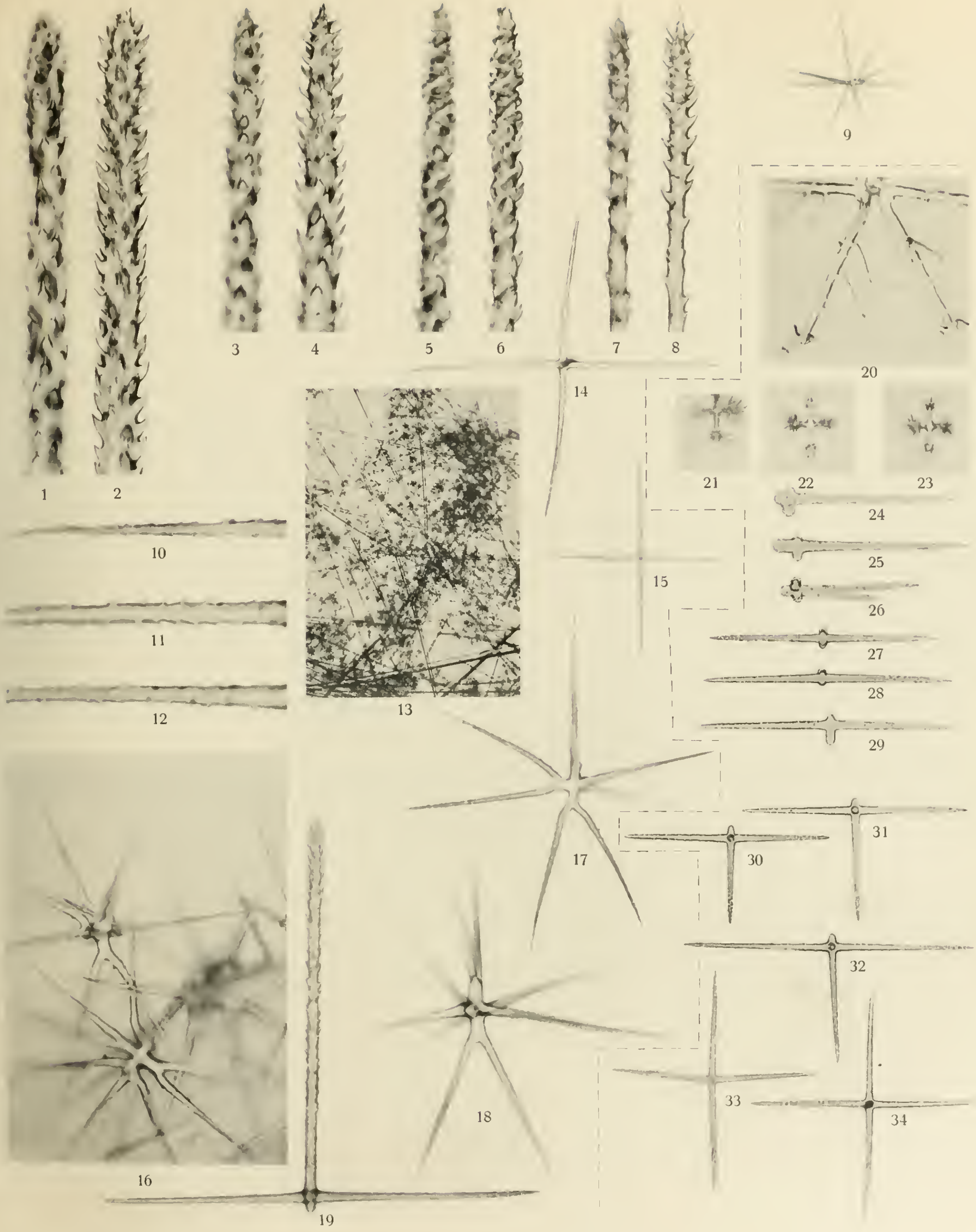


Fig. 1—19 Caulophacella tenuis n. sp.

Fig. 20—34 Lanugonychia flabellum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 13.

PLATE 13.

Lanugonychia flabellum Lendenfeld.

Figures 1–28.

1.— The distal part of an end-ray of a large discohexaster; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

2.— Part of a large discohexaster; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

3.— Part of small discohexaster; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

4.— Fairly large discohexaster; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

5, 6.— Groups of spicules from spicule-preparations; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

a, large discohexasters; b, onychhexasters; c, angularly bent, hexactine-derivate diactine.

7.— Part of the dictyonal skeleton of the stalk; magnified 30; phot. Zeiss, planar 20 mm.

8.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm. (The stalk is detached from the body proper, there is a complete interruption between them at a).

9–13.— Megascleres; magnified 30; phot. Zeiss, planar 20 mm.:

9, side-view of a large pentactine;

10, apical view of the lateral rays of a small pentactine;

11, part of a large rhabd;

12, apical view of the lateral rays of a small pentactine;

13, side-view of a small pentactine.

14.— Part of the lamellar sponge-body in transmitted light; magnified 3; phot. Zeiss, anastig. 167 mm.

15.— Group of microscleres from a spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

a, discohexasters; b, onychhexasters.

16.— Group of megascleres from a spicule-preparation; magnified 10; phot. Zeiss, planar 50 mm.:

a, large, partly broken pentactines; b, small pentactine.

17–26.— Ends of end-rays of discohexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

27.— End of an end-ray of an onychhexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

28.— Hexactine-derivate with only one fully developed ray; magnified 600; u. v. phot. Zeiss, q. monochr. 6, q. oc. 10.

Fig. 1—28 Lanugonychia flabellum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 14

PLATE 14.

Bathydorus laevis spinosissimus Lendenfeld.

Figs. 1–6, 16, 17, 19–32 — specimen B.
Figs. 7–11, 14, 15, 18 — specimen A.
Figs. 12, 13 — specimen C.

1–4.— Ends of small rhabds of specimen B; magnified 600:
1, 3, phot. Zeiss, apochr. 4, compens. oc. 12;
2, 4, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
5, 6.— The central part with tyle of two small centrotyle rhabds of specimen B:
5, magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
6, magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
7–10.— End-parts of large protruding rhabds (prostalia) of specimen A; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
11.— View of the dermal surface of specimen A; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
12.— View of the gastral surface of specimen C; magnified 200, phot. Zeiss, apochr. 8, compens. oc. 6.
13.— View of specimen C; magnified 1.6; phot. Zeiss, anastig. 480/412 mm.
14, 15.— Two transverse sections of specimen A; magnified 10; phot. Zeiss, planar 50 mm.
16.— An oxyhexaster of specimen B; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
17–23.— Oxyhexasters and parts and groups of such; magnified 600:
17, 19–23, of specimen B;
18, of specimen A;
17, 19, 21–23, phot. Zeiss, apochr. 4, compens. oc. 12;
18, 20, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
24–32.— End-rays and parts of such of oxyhexasters of specimen B; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
24–29, parts of end-rays of different oxyhexasters;
30–32, an end-ray of an oxyhexaster;
30, focussed higher; 31, focussed lower; 32, focussed still lower.

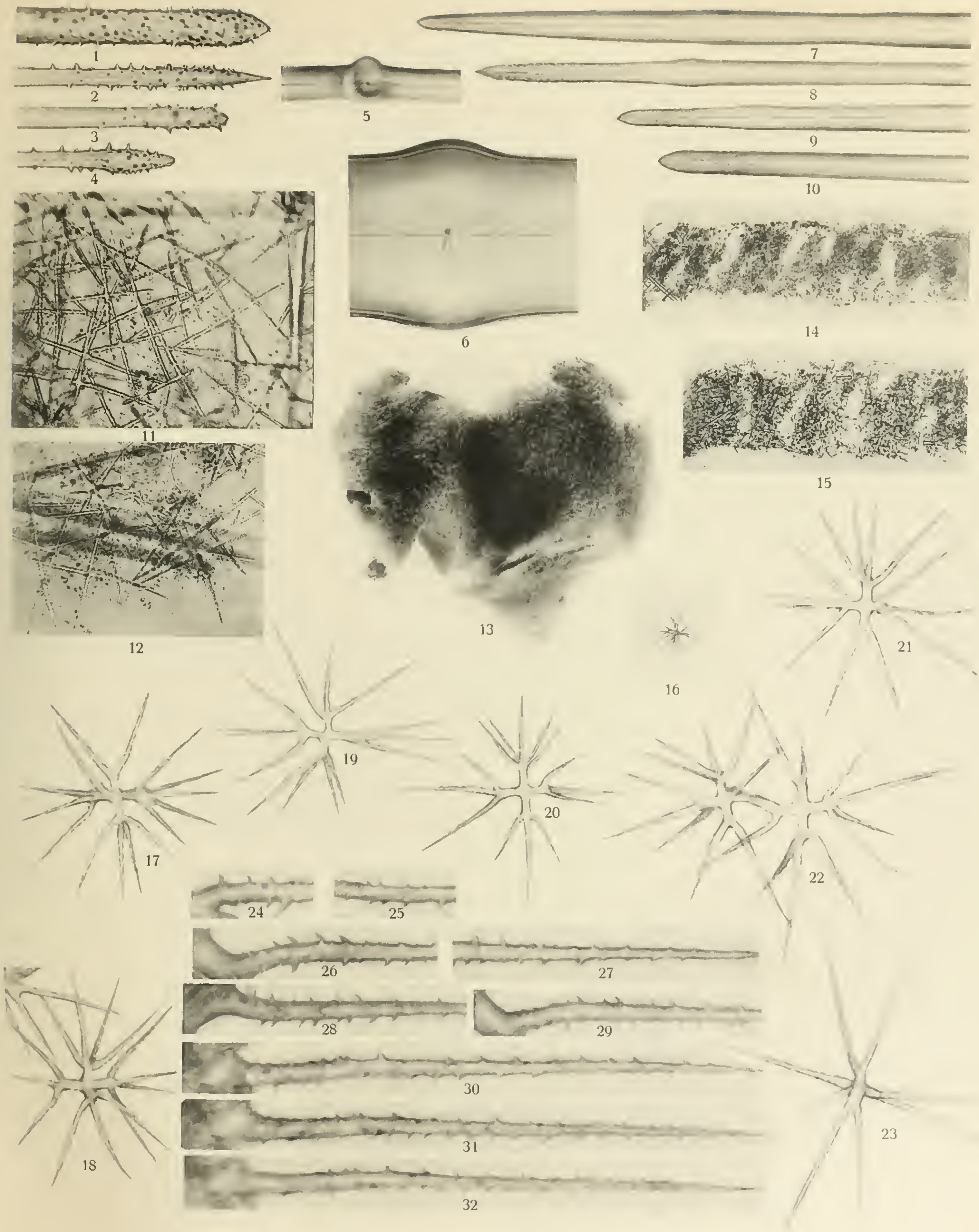


Fig. 1—32 Bathydorus laevis F. E. Sch., subspecies spinosissimus n. subsp. 1—6, 16, 17, 19—32 (B); 7—11, 14, 15, 18 (A); 12, 13 (C).

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 15.

PLATE 15.

Bathydorus laevis spinosissimus LENDENFELD.

Figs. 1–4, 6–10, 14, 16–22 — specimen B.
Figs. 5, 11–13, 15 — specimen A.

1.— Middle-sized, fairly regular, dermal tetractine (stauractine) of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

2.— Small dermal tetractine with rudiment of a fifth ray, of specimen B; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

3.— Part (three upwardly directed rays) of a middle-sized dermal hexactine of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

4.— Small dermal diactine with a rudiment of a third ray, of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

5.— Large dermal diactine with rudiments of two other rays, of specimen A; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

6.— Large dermal diactine with a rudiment of a third ray, of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

7, 8.— Two large gastral pinule-like hexactines with considerably differentiated distal ray, of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

9, 10.— A dermal tetractine with rays considerably shortened and thickened, of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
9, focussed lower; 10, focussed higher.

11.— Part of a large dermal tetractine (stauractine) with one strongly bent ray, of specimen A; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

12, 13.— Two rather large gastral, somewhat pinule-like hexactines with only slightly differentiated distal ray, of specimen A; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

14–17.— Distal, more or less differentiated, pinule ray-like rays of gastral hexactines; magnified 600:
14, 16, 17, of specimen B;
15, of specimen A;
14, 15, phot. Zeiss, apochr. 4, compens. oc. 12;
16, 17, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

18.— Large dermal tetractine (stauractine) with one ray considerably shorter than the others, of specimen B; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

19.— Middle-sized dermal tetractine (stauractine) of specimen B; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

20.— Large dermal tetractine with somewhat unequally developed rays and a rudiment of a fifth ray, of specimen B; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

21.— Middle-sized dermal tetractine with two rays considerably reduced in length, of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 6.

22.— Large dermal tetractine with one ray considerably reduced in length, of specimen B; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

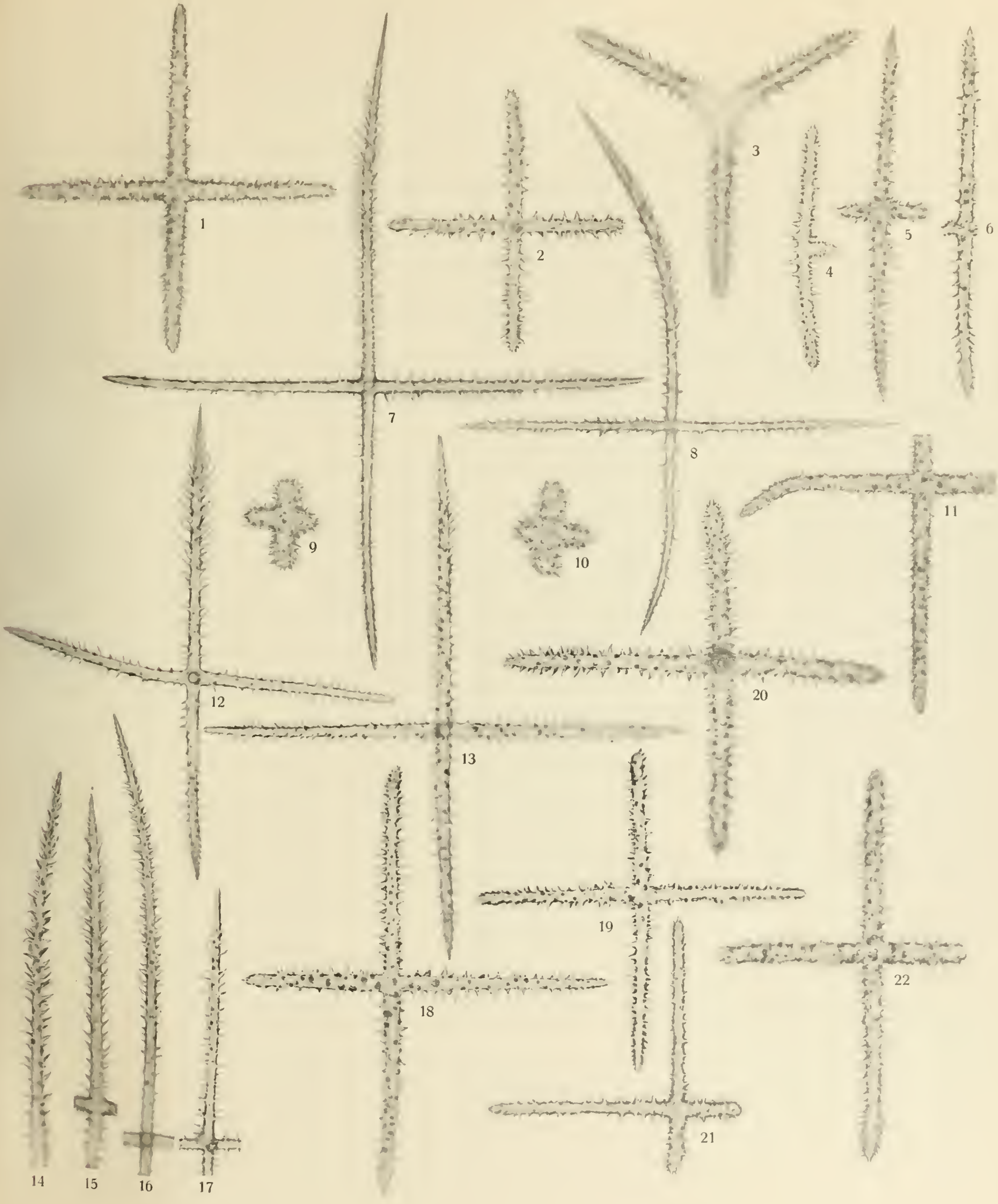


Fig. 1—22 Bathydorus laevis F. E. Sch., subspecies spinosissimus n. subsp. 1—4, 6—10, 14, 16—22 (*B*); 5, 11—13, 15 (*A*).

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 16.

Bathydorus laevis spinosissimus LENDENFELD.

Figs. 1–8, 10, 11, 14–24 — specimen A.
Figs. 9, 12, 13 — specimen B.

1, 2.— Side-views of pentactines with long proximal and short lateral rays, of specimen A; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.
3.— Side-view of a hexactine of specimen A; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.
4–8.— Side-views of pentactines with long lateral rays, of specimen A; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6:
  4–6, 8, with normally developed rays;
  7, with the proximal and two lateral rays reduced in length and terminally thickened.
9.— Gastral pinule-like hexactine of specimen B; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
10, 11.— Two gastral pinule-like hexactines of specimen A; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
12–14.— Dermal stauractines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
  12, 13, of specimen B;
  14, of specimen A.
15.— Part of the apical view of the lateral rays of a pentactine of specimen A; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
16, 17.— Apical views of the lateral rays of pentactines of specimen A; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6:
  16, of a pentactine in which all the lateral rays are properly developed;
  17, of a pentactine with one lateral ray reduced in length.
18.— Abnormal hexactine of specimen A; magnified 30; phot. Zeiss, planar 20 mm.
19.— Rectangular diactine of specimen A; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.
20, 21.— Part of a slightly heated lateral ray of a pentactine of specimen A; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  20, focussed higher; 21, focussed lower.
22, 23.— Part near the base of a lateral ray of a pentactine, of specimen A; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  22, focussed higher; 23, focussed lower.
24.— End of a lateral ray of a pentactine of specimen A; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

Staurocalyptus hamatus LENDENFELD.

Figures 25–43.

25–28.— Ends of rhabds; magnified 200; phot. Zeiss, apochr. 8, compens, oc. 6:
  25–27, of small rhabds;
  28, of a large rhabd.
29.— A small rhabd; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
30–33.— A middle-sized stout rhabd, and parts of it:
  30, the rhabd; magnified 30; phot. Zeiss, planar 20 mm.;
  31–33, parts of the rhabd; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
    31, one end;
    32, portion of the middle-part;
    33, the other end.

34–38.— A large rhabd and parts of it:

34, the rhabd; magnified 30; phot. Zeiss, planar 20 mm.;

a, the part represented more strongly magnified in fig. 36;

35–38, parts of the rhabd; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6;

35, one end;

36, portion near the end (at a, fig. 34) with a thickening of the axial thread;

37, the other end;

38, part of the thickest portion near the middle.

39.— Group of spicules from a spicule-preparation; magnified 30; planar 20 mm.:

a, large rhabd; b, small rhabd; c, hemioxyhexasters with straight rays; d, oxyhexactine with hook-like rays; e, discoctaster.

40–43.— Small, spined, dermal rhabds; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

40, 41, with rudiments of other rays besides the fully developed two;

42, 43, simple rhabds without such ray-rudiments.

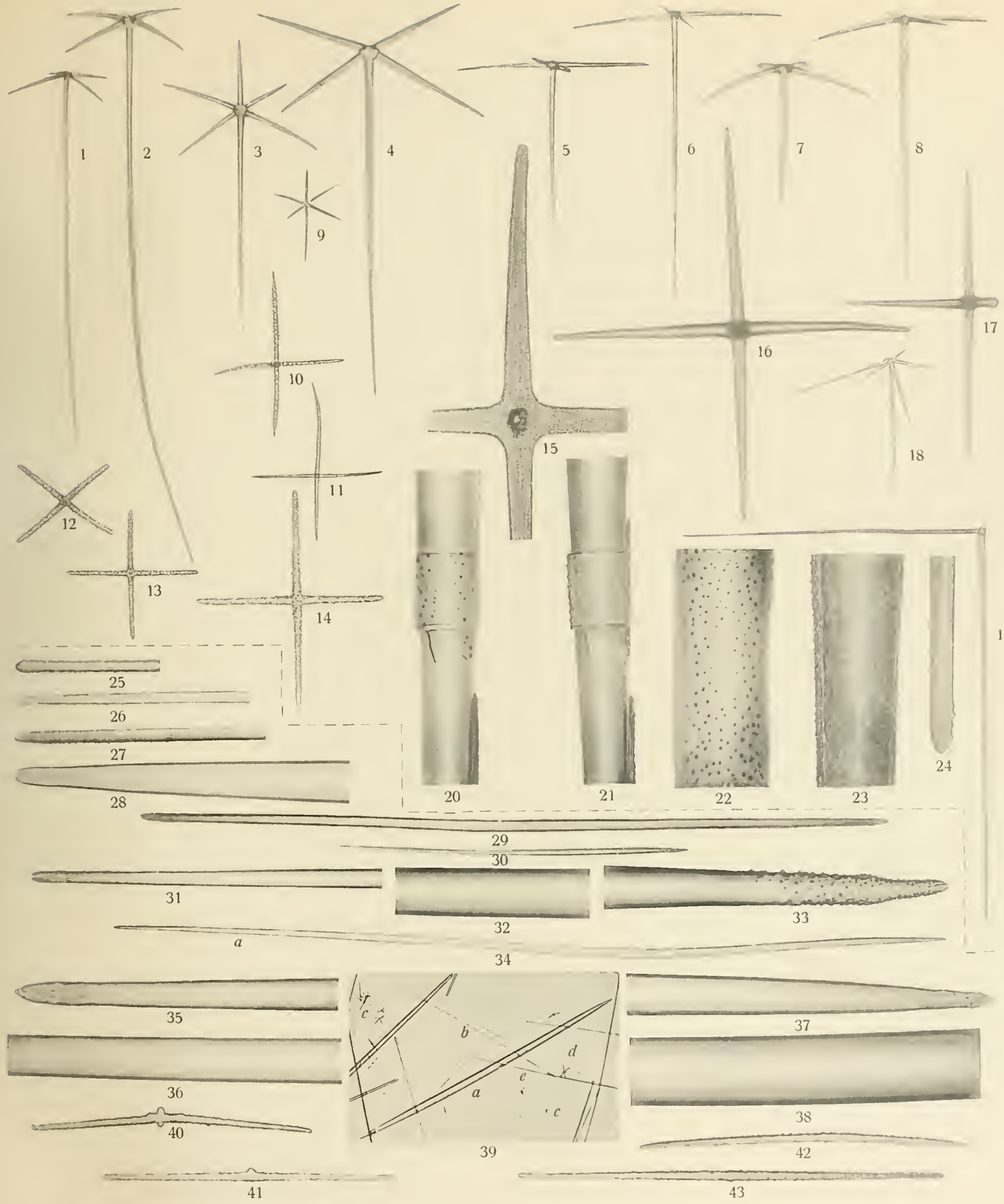


Fig. 1—24 Bathydorus laevis F. E. Sch., subspecies spinosissimus n. subsp. 1—8, 10, 11, 14—24 (A); 9, 12, 13 (B).
Fig. 25—43 Staurocalyptus hamatus n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 17.

PLATE 17.

Staurocalyptus hamatus Lendenfeld.

Figures 1–25.

1–8.— Hemioxyhexasters and microoxyhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

1–3, microoxyhexactines with hook-like rays;

4, hemioxyhexaster with partly straight, partly hook-like rays (end-rays);

5–8, hemioxyhexasters with straight rays.

9, 10.— Groups of spicules from spicule-preparations; magnified 200; phot. Zeiss, apochr. 8, compens oc. 6:

a, dermal rhabd; b, hemioxyhexasters with straight rays; c, microoxyhexactine with hook-like rays, one of which is abnormally elongated; d, discoctasters; e, small discohexaster.

11, 12.— Two regular discoctasters with one main-ray axis parallel to the optical axis of the microscope; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

13.— Group of spicules from a spicule-preparation; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

d, part of an irregular discoctaster; e, small discohexasters.

14–16.— Discoctasters with the three main (main-ray) axes oblique to the optical axis of the microscope; magnified 600:

14, an irregular discoctaster; phot. Zeiss, apochr. 4, compens. oc. 12;

15, 16, regular discoctasters; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

17, 18.— Centre of a discoctaster with the three main (main-ray) axes oblique to the optical axis of the microscope; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

17, focussed higher; 18, focussed lower.

19–23.— Centres of two discoctasters with one main-ray axis parallel to the optical axis of the microscope; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

19, 20, of one discoctaster;

19, focussed higher; 20, focussed lower;

21–23, of another discoctaster;

21, focussed higher; 22, focussed lower; 23, focussed still lower.

24, 25.— End-rays of discoctasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

24, of a large discoctaster;

25, of a small discoctaster.

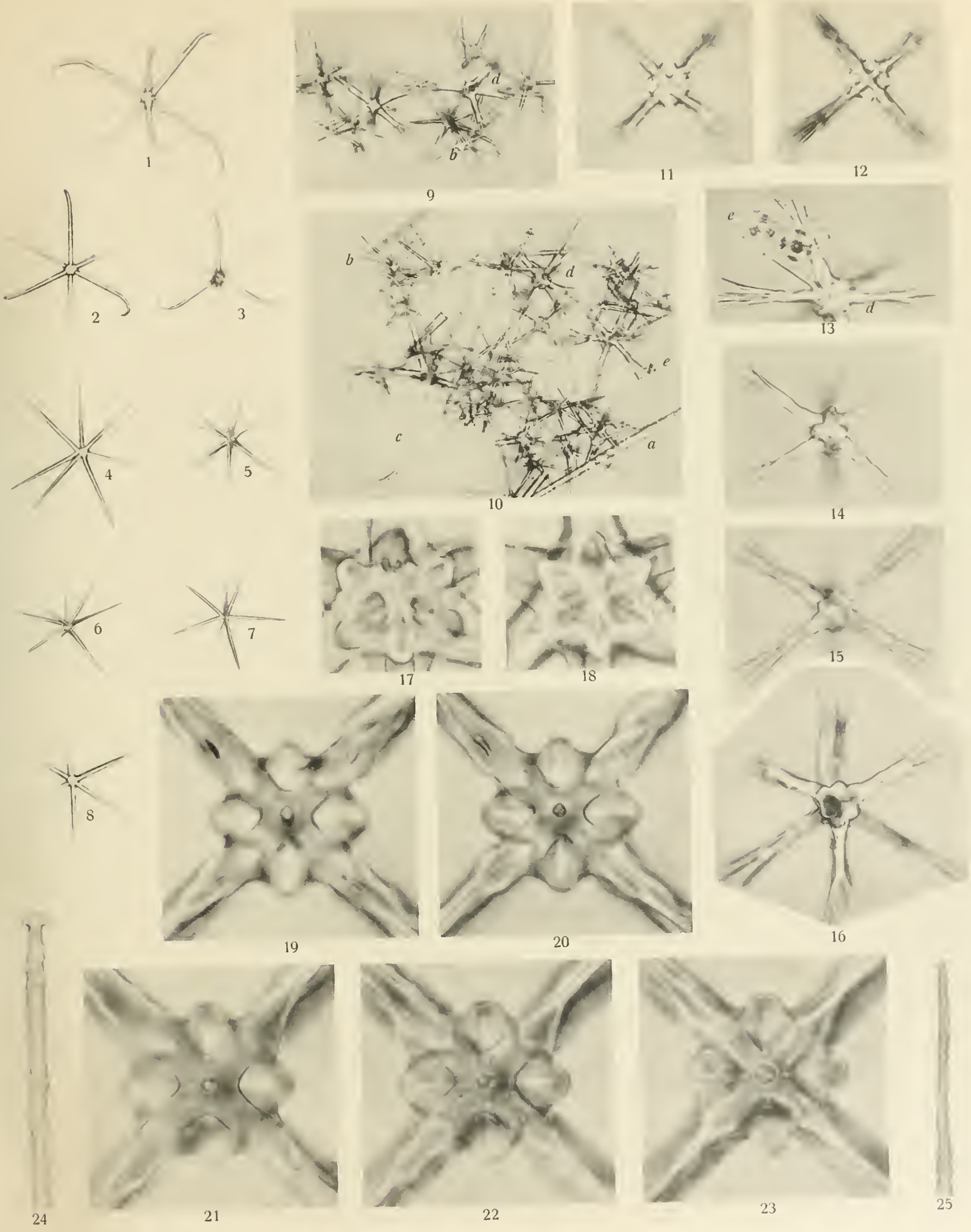


Fig. 1—25 Staurocalyptus hamatus n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 18.

PLATE 18.

Staurocalyptus hamatus Lendenfeld.

Figures 1–14.

1–4.— Two small discohexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 1, 2, one small discohexaster;
  - 1, focussed higher; 2, focussed lower;
- 3, 4, another small discohexaster;
  - 3, focussed higher; 4, focussed lower.

5, 6.— Views of the sponge after removal of the Dicranodromia; reduced 1: 9.85; phot. Zeiss, anastig. 480/412 mm.:
- 5, from below;
- 6, from above.

7.— A small discohexaster; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

8–10.— Side-views of hypodermal pentactines; magnified 30; phot. Zeiss, planar 20 mm.

11, 12.— Part of a spicule-group; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
- 11, focussed higher; 12, focussed lower;
  - a, dermal rhabd; b, small discohexasters.

13.— Part of a large rhabd of abnormal structure; magnified 600; u. v. phot. Zeiss, q. monochr. 6, q. oc. 10.

14.— The sponge with the Dicranodromia seen from the front; natural size; phot. Zeiss, anastig. 480/412 mm.

Holascus edwardsii Lendenfeld.

Figures 15–26.

15.— Group of slender-rayed comital triactines; magnified 30; phot. Zeiss, planar 20 mm.

16.— Group of slender-rayed comital triactines, tetractines, and pentactines; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4.

17, 18.— Hypogastral hexactines; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4.

19–21.— Hypodermal hexactines; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4.

22.— Surface-view of the skeleton of the body-wall. The soft parts and most of the smaller spicules are removed. The large choanosomal pentactines are still nearly in their natural position. Magnified 7.5, phot. Zeiss, planar 50 mm.:
- a, large choanosomal pentactines; b, comitals.

23.— The central part of a slender-rayed, comital spicule with two fully developed long rays, one considerably reduced ray, and two insignificant ray-rudiments which appear as slight protuberances; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

24–26.— The distal part of the distal ray of three hypodermal hexactines; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

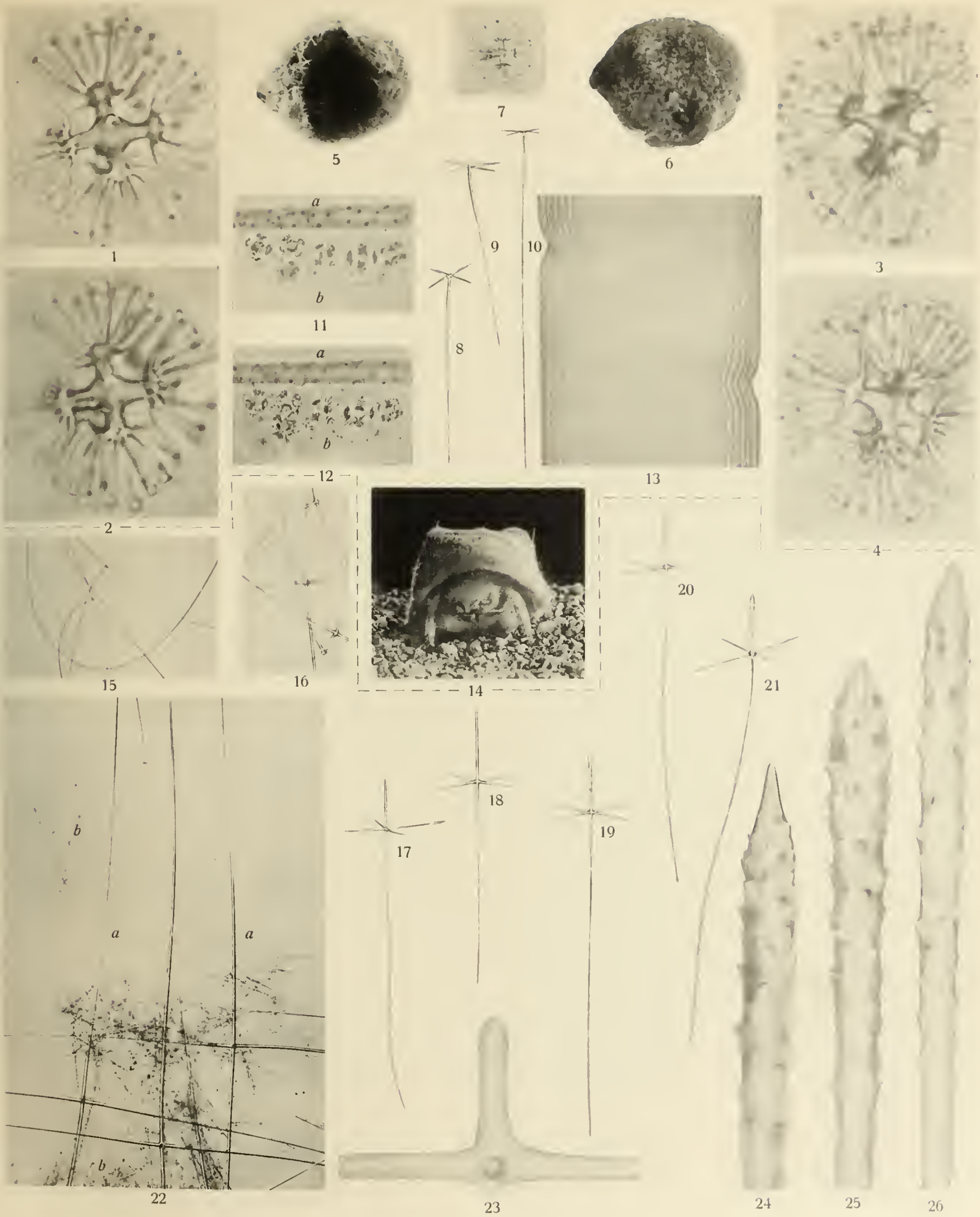


Fig. 1—14 Staurocalyptus hamatus n. sp.
Fig. 15—26 Holascus edwardsii n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 19.

PLATE 19.

Holascus edwardsii Lendenfeld.

Figures 1–24.

1–3.— Oxyhexasters; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

4, 5.— Parts of hemioxyhexasters; magnified 600;
- 4, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
- 5, phot. Zeiss, apochr. 4, compens. oc. 12.

6–10.— Oxyhexasters and hemioxyhexasters; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

11.— An end-ray of an oxyhexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

12, 13.— The central part (the main-rays) of a graphiocome; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
- 12, focussed high; 13, focussed low.

14.— Part (the two tips) of a ring-shaped sigm; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

15.— Ring-shaped sigm with the spiral axis obliquely situated; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

16–21.— Ring-shaped sigms with the spiral axis parallel to the optical axis of the microscope; magnified 600:
- 16, 19–21, phot. Zeiss, apochr. 4, compens. oc. 12;
- 17, 18, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

22–24.— Centrotyle rhabds; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

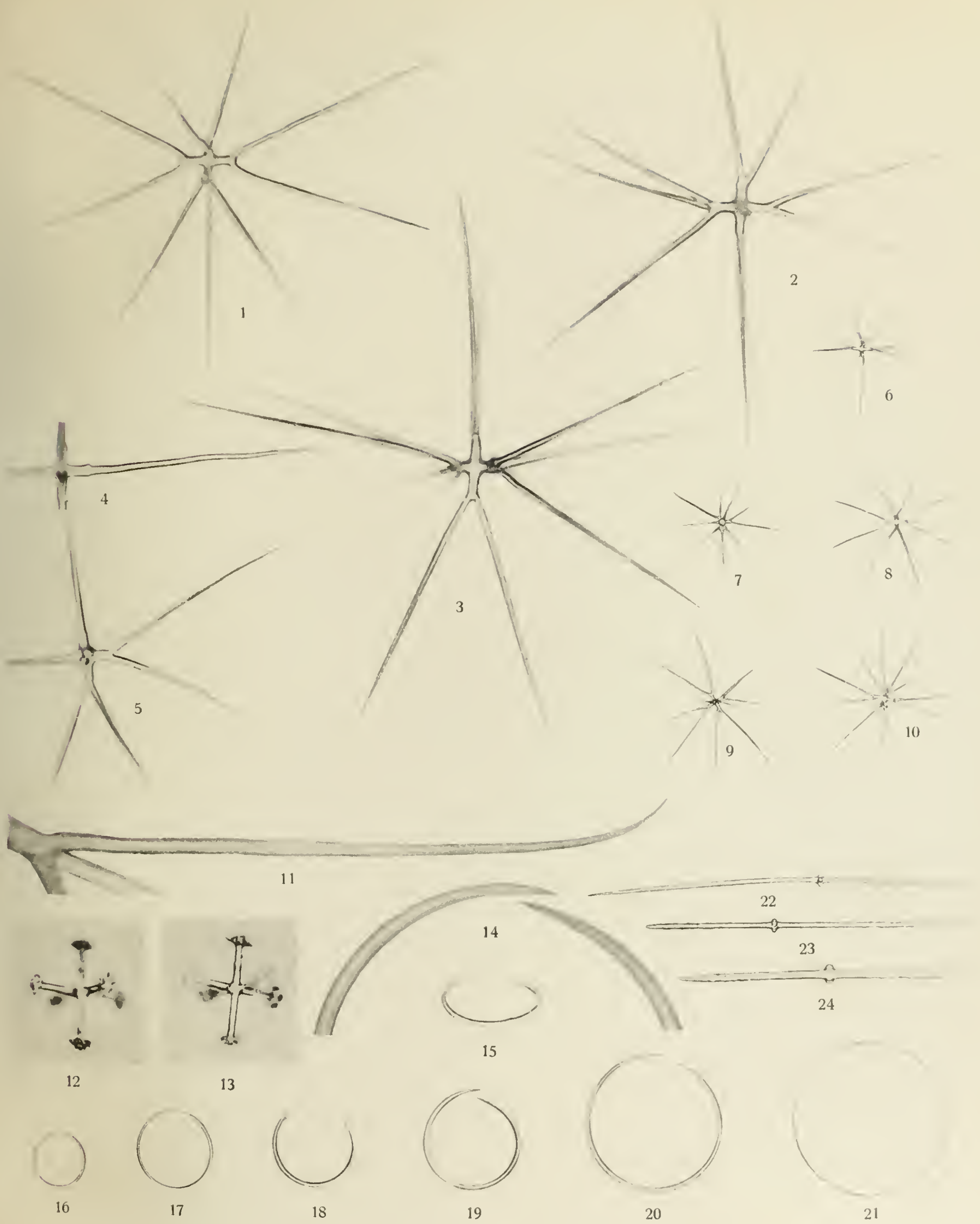


Fig. 1—24 Holascus edwardsii. n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 20.

PLATE 20.

Holascus edwardsii Lendenfeld.

Figures 1–20.

1, 2.— Large choanosomal pentactines; magnified 2.3; phot. Zeiss, anastig. 167 mm.

3.— Inner surface of the body-wall of a specimen cut in half longitudinally; reduced 1: 6.5; phot. Zeiss, anastig. 480/412 mm.

4.— View of a specimen (outer surface of the body-wall); reduced 1: 6.5: phot. Zeiss, anastig. 480/412 mm.

5–10.— The distal end-part of anchoring spicules; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12: a (in figs. 5–8), axial cross.

11–15.— Different parts of one and the same anchoring spicule; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

11, portion of the proximal smooth part;

12–14, successive portions of the spined distal part;

15, the distal end-part with its anchor.

16–20.— The distal end-part of anchoring spicules; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

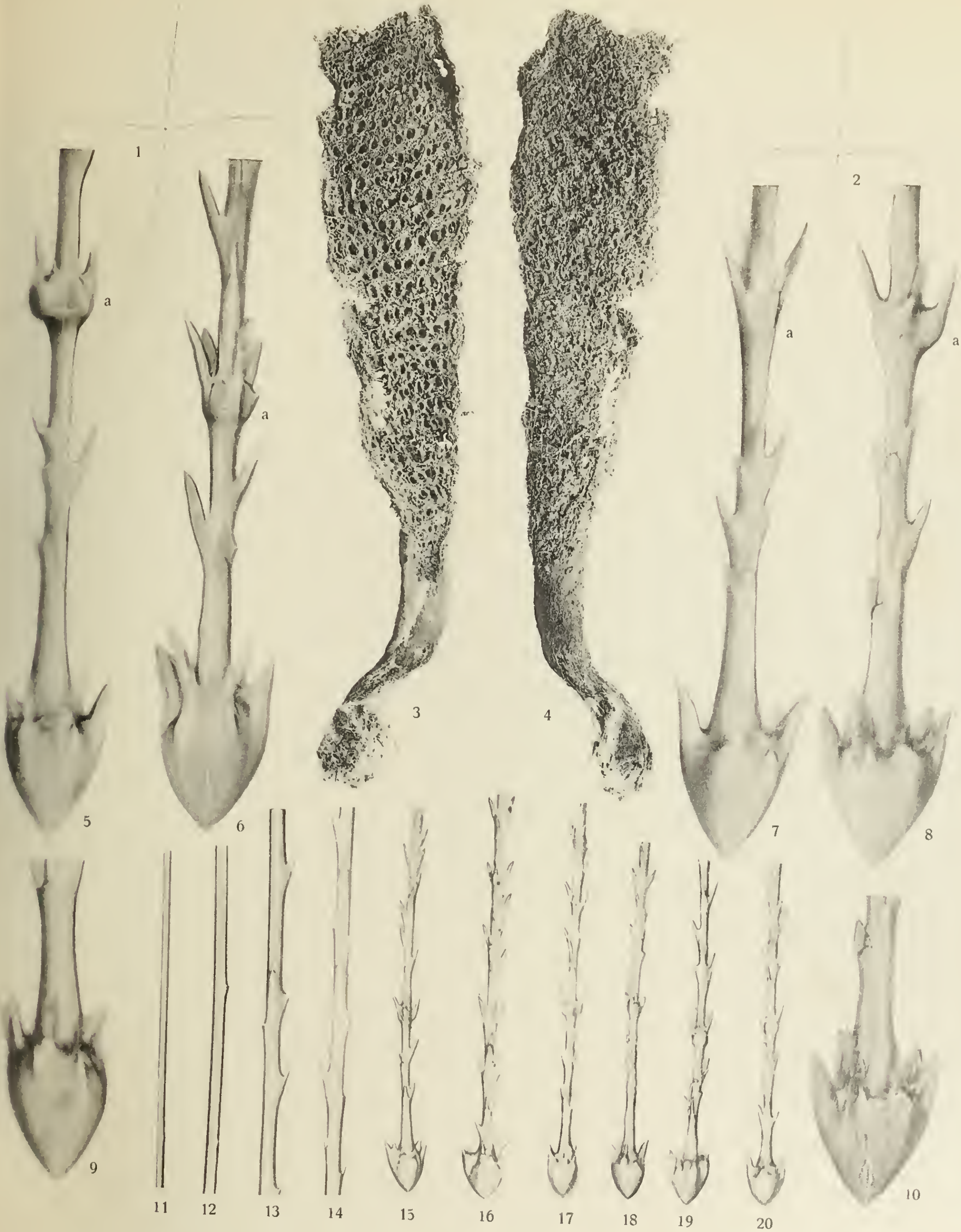


Fig. 1—20 Holascus edwardsii n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 21.

PLATE 21.

Holascella taraxacum LENDENFELD.

Figures 1–13.

1, 2.— A main-ray with its end-rays of an oxyhexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  1, focussed higher; 2, focussed lower.
3, 4.— The distal part of an end-ray of a discohexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  3, focussed higher; 4, focussed lower.
5–7.— The distal part of end-rays of three different discohexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
8.— View of the most complete specimen; reduced 1 : 0.7; phot. Zeiss, anastig. 480/412 mm.
9.— Part of an end-ray of an oxyhexaster; magnified 2000; u. v. phot. Zeiss q. monochr. 1.7, q. oc. 10.
10.— Centrum and main-rays of a discohexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
11, 12.— Large and small discohexasters; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
13.— Small discohexasters; magnified 300; u. v. phot. Zeiss, q. monochr. 6, q. oc. 5.

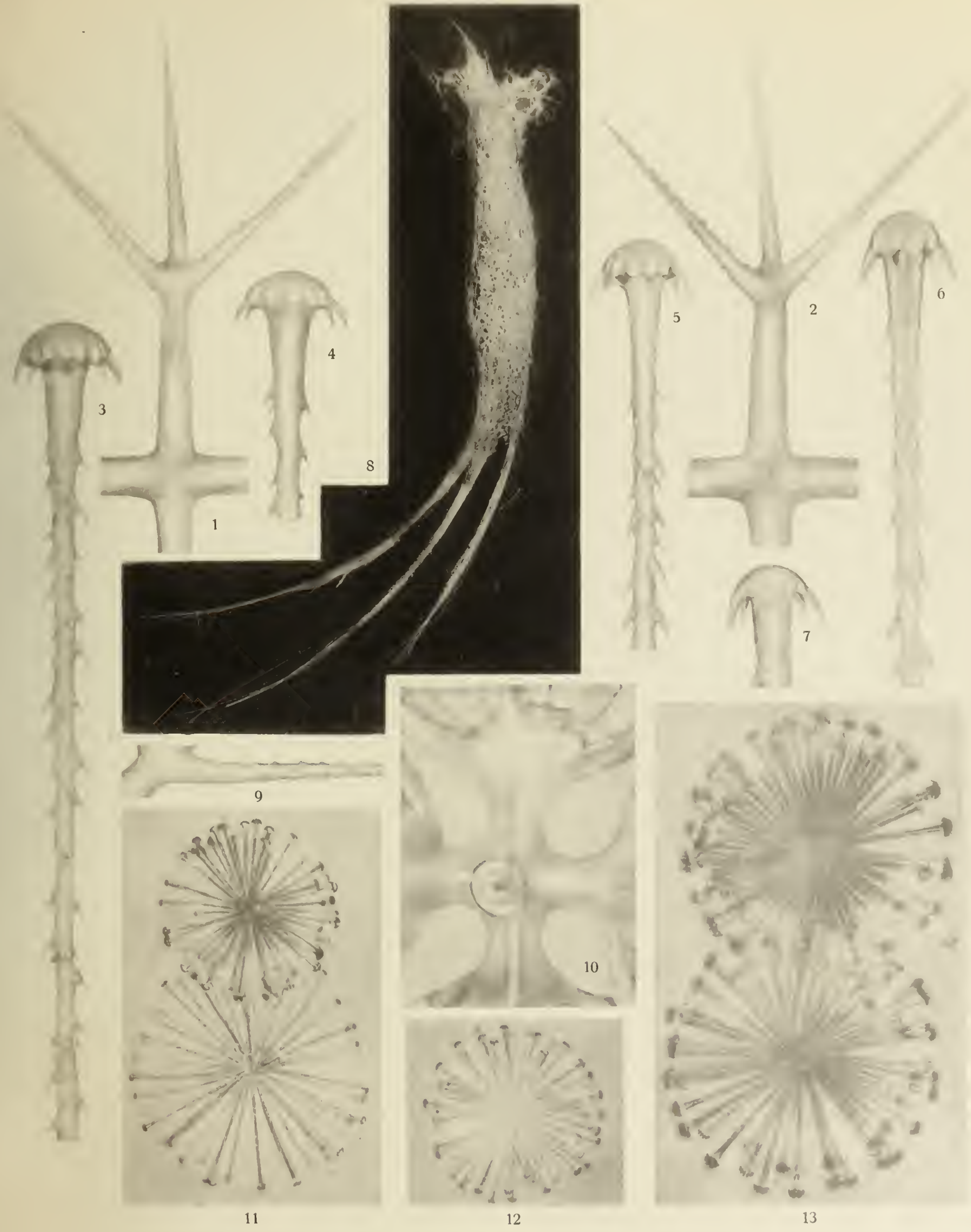


Fig. 1—13 Holascella taraxacum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 22.

PLATE 22.

Holascella taraxacum Lendenfeld.

Figures 1–41.

1–4.— Superficial (hypodermal, hypogastral) hexactines; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.

5–11.— Large choanosomal hexactines, pentactines, and tetractines; magnified 7.5; phot. Zeiss, planar 50 mm.

12–17.— The outer protruding ray of superficial (hypodermal, hypogastral) hexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

18, 19.— The distal part of a ray of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

18, focussed higher; 19, focussed lower.

20–25.— Micro-hexactines and -pentactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

26.— The lower, distal end of an anchoring spicule; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

27, 28.— Parts of groups of onychhexasters in spicule-preparations; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

29–35.— The tyles and adjacent parts of centrotyle rhabds; magnified 200; phot. Zeiss, apochr. 8 compens. oc. 6.

36.— Portion of a ray of a large choanosomal hexactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

37.— The lower, distal end of an anchoring spicule; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

38–41.— Ends of rhabds; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

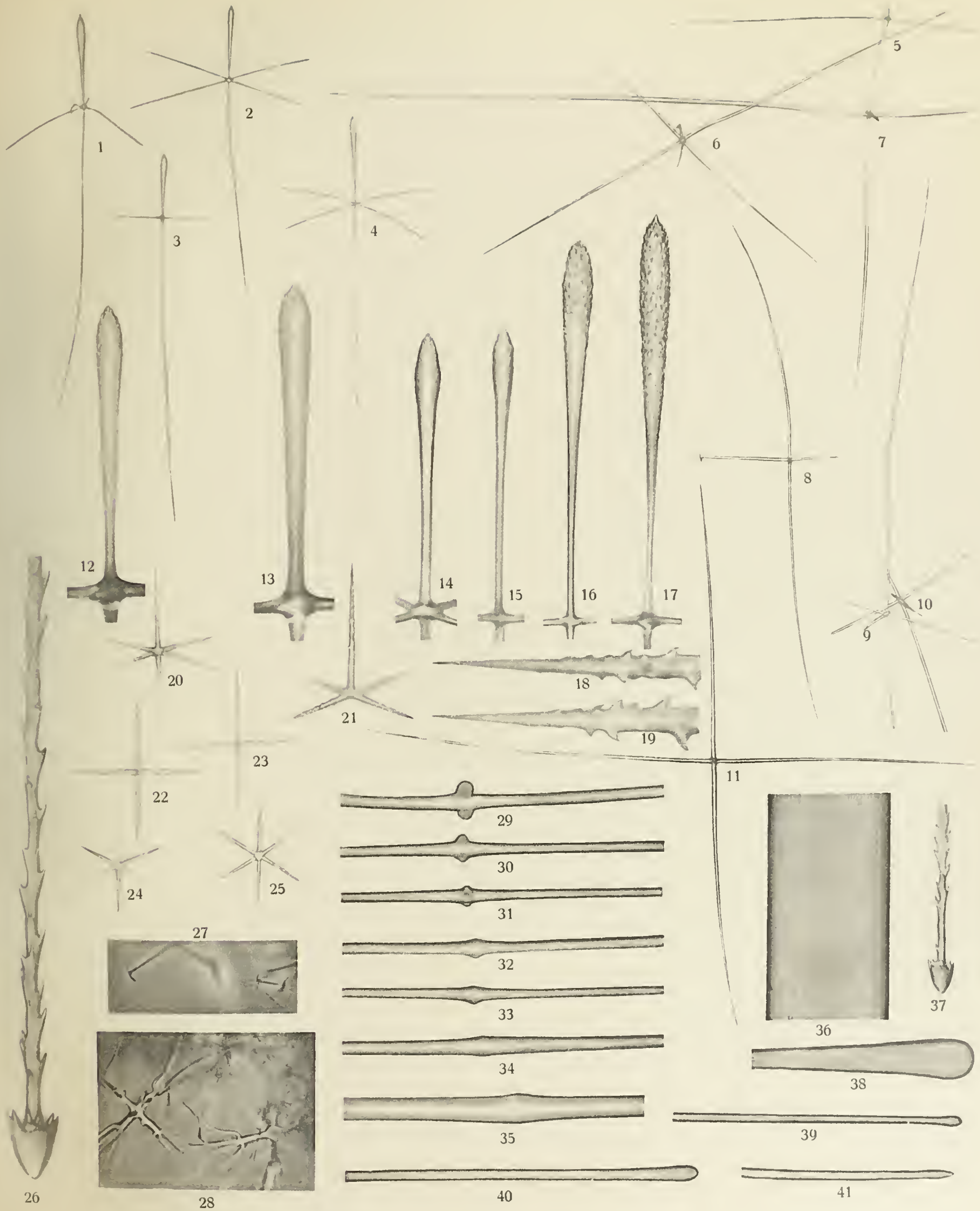


Fig. 1—41 Holascella taraxacum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 23.

PLATE 23.

Holascella taraxacum Lendenfeld.

Figures 1–3.

1.— Portion of the distal part of a longitudinal ray of a large choanosomal hexactine; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

2, 3.— Two distal ends (anchor-heads) of anchoring spicules; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

Holascella ancorata Lendenfeld.

Figures 4–25.

4.— A part of a ray of a principal tetractine where regeneration took place; magnified 600; u. v. phot. Zeiss, q. monochr. 6, q. oc. 10.

5.— A microdiscohexactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

6, 7.— The central parts of a microdiscohexactine (fig. 6) and a hemidiscohexaster (fig. 7); magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

8.— A microoxyhexactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

9.— View of the specimen; magnified 1.4; phot. Zeiss, anastig. 167 mm.

10.— Portion of a group of microscleres from a spicule-preparation; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

a, a ray of a microdiscohexactine; b, rays of microonychhexactines.

11.— The distal part of a ray of a microonychhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

12, 13.— The distal ray of two superficial hexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

12, of a hypodermal hexactine; 13, of a hypogastral hexactine.

14.— Group of microscleres from a spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

a, microdiscohexactines; b, a microonychhexactine.

15.— Fragmentary onychhexasters; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

16.— A ray of a microonychhexactine; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

17–25.— Six distal ends of rays of discohexasters, hemidiscohexasters, or microdiscohexactines; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

Of four there is only one view (figs. 19–22). Of one (figs. 17, 18) there are two views (fig. 17, focussed lower, fig. 18, focussed higher), and of another (figs. 23–25) there are three views (fig. 23, focussed high, fig. 24, focussed intermediate, fig. 25, focussed low).

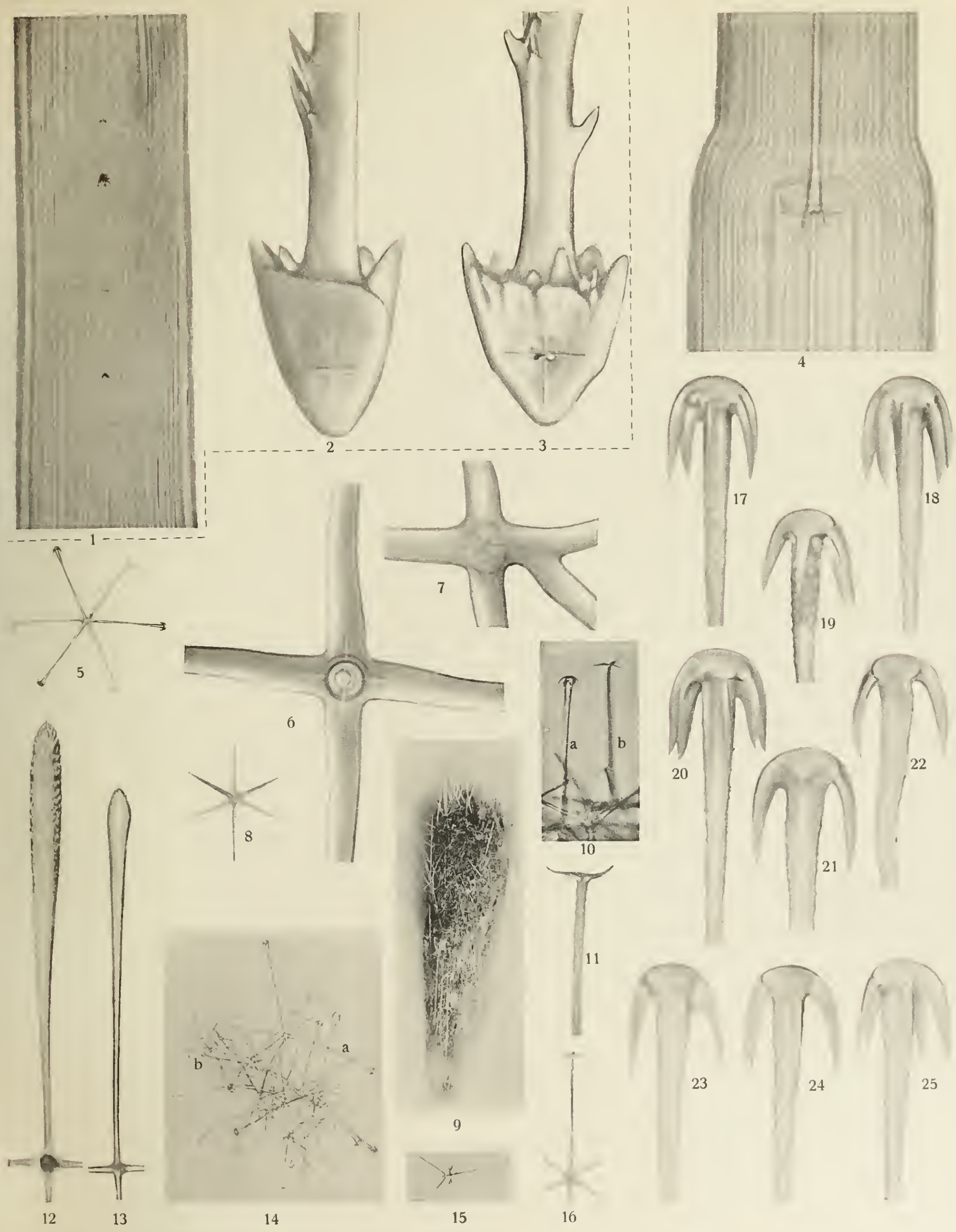


Fig. 1—3 Holascella taraxacum n. sp.
Fig. 4—25 Holascella ancorata n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 24.

PLATE 24.

Holascella ancorata Lendenfeld.

Figures 1–9.

1, 2.— Parts of spiny hexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
3.— Group of principal spicules; magnified 4; phot. Zeiss, planar 100 mm.
4.— Two microscleres from a spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
  a, a microonychhexactine; b, a floricome.
5–7.— Parts of floricomes; magnified 1000; phot. Zeiss, H. I. apochr. 2, compens. oc. 12:
  5, the end of a main-ray with its verticil of end-rays, all of which are broken off rather short, seen from above;
  6, the central part (main-ray cross);
  7, the greater part of a whole floricome.
8.— The central part of a tetractine principal spicule; magnified 300; u. v. phot. Zeiss, q. monochr. 6, q. oc. 5.
9.— The central part of a triactine comital spicule; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

Holascella euonyx Lendenfeld.

Figures 10–17.

10, 11.— The central part (main-rays) of two small discohexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
12.— A small discohexaster; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
13, 14.— Group of microscleres from a spicule-preparation; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  13, focussed lower; 14, focussed higher;
  a, part of an onychhexactine; b, small discohexaster.
15.— The greater part of a small discohexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
16, 17.— Group of two small discohexasters from a spicule-preparation; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  16, focussed lower; 17, focussed higher.

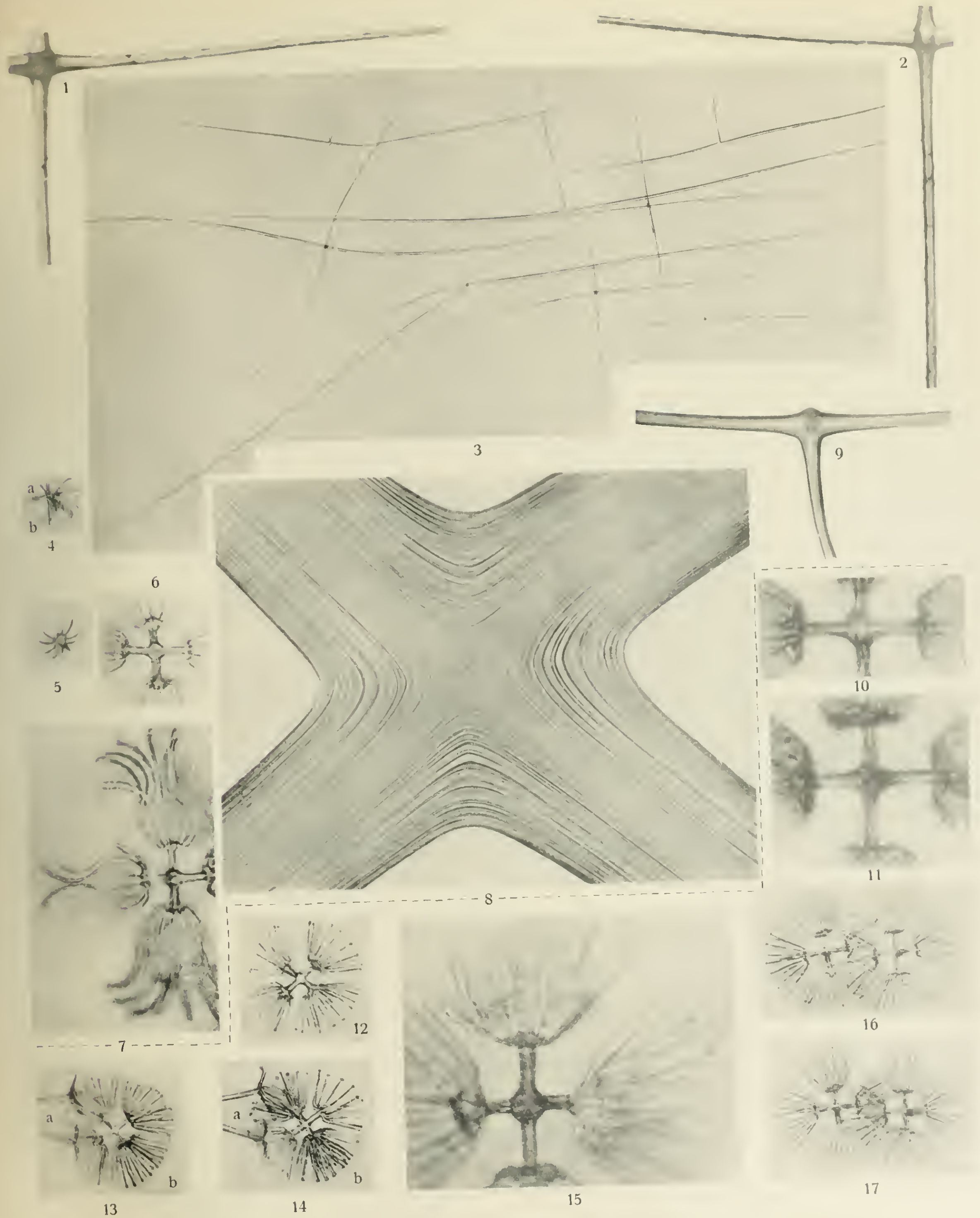


Fig. 1—9 Holascella ancorata n. sp.
Fig. 10—17 Holascella euonyx n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 25.

PLATE 25.

Holascella euonyx Lendenfeld.

Figures 1–24.

1.— The end of a ray of an onychhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

2, 3.— The end of a ray of a large discohexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
2, focussed higher; 3, focussed lower.

4, 5.— The end of a ray of a large discohexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
4, focussed higher; 5, focussed lower.

6.— The end of a ray of an onychhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

7–9.— Onychhexactines and hemionychhexaster; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
7, 9, onychhexactines; 8, a hemionychhexaster.

10, 11.— Large discohexactines; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

12.— Apical view of the terminal spine-verticil (end-disc) of the upstanding ray of the large discohexactine represented in fig. 11; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

13.— Group of microscleres from a spicule-preparation; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
a, small discohexasters; b, onychhexactine.

14, 15.— Side-view of superficial hexactines; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

16.— The central part of a large tetractine principal spicule; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

17.— View of the specimen; reduced 1: 0.86; phot. Zeiss, Tessar 250 mm.

18.— A tetractine comital spicule; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

19, 20.— Two groups of comital and other medium-sized spicules; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

21, 22.— The distal part of the distal ray of a superficial hexactine; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
21, focussed higher; 22, focussed lower.

23, 24.— The distal part of the distal ray of a superficial hexactine; magnified 600; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
23, focussed higher; 24, focussed lower.

Farrea occa scutella Lendenfeld.

Figures 25–29.

25–29.— Small hexactines, attached and free; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
25, a hexactine attached to a stout beam of the main network;
26, a free hexactine;
27, 28, hexactines attached to slender beams;
29, hexactine attached to a medium beam.

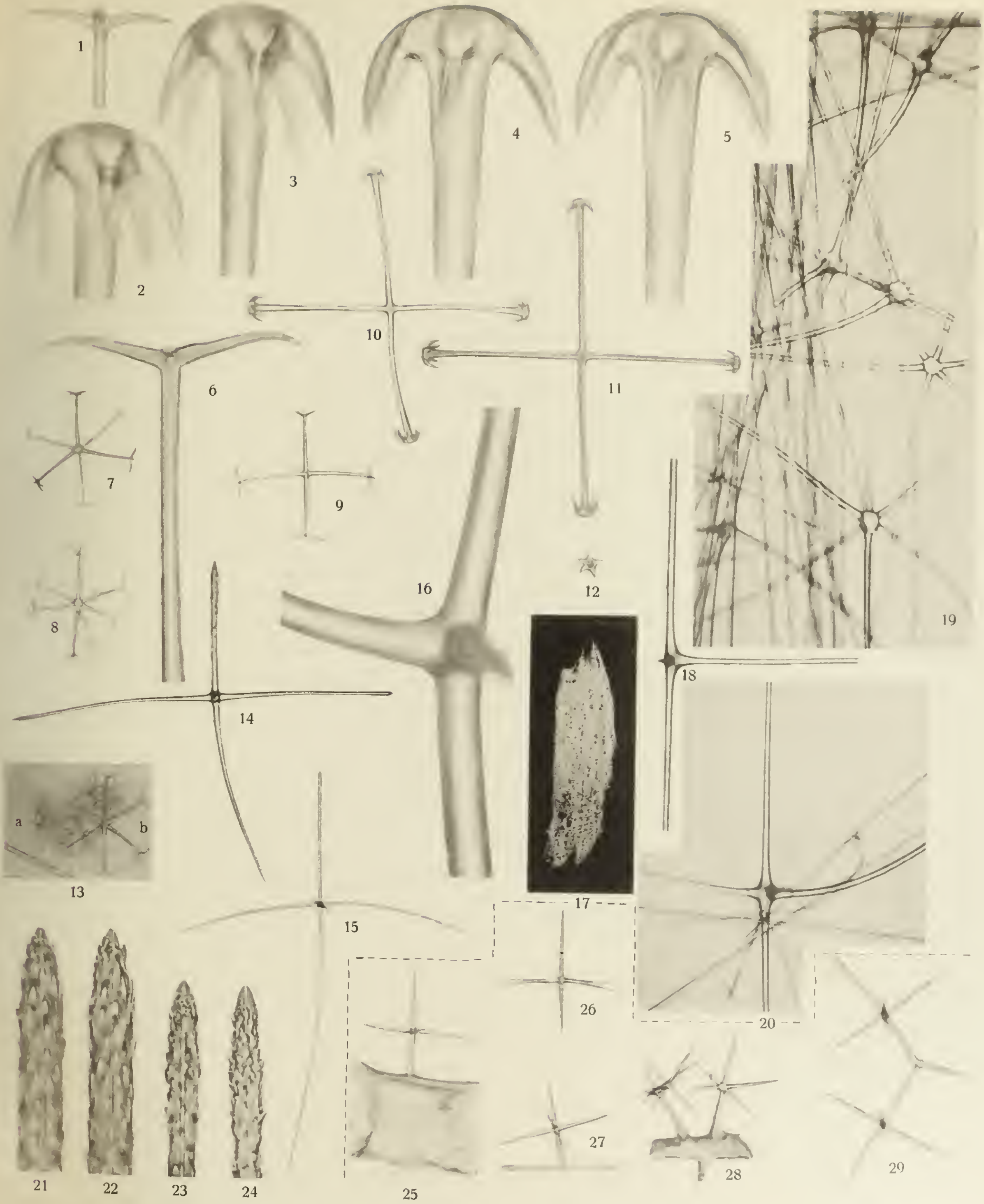


Fig. 1—24 Holascella euonyx n. sp.
Fig. 25—29 Farrea occa Bwbk. var. scutella n. var.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 26.

PLATE 26.

Farrea occa scutella LENDENFELD.

Figures 1–21.

1–3.— Parts of oxyhexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  1, the distal part of a main-ray with the basal parts of the end-rays arising from it;
  2, a whole end-ray;
  3, the centre and one main-ray with its end-rays.

4–6.— Oxyhexasters; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

7.— Oxyhexaster; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

8.— Surface-view of a dried portion of the marginal part of the body; magnified 30; phot. Zeiss, planar 30 mm.:
  a, superficial pentactines; b, clavules; c, oxyhexasters.

9.— The gastral face of a portion of the skeleton-net of the marginal part of the body; magnified 6.6; phot. Zeiss, planar 50 mm.

10.— View of the free upper face of the basal plate of attachment; magnified 6.6; phot. Zeiss, planar 50 mm.

11.— View of the previously attached lower face of the basal plate of attachment; magnified 100; phot Zeiss, apochr. 16, compens. oc. 6.

12, 13.— Portions of the skeleton-net of the upper part of the basal plate of attachment; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

14.— Portion of the skeleton-net of the marginal part of the body; magnified 6.6; phot. Zeiss, planar 50 mm.

15.— Apical view of a superficial pentactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

16, 17.— Views of the stalk and central part of the body of a small specimen from opposite sides; magnified 6.6; phot. Zeiss, planar 50 mm.

18, 19.— A specimen with two stalks (probably produced by the partial concrescence of two specimens growing near together); magnified 2.1; phot. Zeiss, anastig. 167 mm.:
  18, seen from the side;
  19, seen from above.

20, 21.— A regular specimen with a single stalk; magnified 2.1; phot. Zeiss, anastig. 167 mm.:
  20, seen from the side;
  21, seen from above.

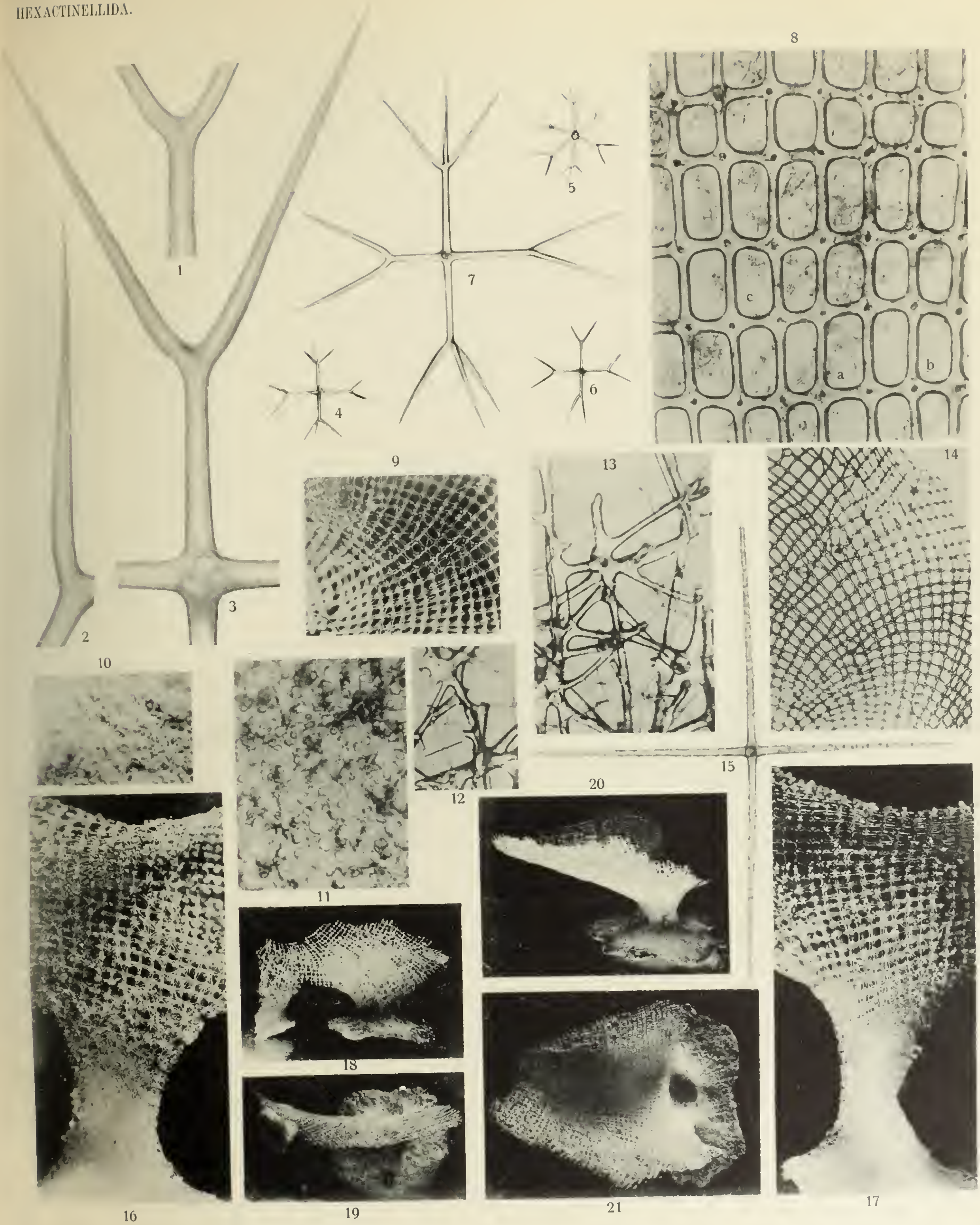


Fig. 1—21 Farrea occa Bwbk. var. scutella n. var.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 27.

PLATE 27.

Farrea occa scutella LENDENFELD.

Figures 1–17.

1.— A clavule with large teeth; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

2–5.— Centres (anchor-heads) of two clavules with large teeth; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:

2, a clavule-head focussed high;

3, the head of the same clavule focussed lower;

4, another clavule-head focussed high;

5, the head of the same clavule focussed lower.

6.— Group of spicules from a spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6: a, apical view of a pentactine; b, a clavule with large teeth; c, oxyhexasters.

7, 8.— Centre (anchor-head) of a clavule with large teeth; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:

7, focussed high; 8, focussed lower.

9, 10.— Centre (anchor-head) of a clavule with large teeth and apical protuberance; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:

9, focussed high; 10, focussed lower.

11.— A clavule with large teeth; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

12.— The centre (anchor-head) of a clavule with small teeth; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

13, 14.— The centre (anchor-head) of a clavule with large, conspicuously spined teeth; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

13, focussed a little higher; 14, focussed a little lower.

15.— The apical protuberance of a clavule with large teeth similar to the one whose anchor-head is represented in figs. 9, 10; magnified 2000; phot. Zeiss, q. monochr. 1.7, q. oc. 10.

16, 17.— The centre (anchor-head) of a clavule with large teeth hardly perceptibly spined; magnified 2000; phot. Zeiss, q. monochr. 1.7, q. oc. 10:

16, focussed high; 17, focussed low.

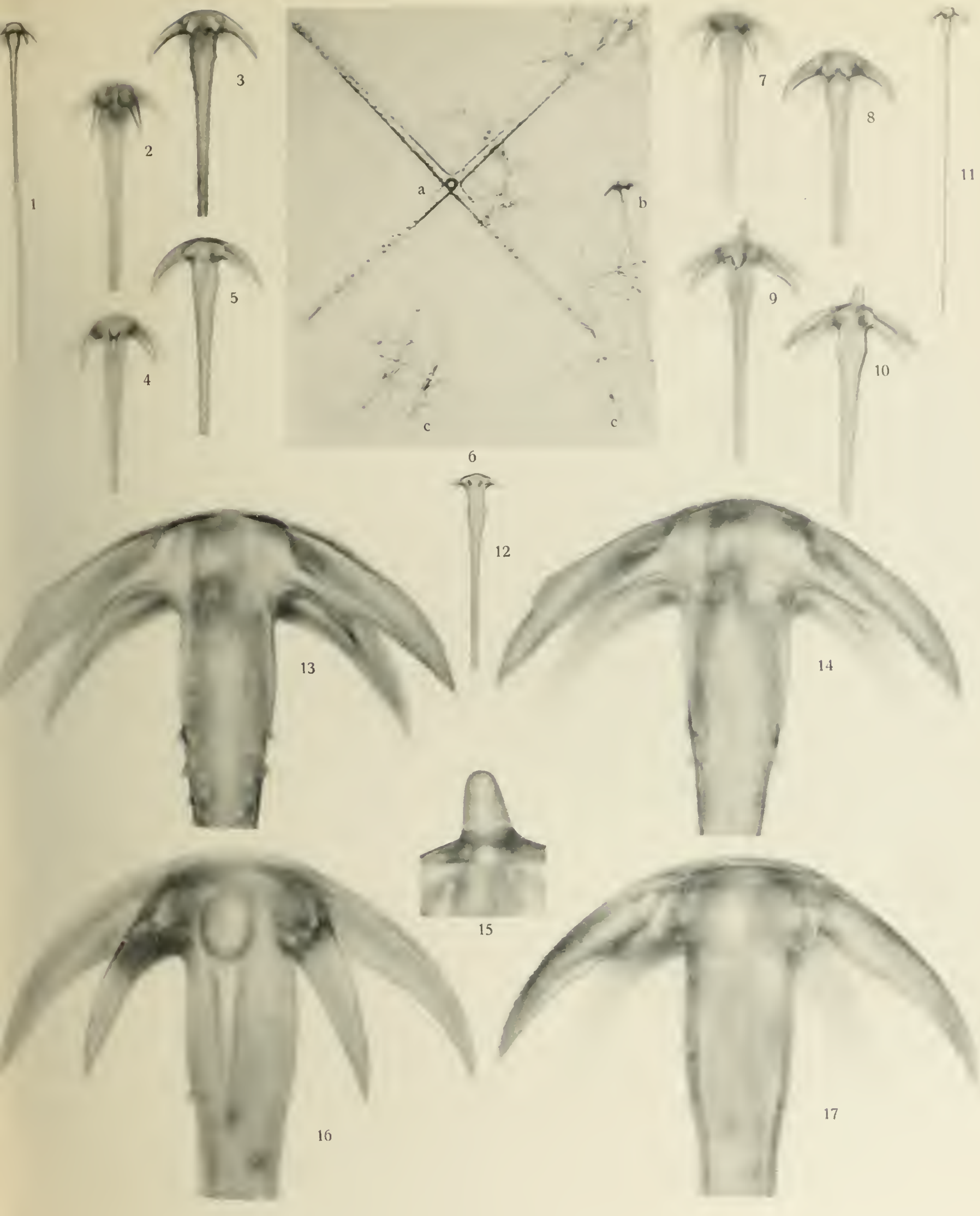


Fig. 1—17 Farrea occa Bwbk. var. scutella n. var.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 28.

PLATE 28.

Hexactinella monticularis LENDENFELD.

Figures 1–28.

1–4.— Four scopules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
5–7.— The centres and end-rays of three scopules; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
8, 9.— The centre of a scopule; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
8, focussed higher; 9, focussed lower.
10.— Part of an uncinate; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
11, 12.— Parts of discohexasters; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
11, the end of an end-ray of a small discohexaster seen obliquely from above;
12, an entire end-ray of a large discohexaster.
13, 14.— The centres and end-rays of two scopules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
15, 16.— Two large discohexasters; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
17, 18.— Parts of long-spined hexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
19.— Apical view of a superficial pentactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
20.— Part of a small discohexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
21.— Part of the superficial skeleton-net (pentactines soldered together); magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
22.— Part of a beam of the skeleton-net with a spine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
23.— The skeleton-net of part of a specimen; magnified 3.5; phot. Zeiss, planar 100 mm.
24.— Part of a transverse section through a superficial portion of the skeleton; magnified 20; phot. Zeiss, planar 20 mm.:
a, internal skeleton-net; b, spines protruding towards the surface.
25.— Group of discohexasters from a spicule-preparation; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
26.— Portion of the inner, sectioned face of a skeleton-net cut longitudinally in half; magnified 6.6; phot. Zeiss, planar 50 mm.
27.— Part of the superficial skeleton-net (pentactines soldered together); magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
28.— Surface-view of the skeleton-net of one of the monticular protuberances of the surface; magnified 6.6; phot. Zeiss, planar 50 mm.

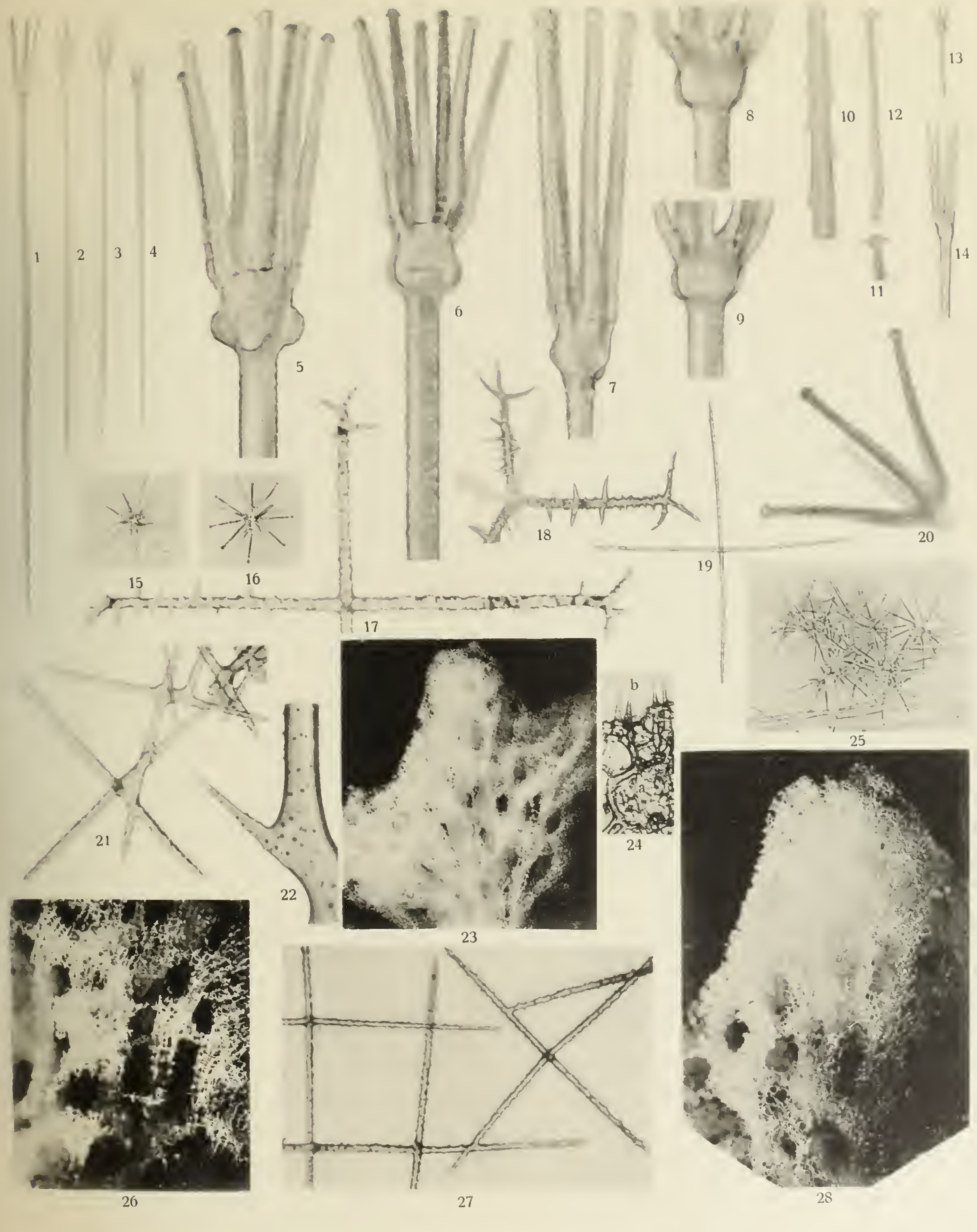


Fig. 1—28 Hexactinella monticularis n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 29.

PLATE 29.

Eurete spinosum Lendenfeld.

Figures 1–26.

1, 2.— Scopules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

3–6.— The centres and end-rays of two scopules; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
3, a scopule-centre focussed high;
4, the centre of the same scopule focussed lower;
5, the centre of another scopule focussed high;
6, the centre of the same scopule focussed lower.

7, 8.— The centre and end-rays of a scopule; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
7, focussed higher; 8, focussed lower.

9.— The central part of a hemioxyhexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

10–13.— Hemioxyhexasters and parts of such; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12:
10, an ordinary, fairly regular, slender-rayed hemioxyhexaster;
11, 13, parts of ordinary, fairly regular, slender-rayed hemioxyhexasters;
12, a stout-rayed irregular hemioxyhexaster.

14–17.— The distal end-parts of main-rays of hemioxyhexasters with one of the end-rays or part of it; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

18, 19.— The two faces of the skeleton-net; magnified 6.6; phot. Zeiss, planar 50 mm.:
18, the dermal face;
19, the gastral face.

20, 21.— Apical views of two superficial pentactines (the crosses formed by their lateral rays); magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

22.— A lateral ray of a superficial pentactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

23.— Part of the dermal zone of the skeleton-net; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4.

24.— Part of the gastral zone of the skeleton-net; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

25.— Part of the gastral zone of the skeleton-net; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4.

26.— Group of spicules from a spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
a, a scopule; b, hemioxyhexasters.

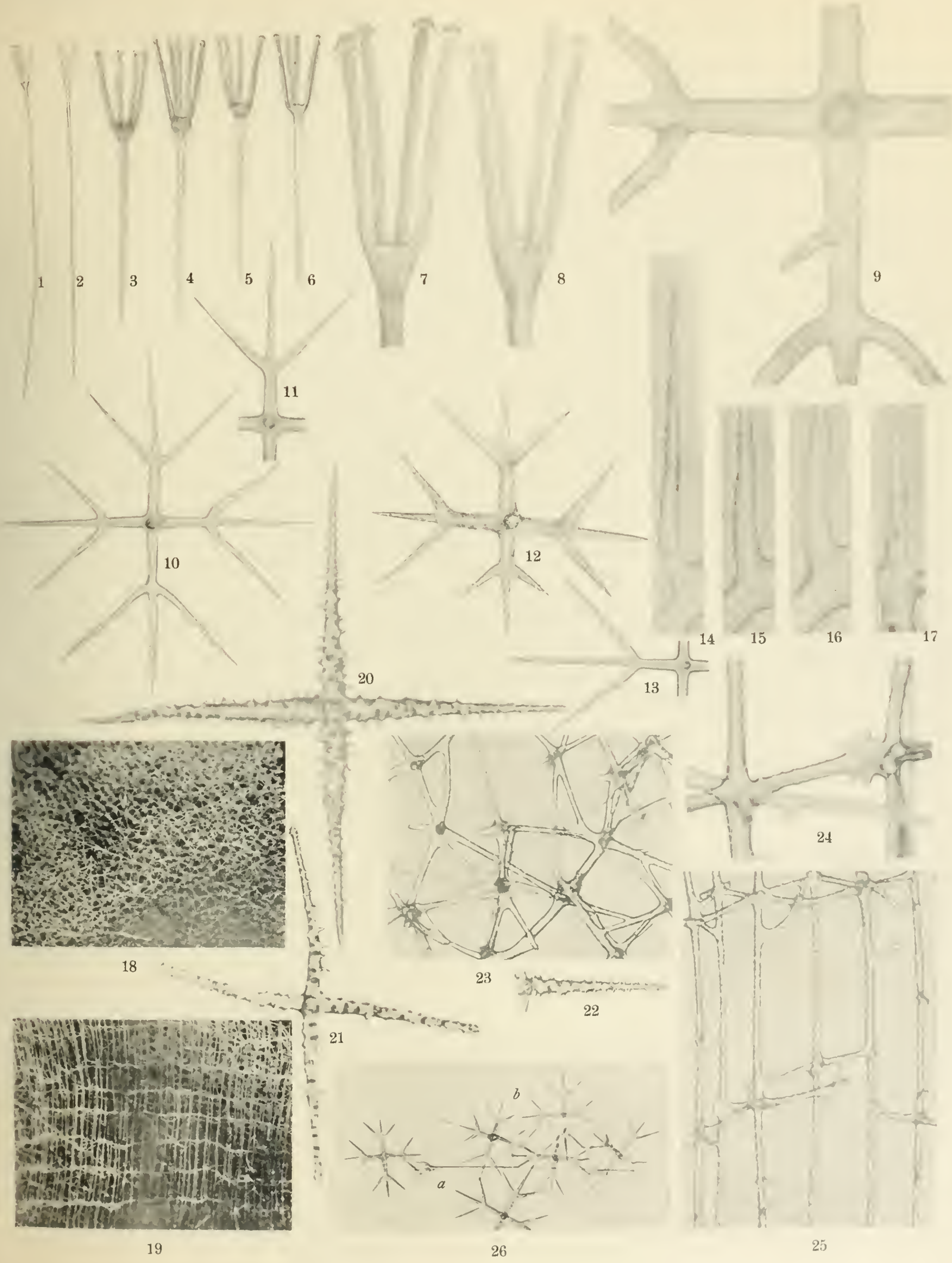


Fig. 1-26 Eurete spinosum n. sp.

Lendenfeld photographed

Lichtdruck von Werner & Winter, Frankfurt a. M.

PLATE 30.

PLATE 30.

Eurete erectum Schulze.

Figures 1–17.

1–3.— Side-views of gastral pinules (pinule-derivates); magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

4.— The dermal face of the skeleton-net; magnified 6.6; phot. Zeiss, planar 50 mm.

5.— The gastral face of the skeleton-net; magnified 2.1; phot. Zeiss, anastig. 167 mm.

6.— The gastral face of the dictyonal skeleton-net; magnified 6.6; phot. Zeiss, planar 50 mm.

7.— Transverse section through the dermal zone of the tube-wall; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

a, lateral rays of dermal pinules; c, flagellate chambers; d, distal ray of a dermal pinule; e, dermal spine of the skeleton-net; f, skeleton-net.

8.— Apical view of a gastral pinule-derivate; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

9.— Side-view of a gastral pinule; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

10.— Transverse section through the dermal zone of the tube-wall; methyl-violet; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

a, lateral rays of dermal pinules; c, flagellate chambers; d, distal ray of dermal pinule; e, dermal spine of the skeleton-net; f, skeleton-net.

11.— View of portion of the gastral face of the skeleton-net; magnified 20; phot. Zeiss, planar 20 mm.

12.— Transverse section through the tube-wall; magnified 30; phot. Zeiss, planar 20 mm.:

a, lateral rays of dermal pinules; b, lateral rays of gastral pinules; d, distal ray of dermal pinules; f, skeleton-net; g, gastral spines of the skeleton-net; h, distal rays of gastral pinules.

13, 14.— Apical views of gastral pinules (pinule-derivates); magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

15.— Transverse section through the gastral zone of the tube-wall; magenta; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

b, lateral rays of gastral pinules; i, gastral scopules.

16.— View of the sponge; magnified 1.2; phot. Zeiss, anastig. 480/412 mm.

17.— Transverse section through the tube-wall; magenta; magnified 30; phot. Zeiss, planar 20 mm.:

a, lateral rays of dermal pinules; b, lateral rays of gastral pinules; c, flagellate chambers; d, distal rays of dermal pinules; f, skeleton-net; g, gastral spines of the skeleton-net; h, distal rays of gastral pinules; i, gastral scopules.

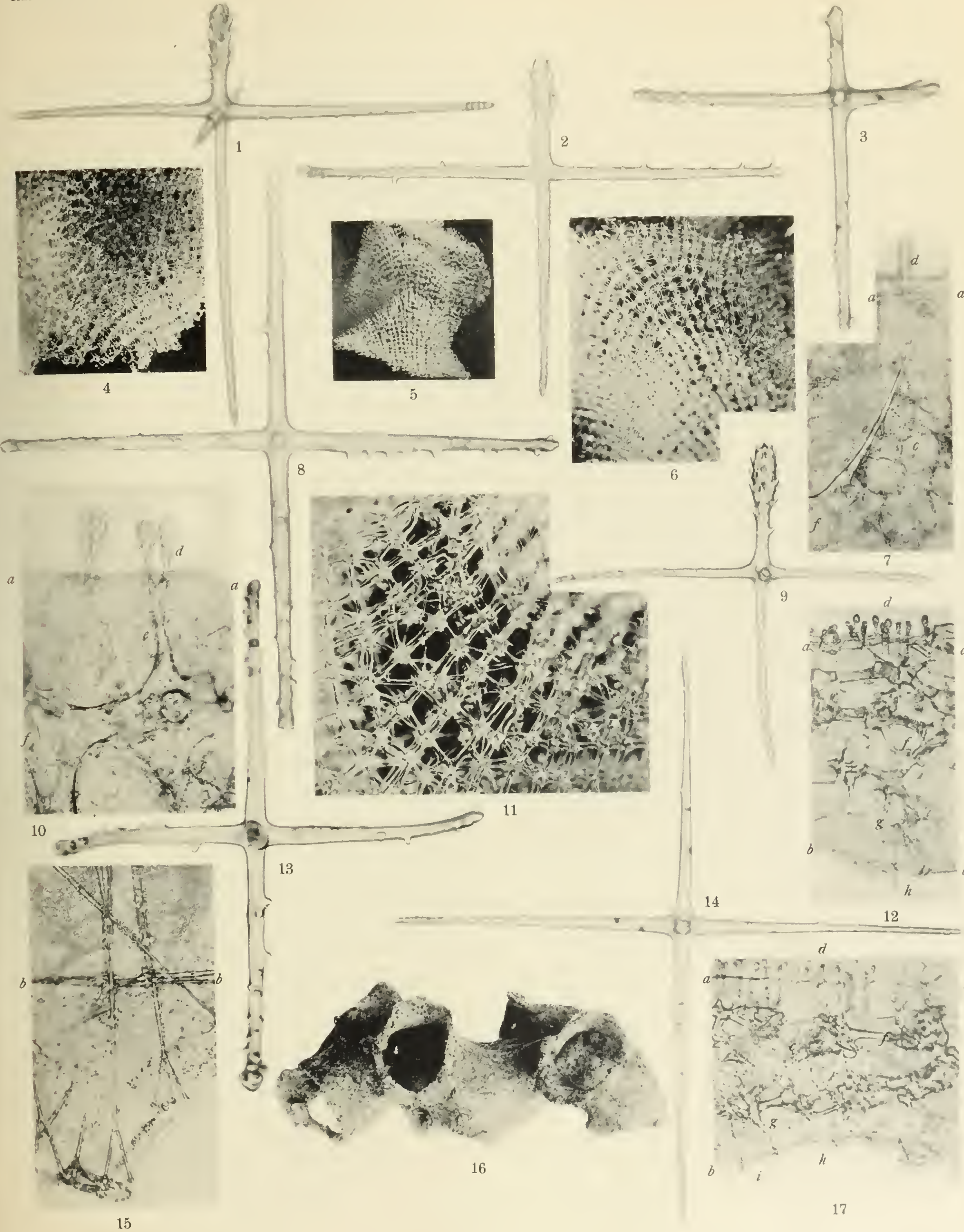


Fig. 1-17 Eurete erectum F. E. Sch.

Lendenfeld photographed

Lichtdruck von Werner & Winter, Frankfurt a. M.

PLATE 31.

PLATE 31.

Eurete erectum SCHULZE.

Figures 1–28.

1.— Centres and end-rays of two gastral scopules with large-headed, strongly divergent end-rays; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

2–5.— Side-views of dermal pinules; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

6–9.— The distal ends of end-rays of two rather large-headed gastral scopules; magnified 1200; phot. Zeiss, H.I. 1/12, compens. oc. 12:
6, an end-ray head focussed high;
7, the head of the same end-ray focussed lower;
8, the head of another end-ray focussed high;
9, the head of the same end-ray focussed lower.

10–12.— The centre and the end-rays of a gastral scopule with large-headed, fairly divergent end-rays; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
10, focussed high; 11, focussed lower; 12, focussed still lower.

13.— Part of a large uncinate; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

14.— A small uncinate; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

15.— Part of a discohexaster; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

16.— Group of scopules from a spicule-preparation; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, two gastral scopules with strongly divergent, large-headed end-rays; b, a dermal scopule with nearly parallel, terminally not thickened end-rays.

17.— The centre and end-rays of a dermal scopule with fairly divergent, terminally only very slightly thickened end-rays; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

18.— An end-ray of a discohexaster; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

19.— The centre and end-rays of a dermal scopule with nearly parallel, terminally not thickened end-rays; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

20.— A gastral scopule with fairly divergent, large-headed end-rays; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

21.— A discohexaster; magnified 600; phot. Zeiss, apochr. 4, compens. oc. 12.

22.— Part of the gastral membrane with the crosses formed by the lateral rays of the gastral pinules and pinule-derivates *in situ;* magnified 30; phot. Zeiss, planar 20 mm.

23.— Two gastral scopules with fairly divergent, large-headed end-rays; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

24.— Transverse section through the gastral zone of the tube-wall; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
b, lateral rays of gastral pinules; f, skeleton-net; g, gastral spines of the skeleton-net; h, distal rays of the gastral pinules; i, gastral scopules.

25–28.— Parts of gastral scopules; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
25, basal part of an end-ray;
26, distal part of an end-ray;
27, 28, centres of two different scopules.

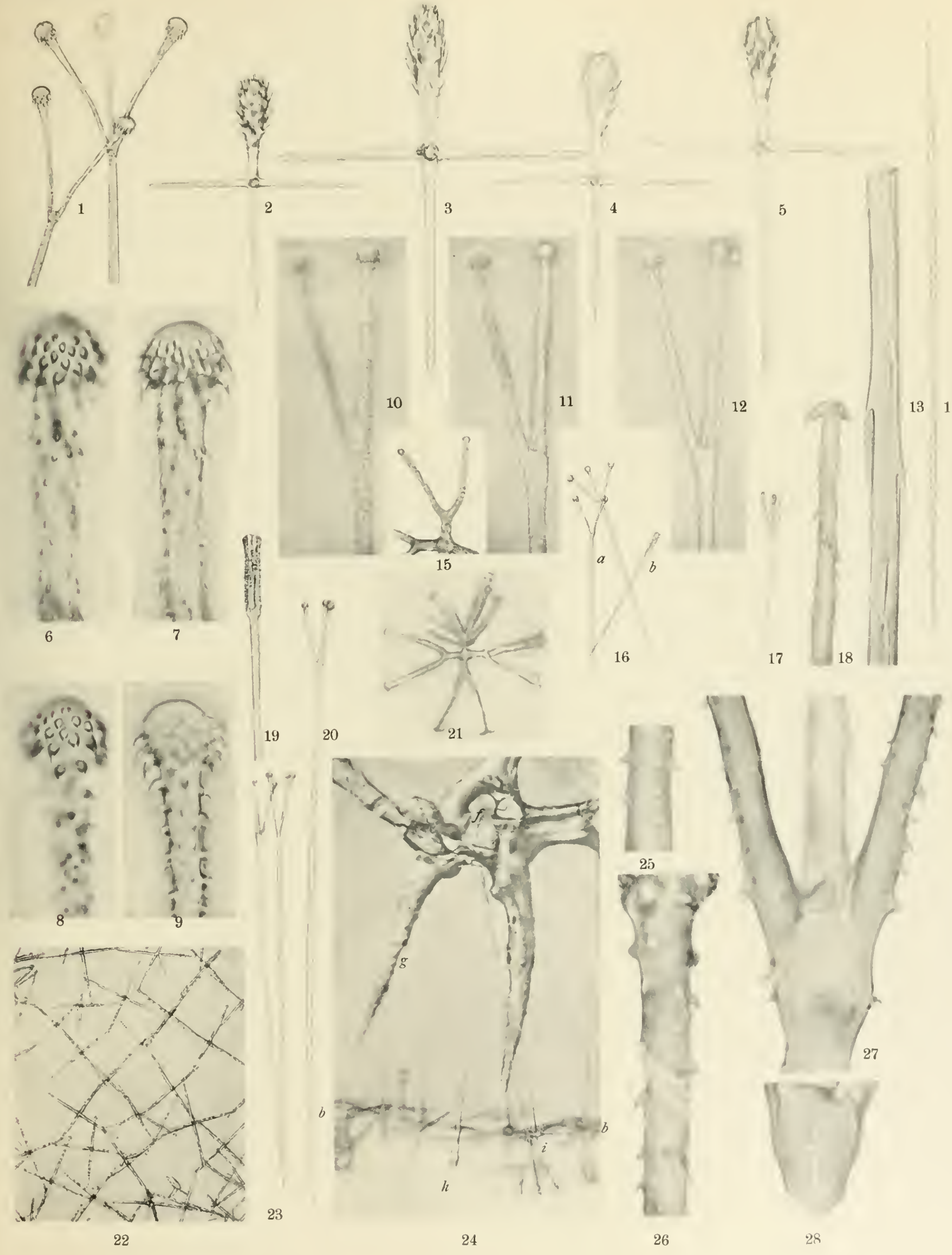


Fig. 1-28 Eurete erectum F. E. Sch.

Lendenfeld photographed

PLATE 32.

PLATE 32.

Farrea sp. Station 4631.

Figures 1–3.

1.— View of the skeleton-net; magnified 2; phot. Zeiss, anastig. 167 mm.
2, 3.— The two faces of the skeleton-net of the wall of the tubular sponge; magnified 8; phot. Zeiss, planar 50 mm.:
  2, the dermal face;
  3, the gastral face.

Euretid. Station 4651.

Figures 4–6.

4.— View of the skeleton-net; natural size; phot. Zeiss, anastig. 480/412 mm.
5, 6.— The two faces of the skeleton-net of the wall of the funnel-shaped sponge; magnified 8; phot. Zeiss, planar 50 mm.:
  5, the inner, concave (gastral?) face;
  6, the outer, convex (dermal?) face.

Chonelasma sp. Station 3689.

Figures 7–9.

7.— View of the skeleton-net; natural size; phot. Zeiss, anastig. 480/412 mm.
8, 9.— The two faces of the skeleton-net of the thick, curved, lamellar sponge; magnified 8; phot. Zeiss, planar 50 mm.:
  8, the convex (dermal?) face;
  9, the concave (gastral?) face.

Caulophacid. Station 3689.

Figures 10–12.

10.— View of the skeleton-net; natural size; phot. Zeiss, anastig. 480/412 mm.
11, 12.— The two faces of the skeleton-net of the wall of the tubular specimen; magnified 8; phot. Zeiss, planar 50 mm.:
  11, the inner, concave (gastral?) face;
  12, the outer, convex (dermal?) face.

Hexactinella sp. Station 4631.

Figures 13–15.

13.— View of the skeleton-net; natural size; phot. Zeiss, anastig. 480/412 mm.
14, 15.— The two faces of the skeleton-net of the thick-walled, funnel-shaped sponge; magnified 8; phot. Zeiss, planar 50 mm.:
  14, the outer, convex face;
  15, the inner, concave face.

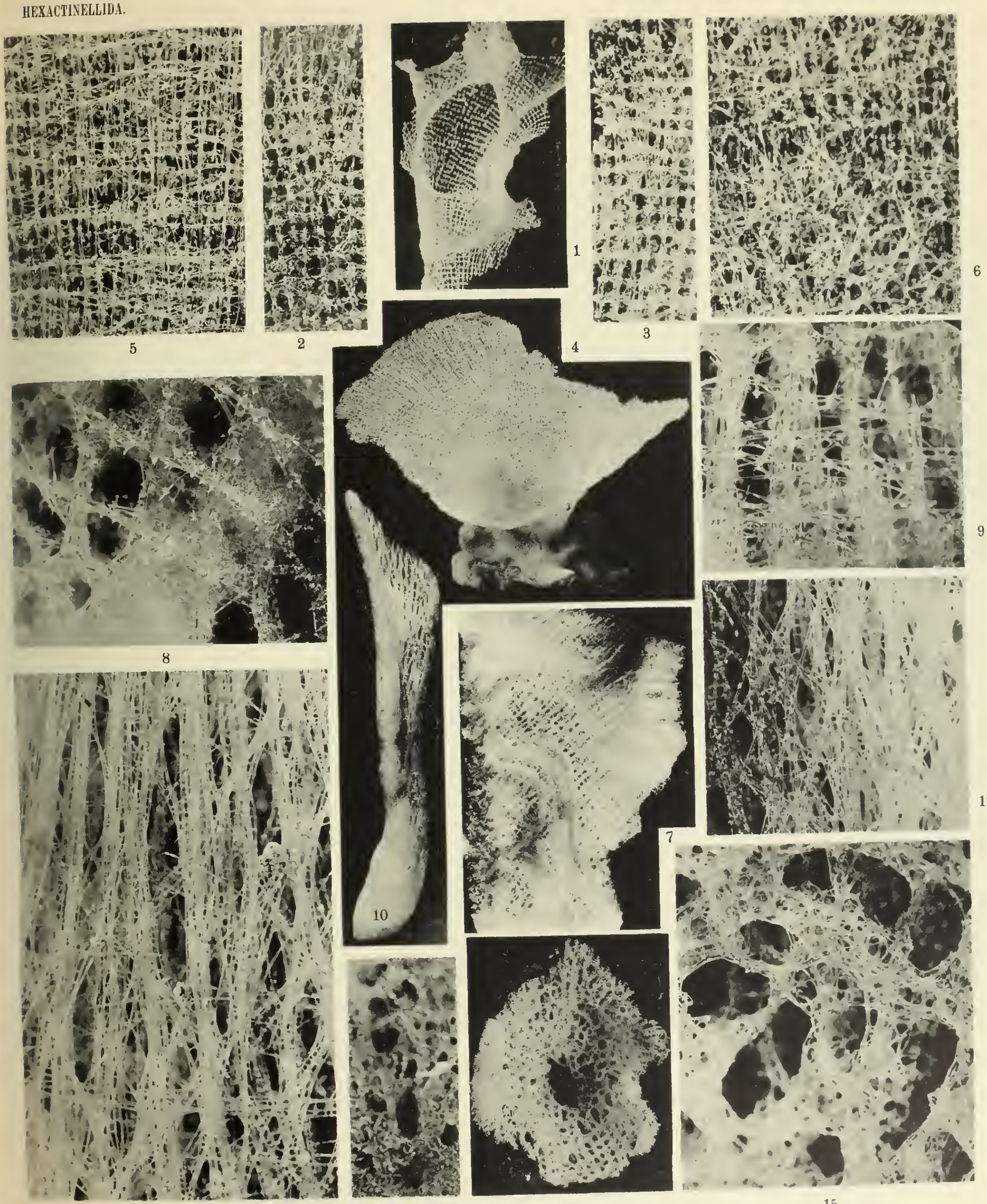


Fig. 1-3 Hexactinellid B (Farrea sp.?) from station 4631. Fig. 4-6 Hexactinellid (Euretid?) from station 4651. Fig. 7-9 Hexactinellid B (Chonelasma?) from station 3689. Fig. 10-12 Hexactinellid A (Caulophacid?) from station 3689. Fig. 13-15 Hexactinellid A (Hexactinella?) from station 4631.

Lendenfeld photographed

PLATE 33

PLATE 33.

Hyalonema (Hyalonema) obtusum gracilis Lendenfeld.

Figures 1–24.

1, 2.— Centrotyle amphioxes; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
3.— Group of small hypodermal amphioxes; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
4.— Small hypodermal amphiox; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
5–14.— Side-views of hypodermal pentactines; magnified 50; phot. Zeiss, achr. aa, compens. oc. 2.
15.— View of the sponge; magnified 1.1; phot. Zeiss, anastig. 480/412 mm.
16.— View of the sectioned face of the sponge cut in half longitudinally and axially; magnified 2; phot. Zeiss, anastig. 167 mm.:
a, oral cone; b, lower end (place where the stalk is broken off).
17.— The tip of a lateral ray of a hypodermal pentactine; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
18–23.— Rhabds of the supporting skeleton; magnified 50; phot. Zeiss, achr. aa, compens. oc. 2:
18, 19, small, slightly centrotyle amphioxes;
20, tylostyle;
21, medium centrotyle amphiox;
22, medium amphiox;
23, large amphiox.
24.— Oblique apical view of a hypodermal pentactine; magnified 50; phot. Zeiss, achr. aa, compens. oc. 2.

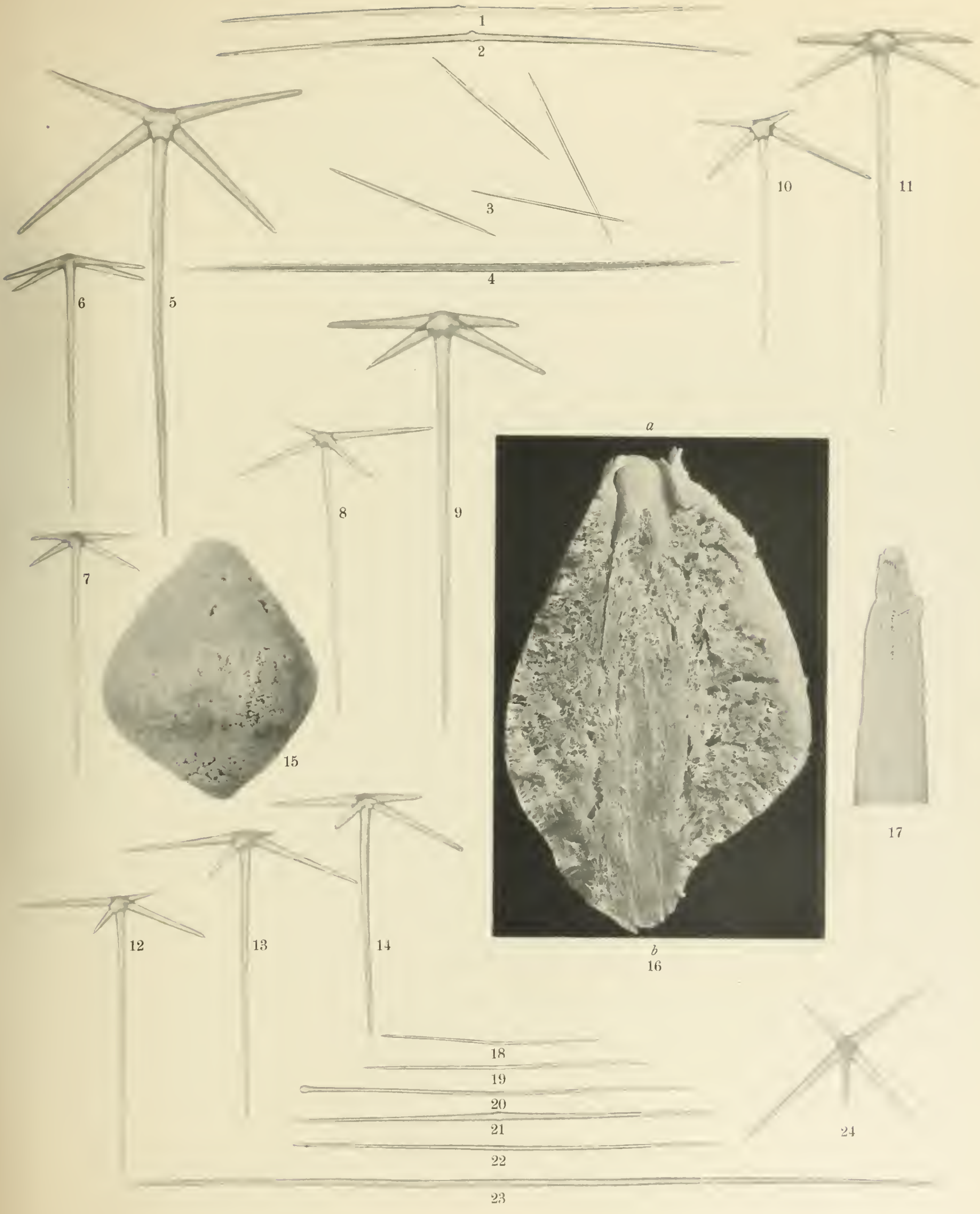


Fig. 1-24 Hyalonema obtusum n. sp. var. gracilis.

Lendenfeld photographed

PLATE 34.

PLATE 34.

Hyalonema (Hyalonema) obtusum gracilis Lendenfeld.

Figures 1–19.

1.— Section vertical to the surface, through a superficial part of the sponge; magnified 30; phot. Zeiss, planar 20 mm.:

a, dermal membrane; b, subdermal cavities; c, a hypodermal pentactine with reduced and terminally rounded apical ray.

2.— Radial section through the choanosome; magenta; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

3.— Axial section through the oral cone and the adjacent parts of the upper end of the sponge; magenta; magnified 5; phot. Zeiss, planar 50 mm.:

a, outer surface (dermal membrane); b, narrow fissure-like gastral cavity between the oral cone and the oral frill; c, summit of the oral cone.

4.— Axial section through the lower part of the sponge; magenta; magnified 5; phot. Zeiss, planar 50 mm.

5–18.— Choanosomal hexactines of the supporting skeleton; magnified 50; phot. Zeiss, achr. aa, oc. 2:

5–7, 10, 12, situated with one axis (two rays) parallel to the optical axis, and two axes (four rays) in a plane vertical to the optical axis;

8, 9, 11, 13–18, situated with the tips of three of the rays in a plane vertical to the optical axis;

5–7, 11, 15, 16, 18, medium-sized hexactines;

8, 10, 13, 17, large hexactines;

9, 12. 14, small hexactines.

19.— Radial section through the superficial part of the sponge; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

a, dermal membrane; b, group of small macramphidiscs; c, subdermal cavity; d, hexactines of the supporting skeleton.

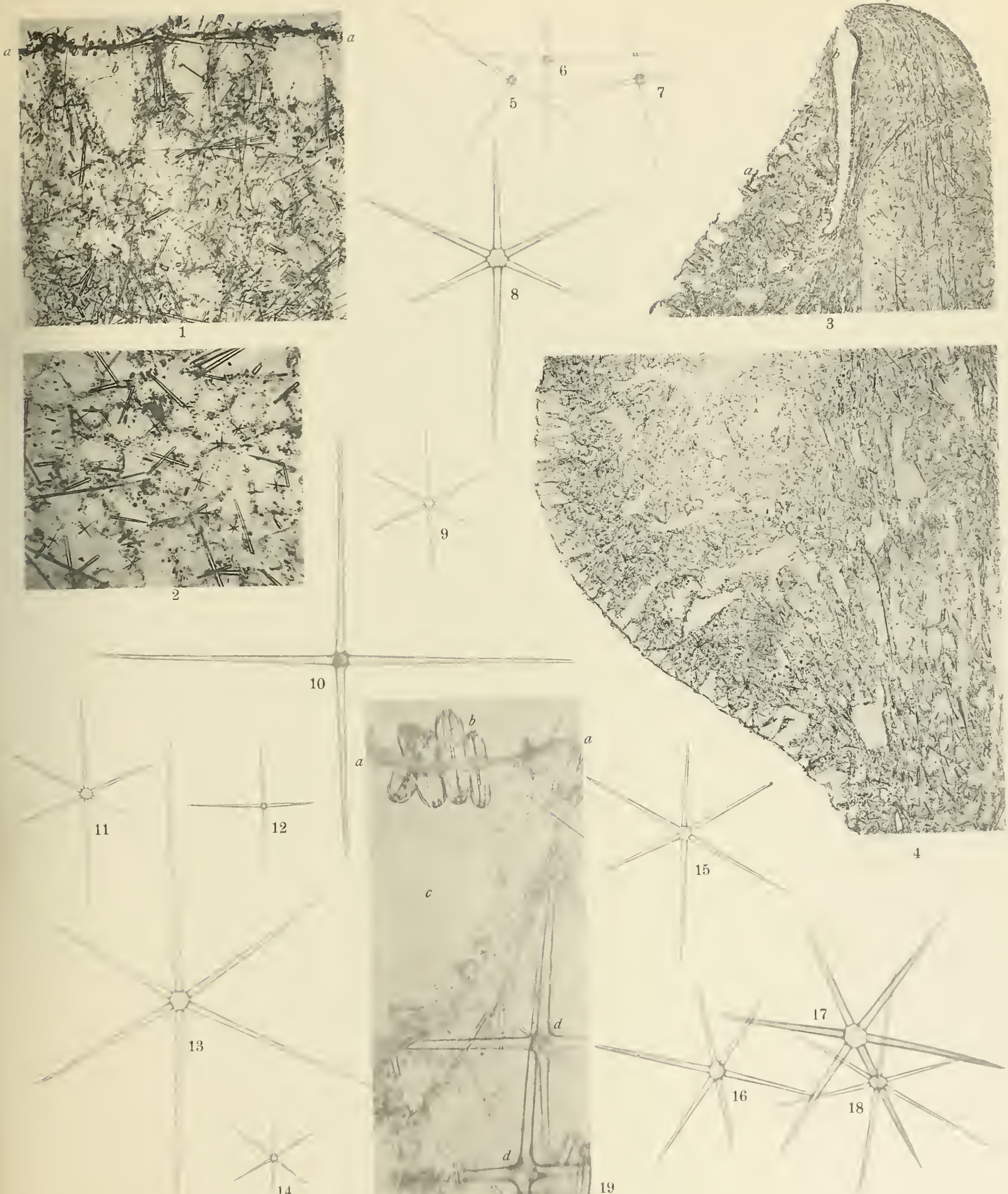


Fig. 1-19 Hyalonema obtusum n. sp. var. gracilis.

Lendenfeld photographed

PLATE 35.

PLATE 35.

Hyalonema (Hyalonema) obtusum gracilis LENDENFELD.

Figures 1–37.

1.— Radial section through the gastral membrane on the outer wall of the gastral cavity; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, pinule-fur.
2.— Apical view of the lateral rays of a gastral pentactine pinule; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
3.— Radial section through the gastral membrane on the oral cone; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, pinule-fur.
4–9.— Side-views of gastral pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
4, a hexactine gastral pinule;
5–9, pentactine gastral pinules.
10–13.— Diactine pinules of the oral frill; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
14, 15.— The end-part of a ray of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
14, focussed higher; 15, focussed lower.
16.— The surface of the oral cone viewed from above; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
17.— Group of microscleres from a centrifuge spicule-preparation; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
a, microhexactines; b, small micramphidiscs.
18–22.— Microhexactines and microhexactine-derivates; magnified 500; phot. Zeiss, II. I. apochr. 2, compens. oc. 6:
18, 19, regular microhexactines;
20–22, microhexactine-derivates with two well-developed and four less (20) or more (21) or quite (22) reduced rays.
23.— Apical view of the lateral rays of a dermal pentactine pinule; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
24.— Radial section through the dermal membrane on the outer surface; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, pinules; b, small macramphidisc.
25.— Dermal pentactine pinule with angularly bent apical (distal) ray; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
26–28.— The distal part (centrum and distal ray) of diactine pinules of the oral frill; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
29–37.— Side-views of dermal pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
29, 30, hexactine dermal pinules;
31–37, pentactine dermal pinules.

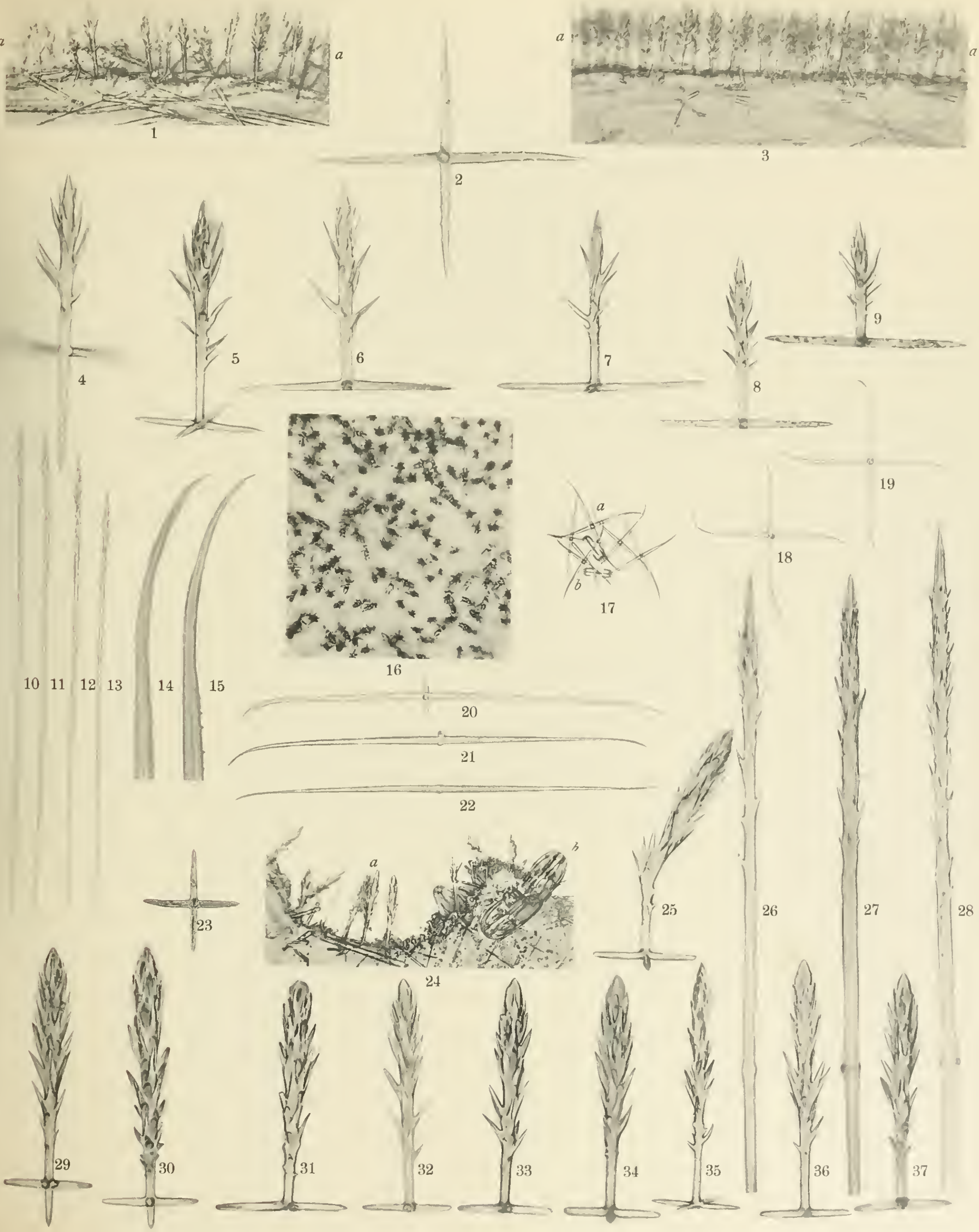


Fig. 1-37 Hyalonema obtusum n. sp. var. gracilis.

Lendenfeld photographed

PLATE 36.

PLATE 36.

Hyalonema (Hyalonema) obtusum gracilis Lendenfeld.

Figures 1–45.

1–25.— Tetractine acanthophores of the sheaths enclosing the large stalk-spicules in the basal part of the sponge-body; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

1–13, forms with rays not very different in size;

14–25, forms in which one or two of the rays are markedly reduced.

26.— Part of an axial section through the basal part of the sponge-body; magnified 30; phot. Zeiss, planar 20 mm.:

a, space previously occupied by a large stalk-spicule.

27, 28.— Ray-ends of the tetractine acanthophore of the sheaths enclosing the large stalk-spicules in the basal part of the sponge-body; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

29–36.— Rhabd-acanthophores of the sheaths enclosing the large stalk-spicules in the basal part of the sponge-body; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

29, 32–36, tylostyles;

30, amphistrongyle;

31, centrotyle style.

37, 38.— The two ends of the amphistrongyle acanthophore represented in fig. 30; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

39–44.— Diactine acanthophores of the sheaths enclosing the large stalk-spicules in the basal part of the sponge-body; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

39, an angularly bent, slender, centrotyle diactine;

40–44, slightly curved, stout, centrotyle diactines.

45.— Strongly curved style acanthophore of the sheaths enclosing the large stalk-spicules in the basal part of the sponge-body; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

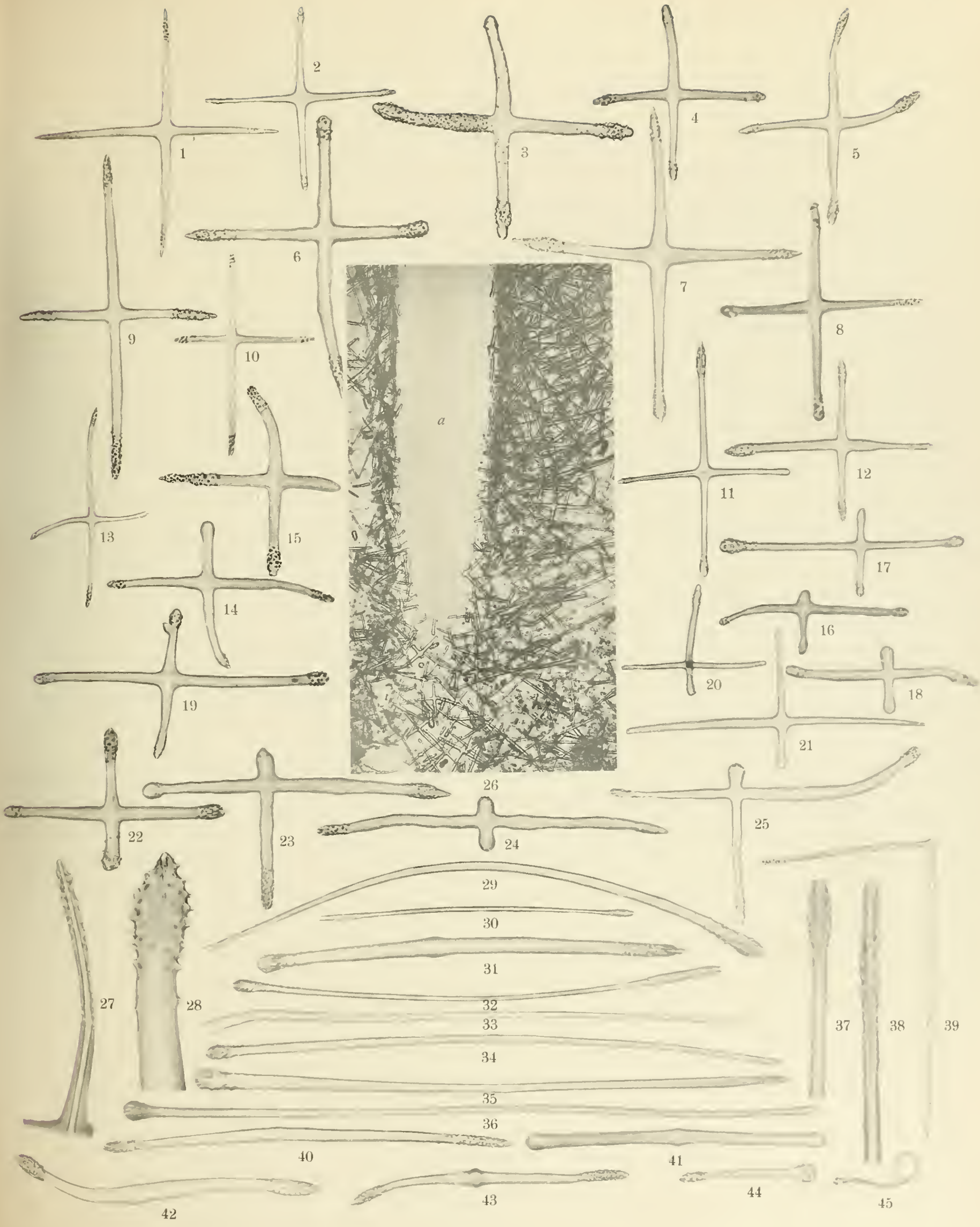


Fig. 1-45 Hyalonema obtusum n. sp. var. gracilis.

Lendenfeld photographed

PLATE 37.

PLATE 37.

Hyalonema (Hyalonema) obtusum gracilis Lendenfeld.

Figures 1–22.

1–5.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
6–11.— Large micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
12, 13.— A small macramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  12, focussed higher; 13, focussed lower.
14–19.— Small macramphidiscs; magnified 500:
  14, 16, 18, 19, phot. Zeiss, H. I. apochr. 1, compens. oc. 6;
  15, 17, phot. Zeiss, apochr. 4, compens. oc. 12.
20.— A large macramphidisc; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.
21, 22.— A large macramphidisc; magnified 500:
  21, u. v. phot. Zeiss, q. monochr. 6, q. oc. 10, and focussed higher;
  22, phot. Zeiss, apochr. 4, compens. oc. 12, and focussed lower.

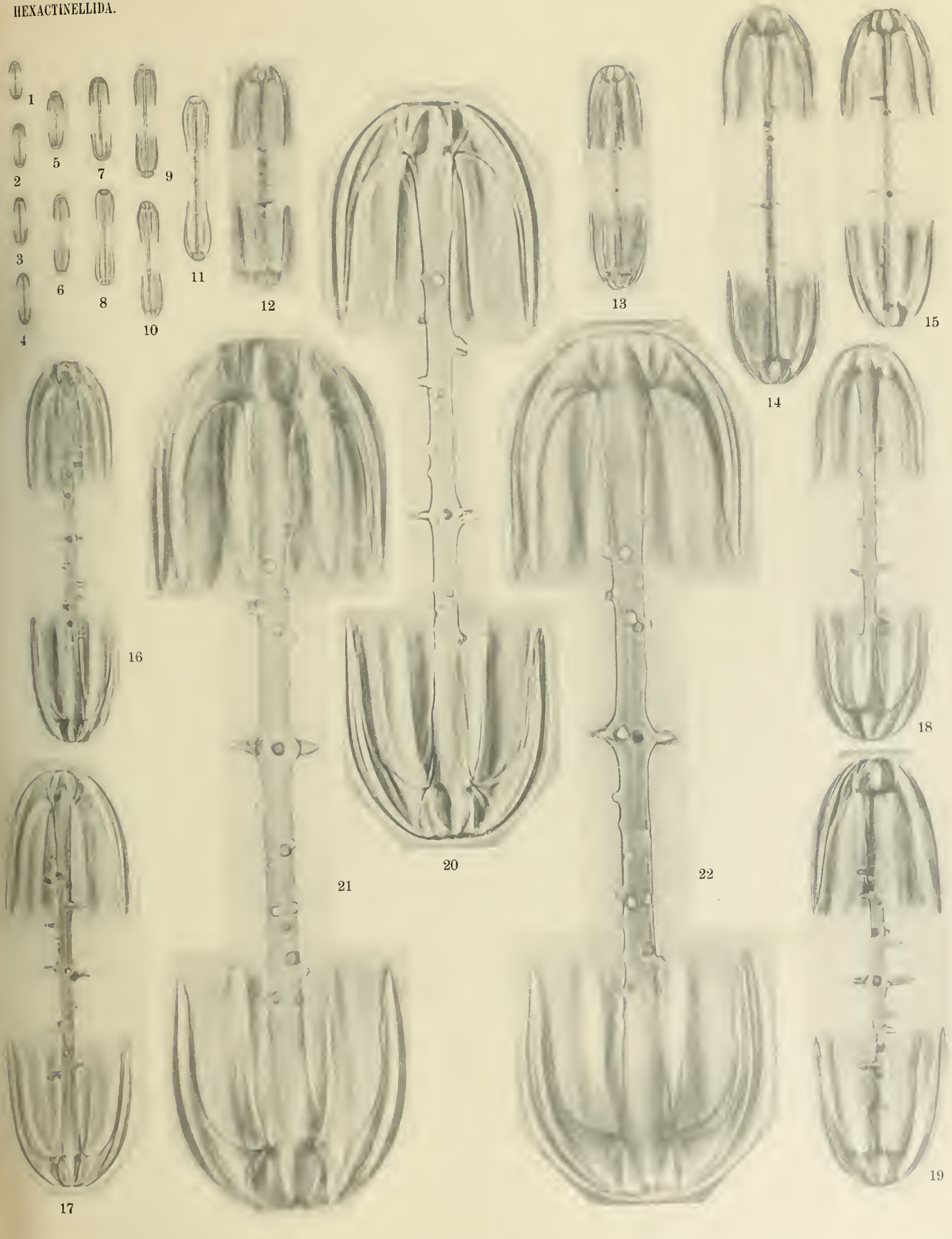


Fig. 1-22 *Hyalonema (Hyalonema) obtusum n. sp. var. gracilis.*

Lendenfeld photographed.

PLATE 38.

PLATE 38.

Hyalonema (Hyalonema) obtusum gracilis LENDENFELD.

Figures 1–8.

1–3.— A small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
1, focussed high; 2, focussed lower; 3, focussed still lower.

4, 5.— The central part of the shaft of a small macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
4, focussed lower; 5, focussed higher.

6.— Part of the tooth-verticil of a small macramphidisc, focussed high to show the two uppermost anchor-teeth: magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

7, 8— Part of the tooth-verticil of the small macramphidisc, the central part of the shaft of which is shown in figs. 4 and 5; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
7, focussed higher; 8, focussed lower.

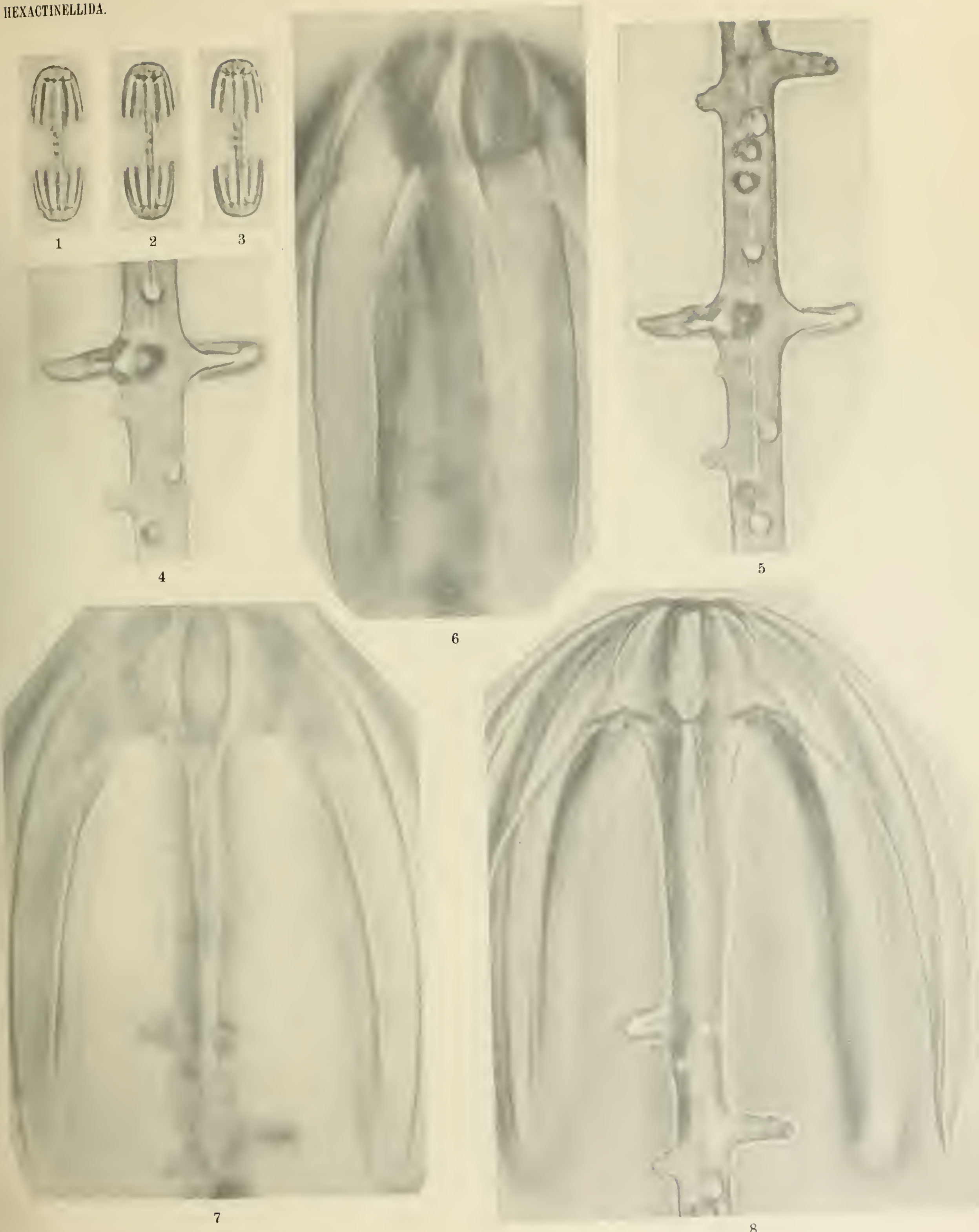


Fig. 1-8 Hyalonema (Hyalonema) oblusum n. sp. var. gracilis.

Lendenfeld photographed.

PLATE 39.

PLATE 39.

Hyalonema (Hyalonema) obtusum gracilis Lendenfeld.

Figures 1–10.

1.— An intermediate acanthophore with large spines, from the basal felt; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

2–4.— Slender-rayed acanthophore with long spines and parts of such, from the basal felt; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

5.— A very young hexactine; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

6.— Part of lean acanthophore from the basal felt; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

7–10.— Pachymicrohexactines from the basal part of the sponge; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:

- 7, a small one with stout, nearly straight rays;
- 8, a large one with more slender rays;
- 9, 10, a large one with very stout rays;
  - 9, focussed higher; 10, focussed lower.

Hyalonema (Hyalonema) obtusum robusta Lendenfeld.

Figures 11–41.

11, 12.— Parts of intermediate acanthophores with large spines, from the basal felt; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

- 11, a central part of a triactine;
- 12, the tip of a ray.

13–16.— Parts of slender-rayed acanthophores with large spines, from the basal felt; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

- 13–15, tips of rays;
- 16, the central part of a triactine.

17–21.— Stout-rayed tetractine and tetractine-derivate acanthophores from the cement surrounding the upper parts of the large stalk-spicule imbedded in the sponge-body; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

- 17, an angularly bent diactine;
- 18–20, tetractines;
- 21, a triactine.

22–24.— Parts of the felt, composed chiefly of the slender-rayed acanthophores with long spines, in the basal part of the sponge:

- 22, 23, magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6;
- 24, magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

25, 26.— Uncinate amphioxes; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

27–29.— Parts of the uncinate amphiox represented in fig. 26; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

- 27, the end from which the spines diverge;
- 28, the central part;
- 29, the end towards which the spines are inclined.

30.— Part of an uncinate amphiox; magnified 2000; phot. Zeiss, q. monochr. 1.7, q. oc. 10.

31, 32.— Two small, fairly regular hypodermal pentactines; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4:

- 31, a side-view;
- 32, an apical view.

33.— View of the specimen; reduced 1: 0.85; phot. Zeiss, anastig. 480/412 mm.

34–38.— Rhabd-acanthophores; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

39.— An angularly bent diactine; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

40, 41.— Larger hypodermal pentactines; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4:

- 40, side-view of a fairly regular one;
- 41, apical view of an irregular one with one of the lateral rays reduced.

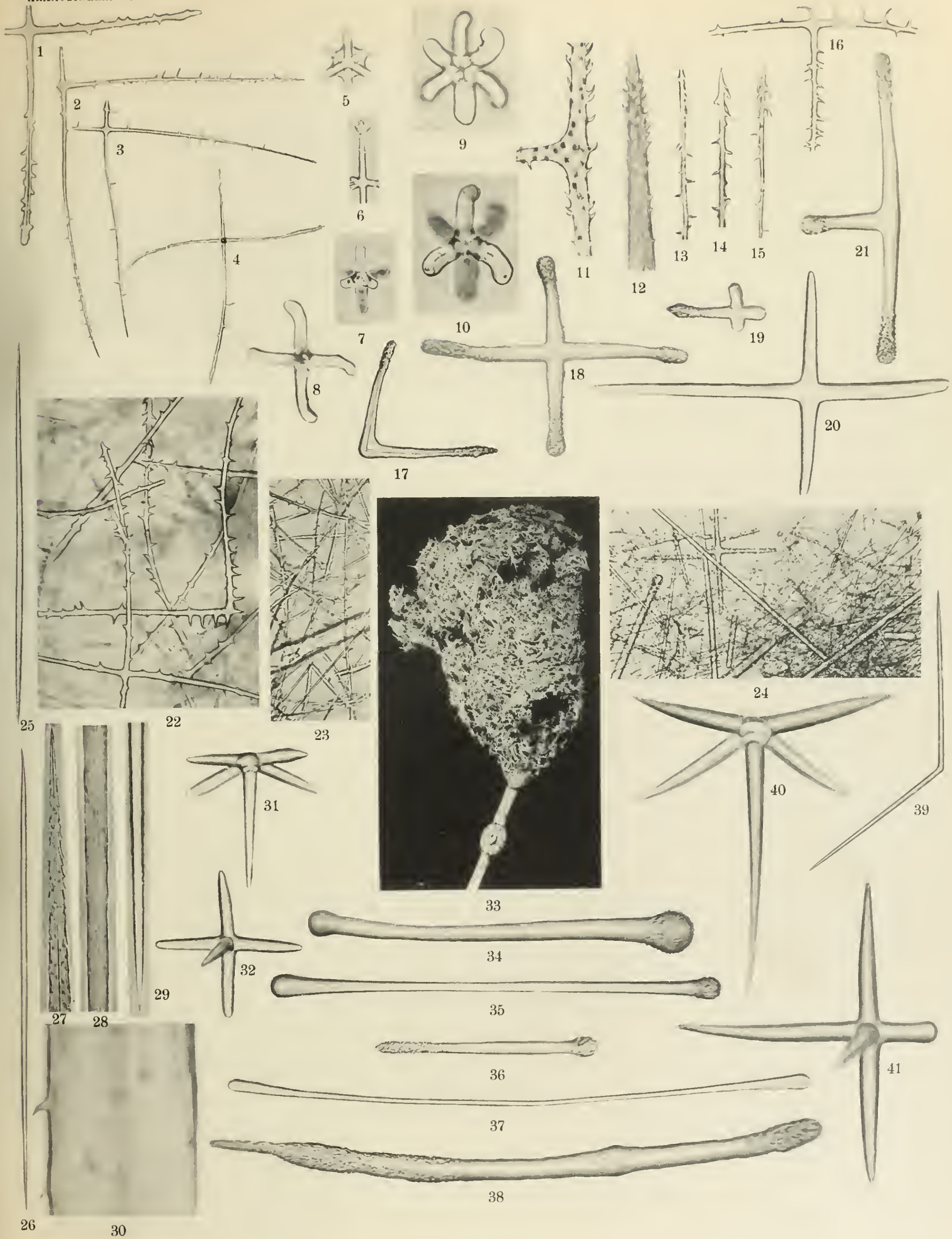


Fig. 1-10 Hyalonema (Hyalonema) obtusum n. sp. var. gracilis. Fig. 11-41 Hyalonema (Hyalonema) obtusum n. sp. var. robusta.

Lendenfeld photographed

PLATE 40.

PLATE 40.

Hyalonema (Hyalonema) obtusum robusta Lendenfeld.

Figures 1–22.

1, 2.— Large macramphidiscs; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

3–5.— Pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:

3, a gastral hexactine pinule;

4, a dermal pentactine pinule with reduced lateral rays;

5, a dermal pentactine pinule.

6–15.— Microhexactines and microhexactine-derivates; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:

6, 7, regular microhexactines;

8, a pentactine microhexactine-derivate;

9, a microhexactine with two opposite rays much longer than the others;

10, a diactine microhexactine-derivate, the fully developed rays of which are not opposite;

11, a triactine microhexactine-derivate;

12, 13, diactine (centrotyle), microhexactine-derivates, the fully developed rays of which are opposite;

14, 15, monactine (tylostyle or tyle) microhexactine-derivates.

16, 17.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

18.— A young micramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

19.— Part of an irregular macramphidisc; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

20.— Group of microscleres from a centrifuge spicule-preparation; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:

a, small micramphidiscs; b, microhexactine; c, microhexactine-derivate with only two opposite, fully developed rays.

21, 22.— Parts of the upper end of a large stalk-spicule; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

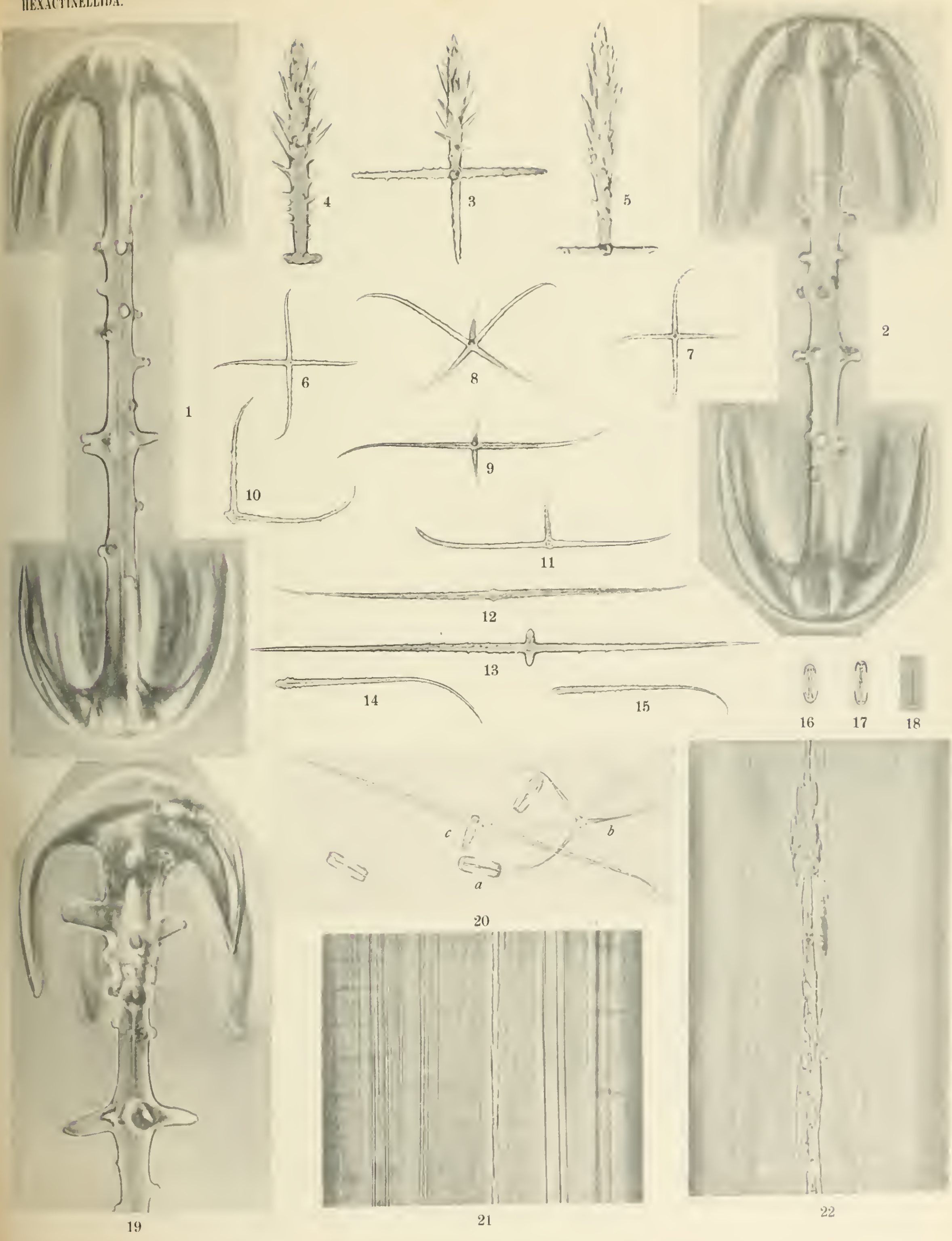


Fig. 1-22 Hyalonema (Hyalonema) obtusum n. sp. var. robusta.

Lendenfeld photographed.

PLATE 41.

PLATE 41.

Hyalonema (Hyalonema) agassizi LENDENFELD.

Fig. 1 — form B, Station 4651.
Figs. 2–11 — form A, Station 4656.
Fig. 12 — form D, Station 3684 (A. A. 17).
Figs. 13, 14 — form C, Station 4740.

1.— Side-view of the specimen of form B; natural size; phot. Zeiss, anastig. 480/412 mm.
2.— Side-view of the specimen of form A; reduced 1: 0.83; phot. Zeiss, anastig. 480/412 mm.
3–6.— Oblique view of hypodermal pentactines of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
3, 4, 6, larger ones;
5, a small one.
7.— Side-view of a small hypodermal pentactine of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.
8.— Apical view of the lateral rays of a large hypodermal pentactine of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.
9.— The end-part of a lateral ray of a large hypodermal pentactine of form A; magnified 300; phot Zeiss, apochr. 4, compens. oc. 6.
10, 11.— Smaller hypodermal pentactines of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
10, apical view of the lateral rays of one;
11, side-view of another
12.— The specimen of form D seen from above; natural size; phot. Zeiss, anastig. 480/412 mm.
13, 14.— A specimen of form C; reduced 1: 0.83; phot. Zeiss, anastig. 480/412 mm.:
13, seen from below;
14, seen from above.

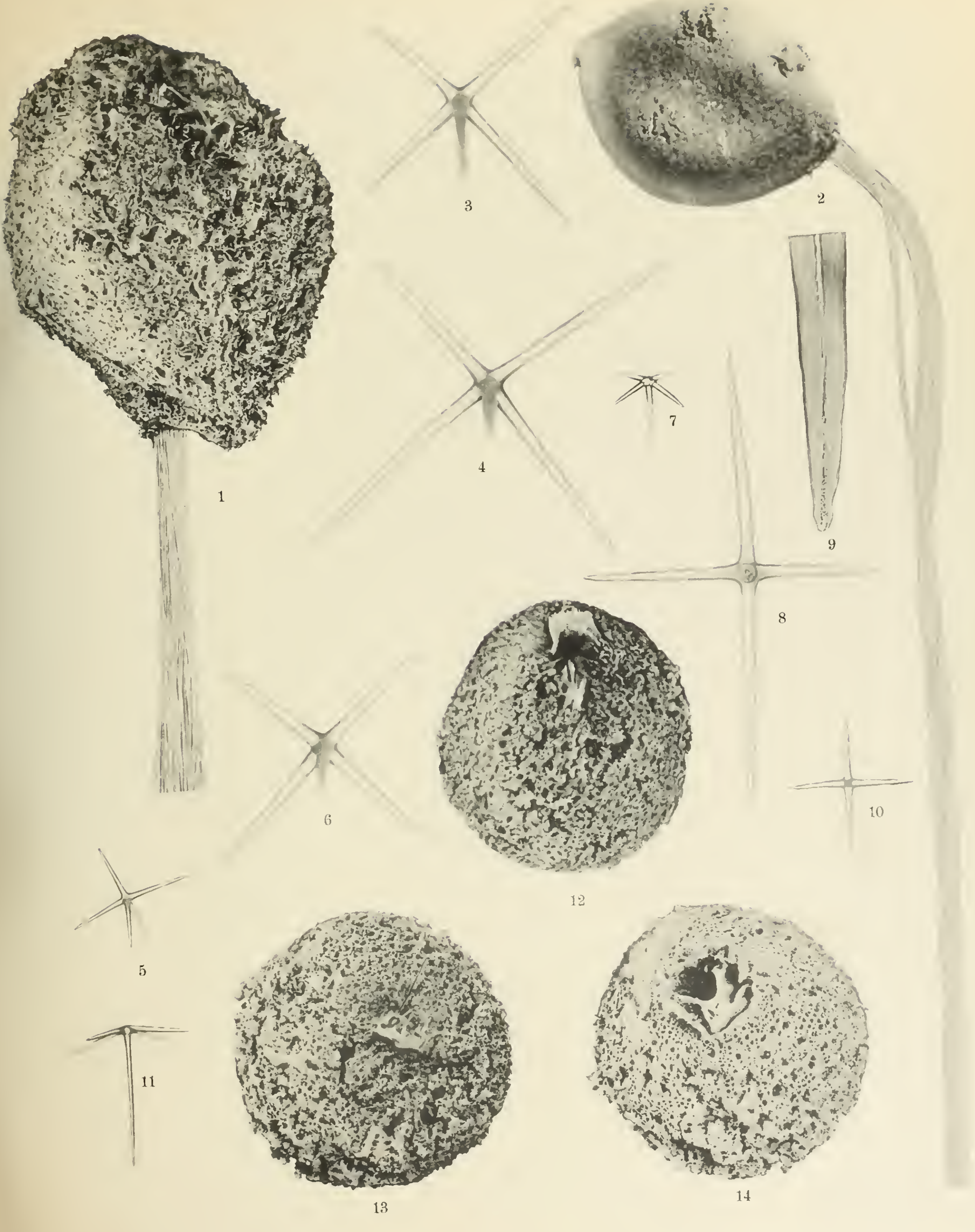


Fig. 1-14 Hyalonema agassizi n. sp.
1 form B; 2-11 form A; 12 form D; 13, 14 form C.

Lendenfeld photographed.

Winter, Frankfurt a. M.

PLATE 42.

Hyalonema (Hyalonema) agassizi LENDENFELD.

Figs. 1–13, 25–28, 35, 36, 38–41, 49, 51, 52 — form A, Station 4656.
Figs. 14, 15, 29, 37, 47, 48, 50, 53, 54 — form B, Station 4651.
Figs. 16–23, 43, 44, 55, 56, 58 — form C, Station 4740.
Figs. 24, 30–34, 42, 45, 46, 57, 59 — form D, Station 3684 (A. A. 17).

1–8.— Side-views of gastral pinules from the surface of the gastral cone of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
1, normal hexactine pinule with long proximal ray;
2, normal hexactine pinule with short proximal ray;
3–7, normal pentactine pinules;
8, abnormal pentactine pinule.

9.— Minute pentactine from the surface of the gastral cone of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

10–12.— Apical view of the lateral rays of gastral pinules from the surface of the gastral cone of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

13.— A diactine gastral pinule from the surface of the gastral cone of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

14–19.— Side-views of gastral pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
14, 15, from the surface of the gastral cone of form B;
16, 17, from the surface of the gastral cone of form C;
18, 19, from the surface of one of the radial walls separating the canalicular diverticula of the gastral cavity of form C.

20–23.— Side-views of dermal pinules from the outer surface of form C; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

24 — Side-view of a gastral pinule from the surface of the gastral cone of form D; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

25–34.— Side-views of dermal pinules from the outer surface; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
25–28, of form A;
29, of form B;
30–34, of form D.

35, 36.— Apical views of the lateral rays of two dermal pinules from the outer surface of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

37.— Surface-view of the dermal membrane on the basal part of form B; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
a, hypodermal pentactines; b, dermal pinules.

38–41.— Modified, slender-rayed, long-spined pinules of the basal part of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
38, 39, hexactine forms;
40, 41, pentactine forms.

42.— Group of spicules from a spicule-preparation of the basal part of form D; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
a, microhexactines; b, dermal pinules.

43–45.— Modified, slender-rayed, long-spined pinules from the basal part of the sponge; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
43, 44 of form C;
45, of form D.

46.— Spined, slender-rayed hexactine acanthophore of form D; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

47, 48.— Modified, slender-rayed, long-spined pinules from the basal part of form B; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

49.— A slender-rayed, long-spined tetractine acanthophore of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

50.— Minute pentactine of the basal part of form B; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

51–59.— Slender-rayed, long-spined tetractine and pentactine acanthophores; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
51, 52, tetractine ones of form A;
53, 54, tetractine ones of form B;
55, 56, tetractine ones of form C;
57, a pentactine one of form D;
58, a pentactine one of form C;
59, a tetractine one of form D.

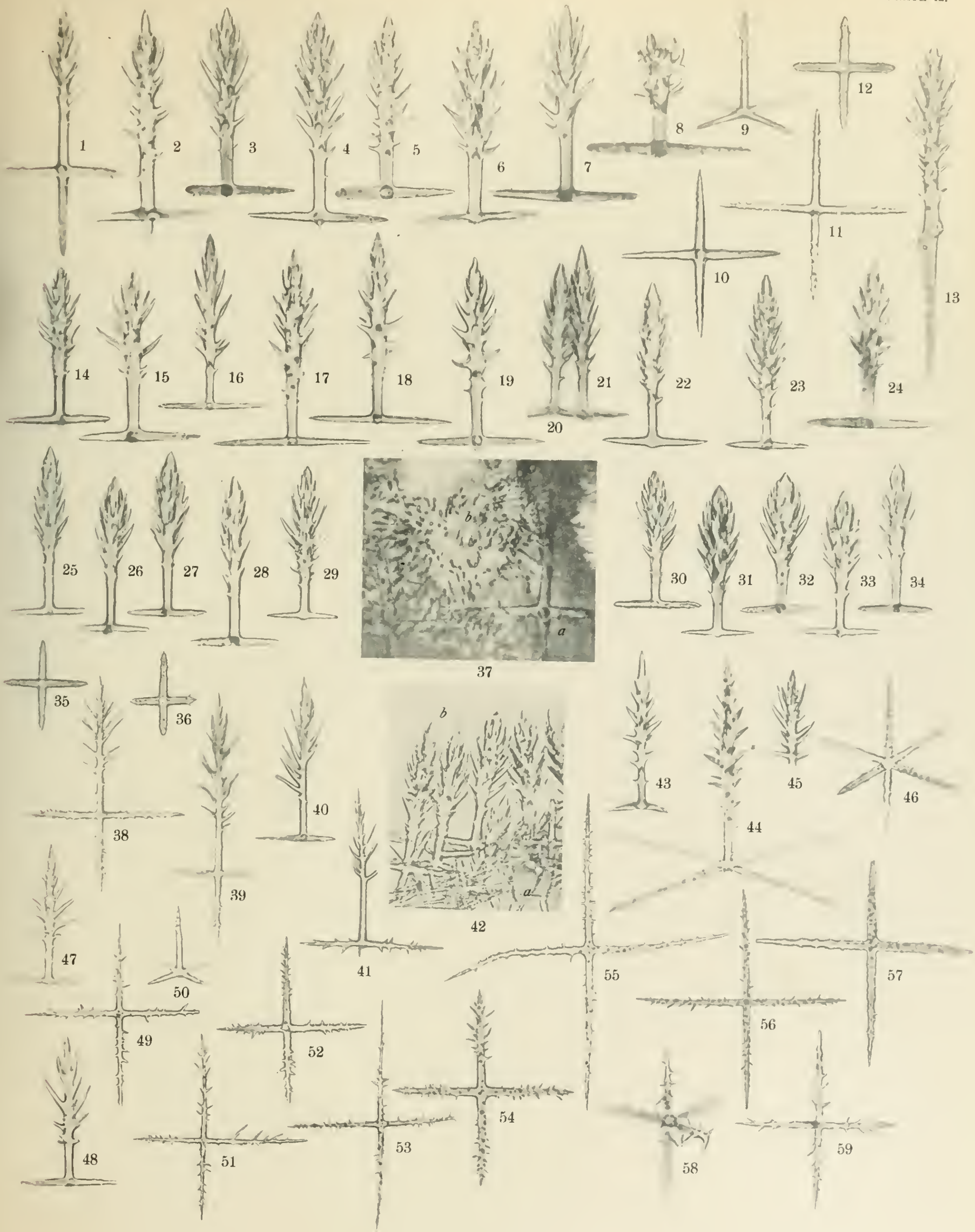


Fig. 1-59 Hyalonema (Hyalonema) agassizi n. sp.
1-13, 25-28, 35, 36, 38-41, 49, 51, 52 form A; 14, 15, 29, 37, 47, 48, 50, 53, 54 form B; 16-23, 43, 44, 55, 56, 58 form C. 24, 30-34, 42, 45, 46, 57, 59 form D.

Lendenfeld photographed.

Lichtdruck von Werner & Winter, Frankfurt a. M.

PLATE 43.

PLATE 43.

Hyalonema (Hyalonema) agassizi Lendenfeld.

Figures 1–7 — form A, Station 4656.

1.— The upper part of a stalk-spicule; reduced 1 : 0.5; phot. Zeiss, anastig. 480/412 mm.:
a, the portion represented in fig. 2; b, the portion represented in fig. 5; c, the portion represented in figs. 6 and 7; d, the portion represented in figs. 3 and 4.

2–7.— Parts of the stalk-spicule represented in fig. 1; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
2, 1 cm. from the upper end (at a in fig. 1) focussed on the axial thread;
3, 4, 41 cm. from the upper end (at d in fig. 1);
3, focussed lower, on the axial thread; 4, focussed higher, on the upper surface;
5, 20 cm. from the upper end (at b in fig. 1) focussed on the axial thread;
6, 7, 29 cm. from the upper end (at c in fig. 1);
6, focussed lower, on the axial thread; 7, focussed higher, on the upper surface.

a

2

5

b

1

c

6

3

4

d

7

Fig. 1-7 (Hyalonema) agassizi n. sp. form A.

Lendenfeld photographed.

Lichtdruck von Werner & Winter, Frankfurt a. M.

PLATE 44.

PLATE 44.

Hyalonema (**Hyalonema**) **agassizi** Lendenfeld.

Figs. 1–20, 22–24, 30 — form A, Station 4656.
Figs. 21, 25, 27 — form B, Station 4651.
Fig. 26 — form C, Station 4740.
Figs. 28, 29 — form D, Station 3684 (A. A. 17).

1–5.— Marginal diactine pinules of form A:

1, 2, two smaller ones; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6;

3, 4, the distal parts of two larger ones; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6;

5, a larger one; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

6–10.— Parts of the stoutest portions of uncinate amphioxes of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

6, part of an uncinate focussed lower; 7, the same focussed higher; 8, part of another uncinate focussed lower; 9, the same focussed higher; 10, part of a third uncinate.

11, 12.— The distal end-parts of two uncinates of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

13, 14.— Two uncinates of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

15.— A microhexactine with fairly straight rays of form A; magnified 500; u. v. phot. Zeiss, q. monochr. 6, q. oc. 7.

16.— The central part of a microhexactine of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

17.— Group of spicules from a centrifuge spicule-preparation of form A; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

a, uncinate amphioxes; b, regular microhexactines; c, irregular microhexactine with two rays much longer than the others; d, micramphidiscs.

18, 19.— Part (three rays and centre) of a regular microhexactine of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

18, focussed higher; 19, focussed lower.

20.— A microhexactine with nearly straight rays of form A; magnified 500; u. v. phot. Zeiss, q. monochr. 6, q. oc. 7.

21–23.— Microhexactines with more or less curved rays; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:

21, of form B;

22, 23, of form A.

24.— Microhexactine-derivate diactine of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

25–28.— Microhexactines; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:

25, 27, of form B;

26, of form C;

28, of form D.

29.— Part of a microhexactine of form D; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

30.— Part (one ray and centre) of a microhexactine of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

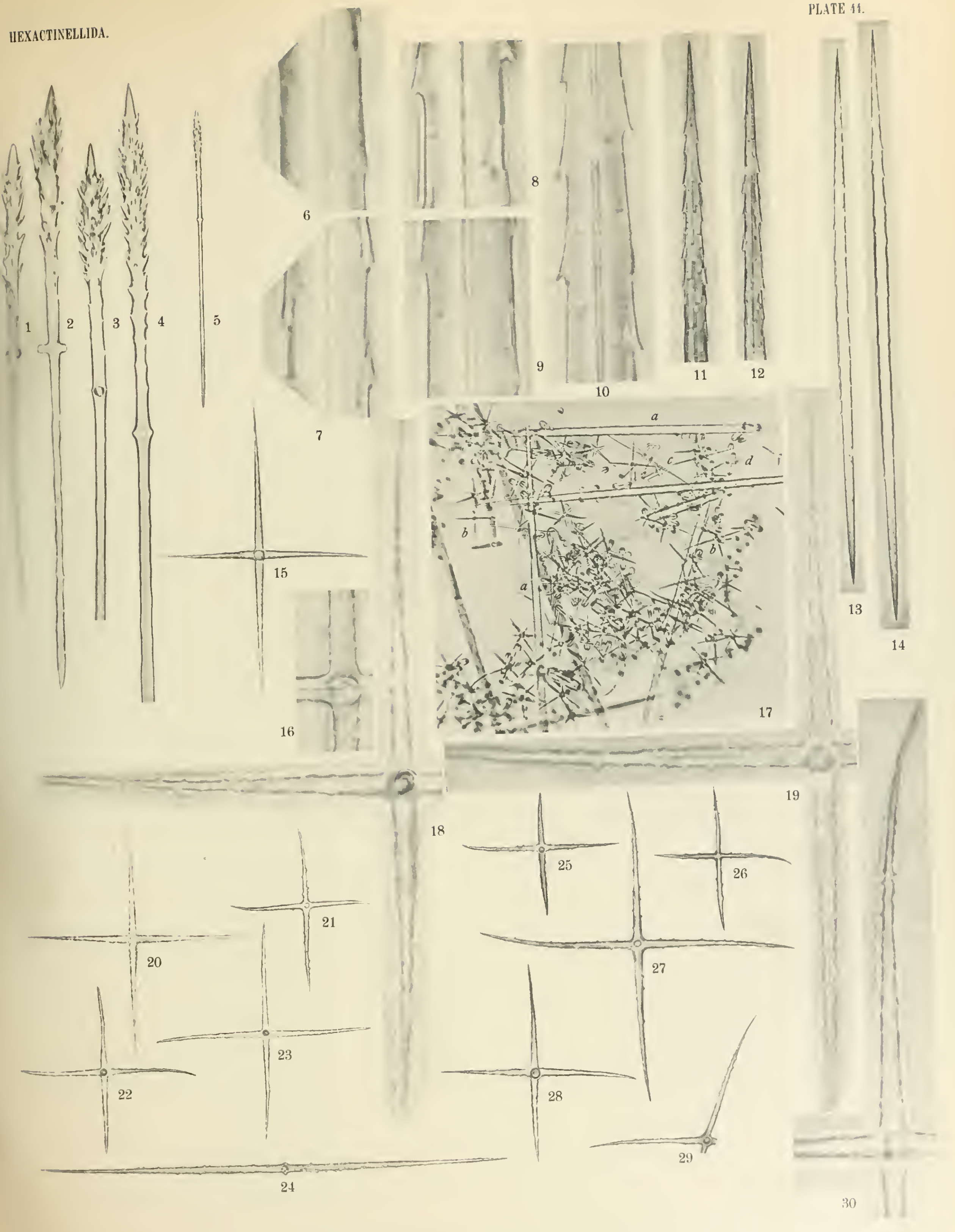


Fig. 1-30 Hyalonema (Hyalonema) agassizi n. sp.
1-20, 22-24, 30 form A; 21, 25, 27 form B; 26 form C; 28, 29 form D.

Lendenfeld photographed.

PLATE 45.

PLATE 45.

Hyalonema (Hyalonema) agassizi LENDENFELD.

Figs. 1–38, 40–49 — form A, Station 4656.
Figs. 39, 62–64 — form D, Station 3684 (A. A. 17).
Figs. 50–53 — form B, Station 4651.
Figs 54–61 — form C, Station 4740.

1–4.— Stout-rayed tetractine acanthophores of the spicule-cement in the basal part of form A; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

5.— Part of a rhabd acanthophore of the spicule-cement of the basal part of form A; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

6–13.— Hexactine megascleres of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
- 6–8, 11, small ones;
- 9, 10, large ones;
- 12, 13, medium-sized ones.

14–17.— Stout-rayed acanthophores of the cement in the basal part of form A; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
- 14, 15, tetractines with one ray strongly reduced;
- 16, 17, diactine tetractine-derivates.

18.— Section vertical to the surface through a superficial part of form A; magnified 20; phot. Zeiss, planar 20 mm.:
- a, dermal membrane with pinule-fur.

19–22.— Rhabds of the choanosome of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
- 19, 21, 22, amphioxes;
- 20, a tylostyle.

23.— Section vertical to the surface through a superficial part of form A; magenta; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
- a, dermal pinule-fur.

24, 25.— Stout-rayed tetractines, with rays strongly reduced in length, of the spicule-cement in the basal part of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

26–34.— Spheres of the basal part of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

35, 36.— Stout-rayed tetractine acanthophores of the spicule-cement of the basal part of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
- 35, a young one;
- 36, an adult one.

37.— A stout-rayed triactine acanthophore from the spicule-cement of the basal part of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

38.— A stout-rayed pentactine acanthophore with rays reduced in length, from the spicule-cement in the basal part of form A; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

39.— A stout-rayed tetractine acanthophore from the spicule-cement in the basal part of form D; magnified 30; phot. Zeiss, apochr. 4, compens. oc. 6.

40–64.— Amphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:
- 40–45, small micramphidiscs of form A;
- 46–49, large micramphidiscs of form A;
- 50–52, small micramphidiscs of form B;
- 53, small macramphidisc of form B;
- 54–58, small micramphidiscs of form C;
- 59–61, large micramphidiscs of form C;
- 62, small micramphidisc of form D;
- 63, 64, large micramphidiscs of form D.

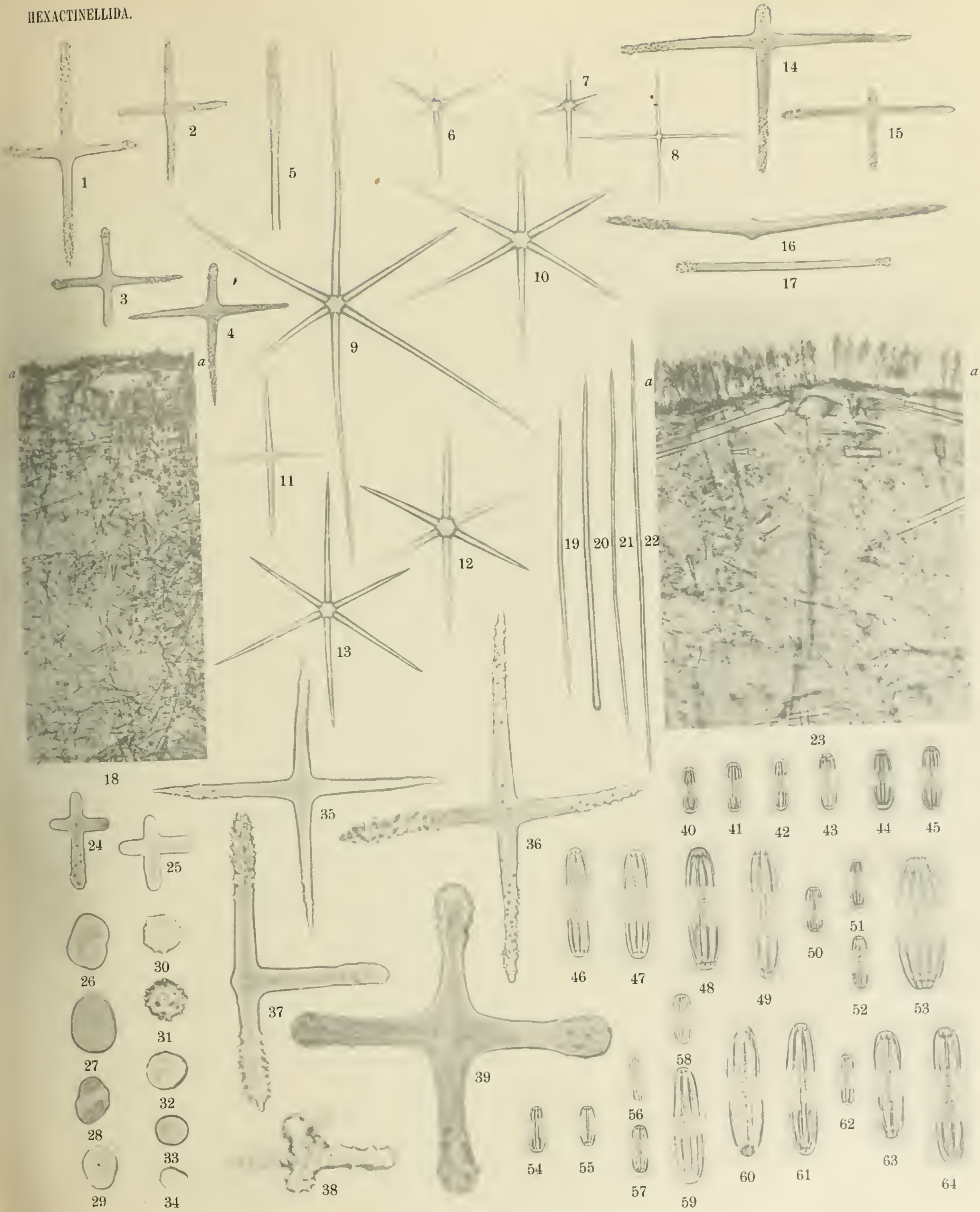


Fig. 1-64 Hyalonema (Hyalonema) agassizi n. sp.
1-38, 40-49 form A; 39, 62-64 form D; 50-53 form B; 54-61 form C.

Lendenfeld photographed.

PLATE 46.

PLATE 46.

Hyalonema (Hyalonema) agassizi LENDENFELD.

Figs. 1–5, 9, 12, 13 — form A, Station 4656.
Figs. 6–8, 16 — form D, Station 3684 (A. A. 17).
Figs. 10, 11 — form C, Station 4740.
Figs. 14, 15 — form B, Station 4651.

1–16.— Macramphidiscs; magnified 500:

1, 3–11, 14–16, phot. Zeiss, apochr. 4, compens. oc. 6;

2, 12, 13, u. v. phot. Zeiss, q. monochr. 6, q. oc. 7:

1, an adult normal small macramphidisc of form A;

2, an adult normal large macramphidisc of form A;

3, 4, an adult normal large macramphidisc of form A;

3, focussed high; 4, focussed lower;

5, an adult normal large macramphidisc of form A;

6, an adult normal large macramphidisc of form D;

7, an adult abnormal spiny large macramphidisc of form D;

8, a young normal large macramphidisc of form D;

9, a young normal large macramphidisc of form A;

10, 11, adult normal large macramphidiscs of form C;

12, 13, adult normal large macramphidiscs of form A;

14, 15, adult normal large macramphidiscs of form B;

16, an adult normal large macramphidisc of form D.

Fig. 1-16 Hyalonema (Hyalonema) agassizi n. sp.
1-5, 9, 12, 13 form A; 6-8, 16 form D; 10, 11 form C; 14, 15 form B.

Lendenfeld photographed.

PLATE 47.

PLATE 47.

Hyalonema (Hyalonema) agassizi Lendenfeld.

Figures 1–13 — form A, Station 4656.

1, 2.— Side-view of an anchor of a large macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  1, focussed lower; 2, focussed high.

3.— Group of three small micramphidiscs; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

4.— Side-view of part of a small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

5, 6.— Apical view of a large macramphidisc; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:
  5, focussed lower; 6, focussed higher.

7.— Side-view of a small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

8, 9.— Side-view of a small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  8, focussed higher; 9, focussed lower.

10.— The central part of the shaft of a large macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

11–13.— Side-view of a larger macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  11, focussed high; 12, focussed low; 13, focussed intermediate, on the axis of the shaft.

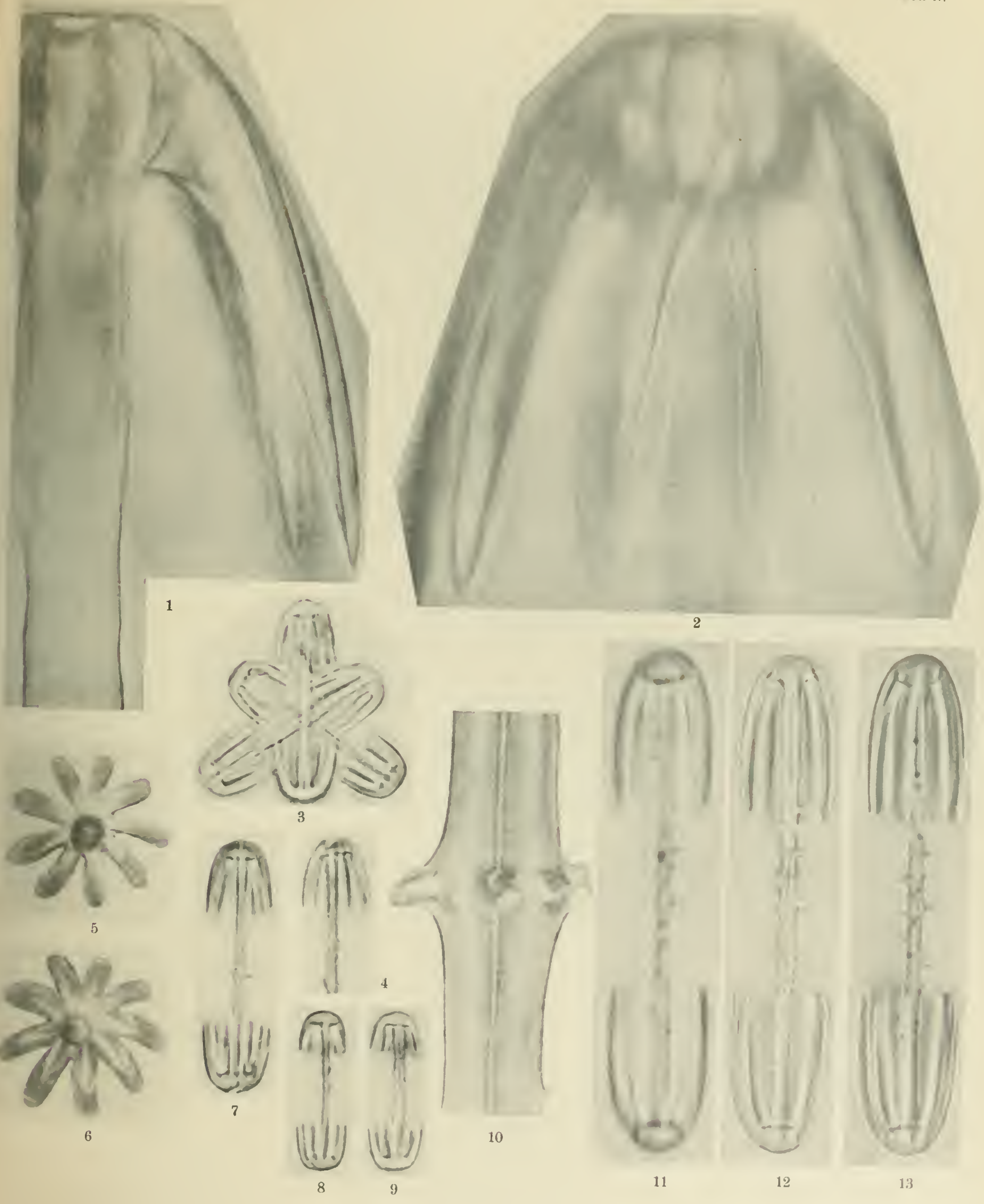


Fig. 1-13 Hyalonema (Hyalonema) agassizi n. sp. form A.

Lendenfeld photographed.

Lichtdruck von Werner & Winter, Frankfurt a. M.

PLATE 48.

PLATE 48.

Hyalonema (Prionema) spinosum LENDENFELD.

Figures 1–31.

1–10.— Acanthophores; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
- 1–5, tetractines;
- 6, a triactine;
- 7–9, diactines;
- 10, a monactine.

11, 12.— Views of the two specimens; reduced 1: 0.9; phot. Zeiss, anastig. 480/412 mm.:
- 11, side-view of the smaller specimen;
- 12, the larger specimen seen from above.

13.— Part of an axial section of the smaller specimen; magenta; magnified 10; phot. Zeiss, planar 50 mm.

14–16.— The central part of the shaft of a large macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 14, focussed high; 15, focussed low; 16, focussed intermediate.

17–22.— Side-views of dermal pinules; magnified 300; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
- 17–19, 21, 22, pentactine pinules;
- 20, a hexactine pinule.

23.— Part of the gastral pinule-fur in an axial section; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

24, 25.— Gastral pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
- 24, apical view of the lateral rays of one;
- 25, side-view of another.

26, 27.— Part of the distal ray of a gastral pinule; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 26, focussed lower; 27, focussed higher.

28–31.— Small micramphidiscs; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 28, a larger one with slightly curved shaft;
- 29, a smaller one with broad anchors;
- 30, 31, a smaller one with narrow anchors;
  - 30, focussed higher; 31, focussed lower.

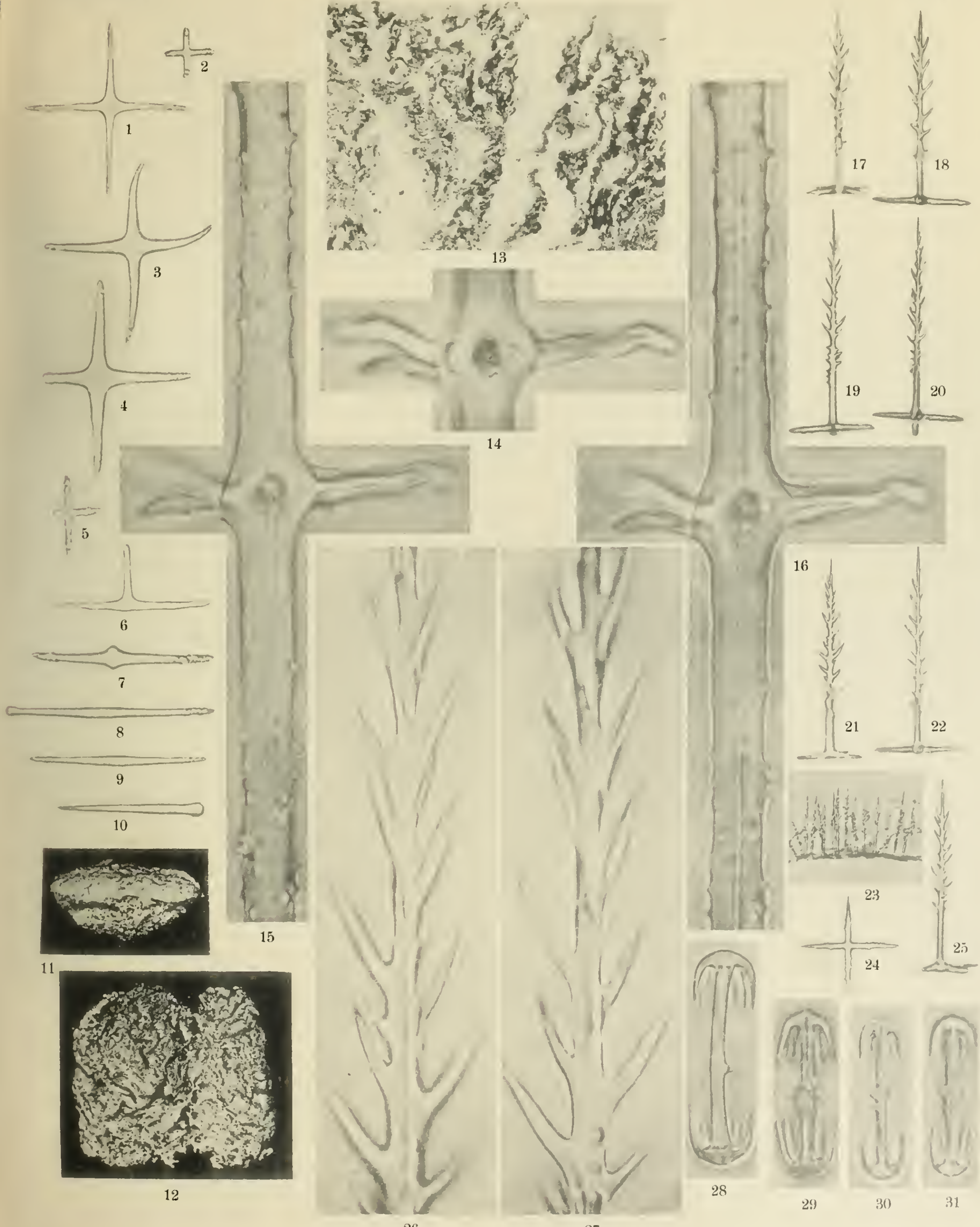


Fig. 1-31 Hyalonema (Prionema) spinosum n. sp.

Lendenfeld photographed

Lichtdruck von Werner & Winter, Frankfurt a. M.

PLATE 49.

PLATE 49.

Hyalonema (Prionema) spinosum LENDENFELD.

Figures 1–23.

1–11.— Amphidiscs; magnified 500:

1–4, small micramphidiscs; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;

5, small macramphidiscs; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;

6, small macramphidisc; u. v. phot. Zeiss, q. monochr. 6, q. oc. 7;

7, 8, normal large macramphidisc; phot. Zeiss, H. I. apochr. 2, oc. 4;

7, focussed high; 8, focussed low;

9, normal large macramphidisc; u. v. phot. Zeiss, q. monochr. 6, q. oc. 7;

10, abnormal large macramphidisc; phot. Zeiss, apochr. 4, compens. oc. 6;

11, normal large macramphidisc; phot. Zeiss, apochr. 4, compens. oc. 6.

12–14.— Side-views of hypodermal pentactines; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.

15–18.— Microhexactines and parts of such; magnified 500:

15, 18, u. v. phot. Zeiss, q. monochr. 6, q. oc. 7;

16, 17, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

19.— A hexactine megasclere; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.

20–22.— Part of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

20, focussed high; 21, focussed intermediate; 22, focussed low.

23.— Part of a ray of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

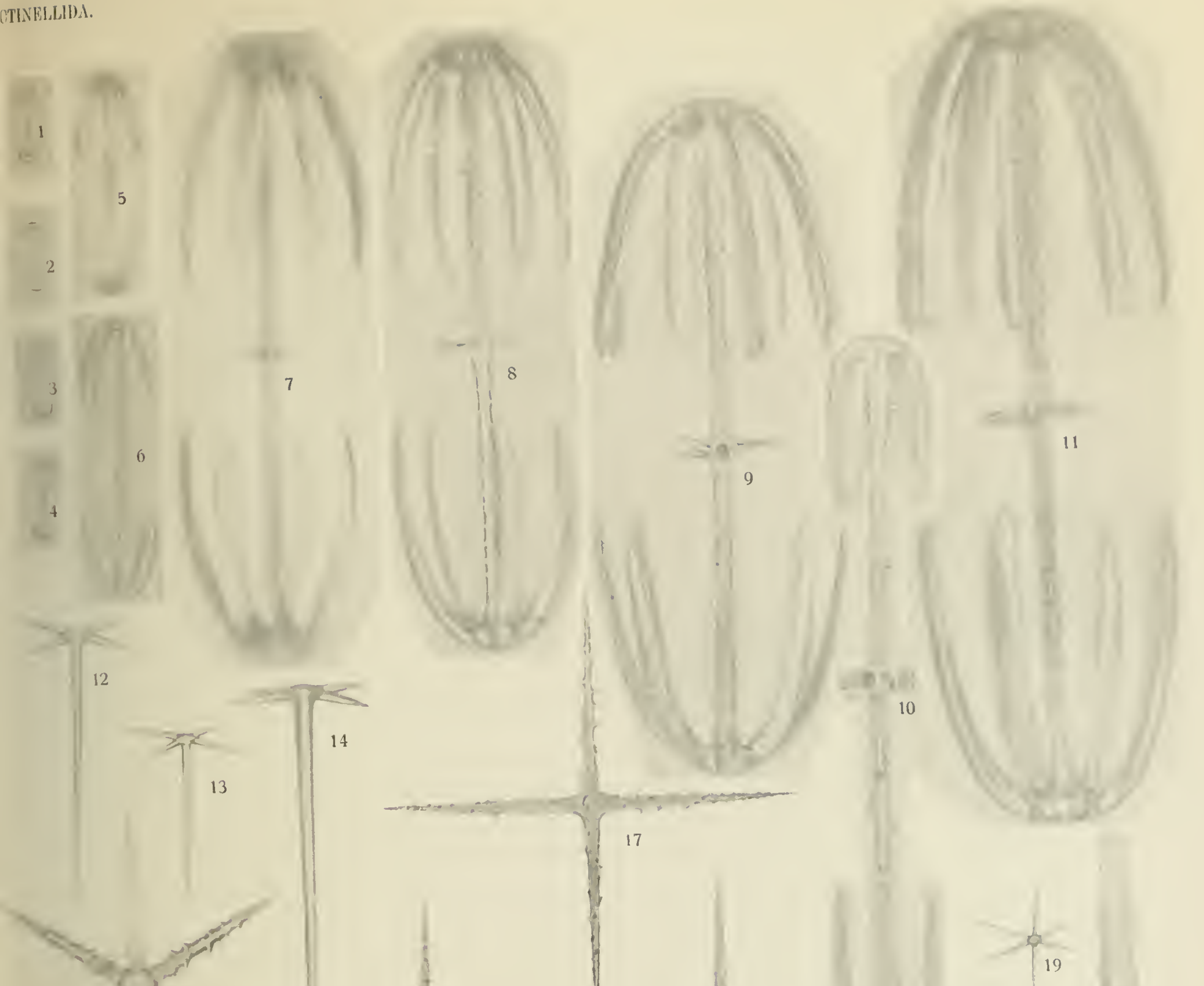


Fig. 1—23 Hyalonema (Prionema) spinosum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 50.

PLATE 50.

Hyalonema (Prionema) spinosum LENDENFELD.

Figures 1–5.

1–5.— Anchor-teeth of large macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
1, slightly oblique view of an anchor-tooth focussed high; 2, the same focussed lower;
3, the uppermost two teeth of an anchor, nearly *en face;*
4, an anchor-tooth *en profile,* focussed lower; 5, the same, focussed higher.

Hyalonema (Phialonema) pateriferum WILSON.

Figures 6–15 — form E.

6–8.— Ordinary pentactine pinules; magnified 300; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
9, 10.— Parts of microhexactines; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
9, the central part of a microhexactine;
10, the central part and one ray of a microhexactine.
11–14.— Micramphidiscs; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
11, a small micramphidisc with short anchors;
12, 13, a small micramphidisc with longer anchors;
12, focussed lower; 13, focussed higher;
14, a large micramphidisc.
15.— The central part of the shaft of a large macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

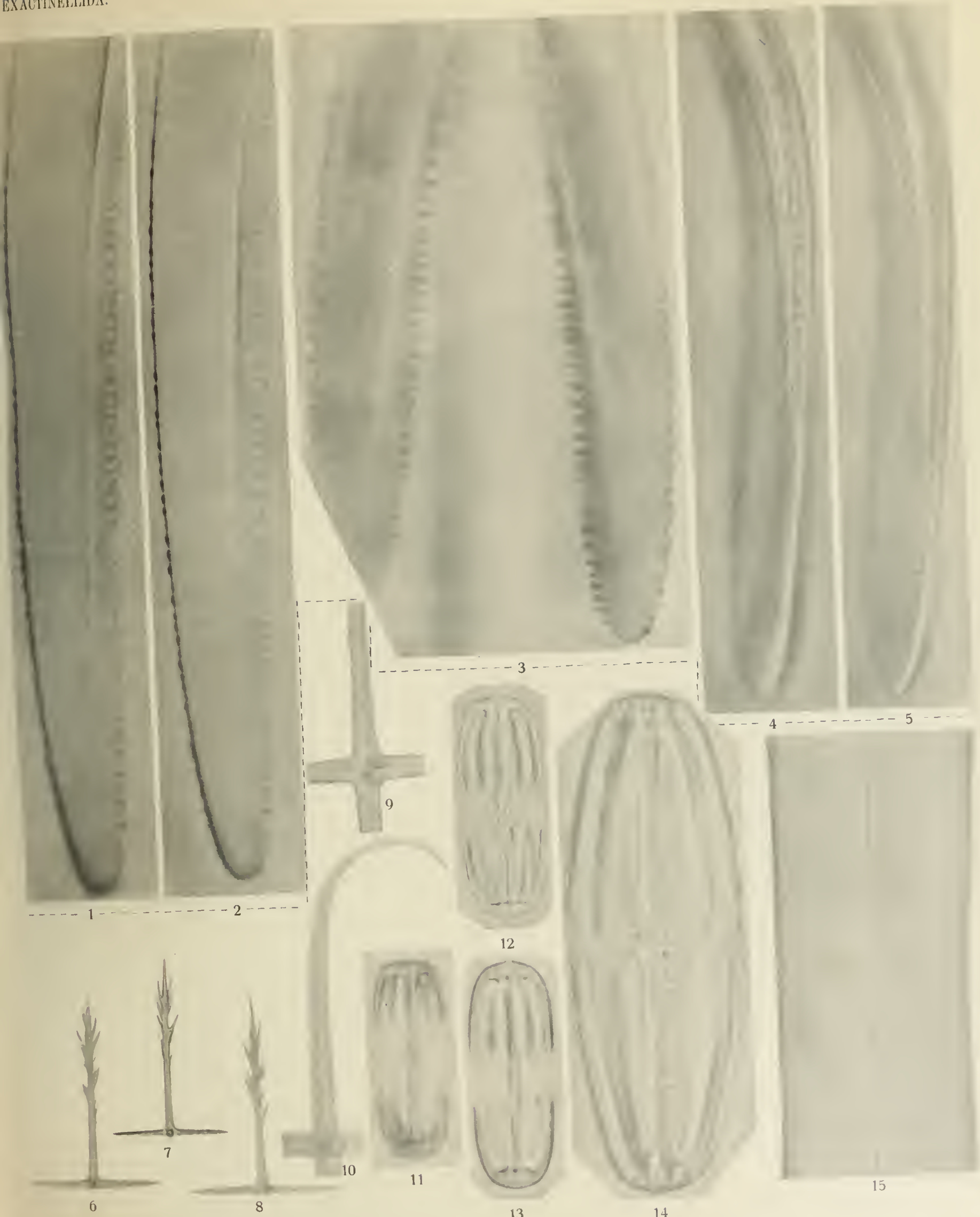


Fig. 1—5 Hyalonema (Prionema) spinosum n. sp.
Fig. 6—15 Hyalonema (Phialonema) pateriferum Wilson form E.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 51

PLATE 51.

Hyalonema (Phialonema) pateriferum Wilson.

Figures 1–28.

1.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm.

2.— Groups of large macramphidiscs from a spicule-preparation; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

3–6.— Small micramphidiscs; magnified 500:
3, 5, phot. Zeiss, H. I. apochr. 2, compens. oc. 4;
4, 6, phot. Zeiss, apochr. 4, compens. oc. 12.

7–12.— Large micramphidiscs; magnified 500:
7, 8, 10–12, phot. Zeiss, H. I. apochr. 2, compens. oc. 4;
9, u. v. phot. Zeiss, q. monochr. 6, q. oc. 7.

13, 14.— A large micramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:
13, focussed higher; 14, focussed lower.

15.— Side-view of a small macramphidisc, with regular anchors; magnified 500; u. v. phot. Zeiss, q. monochr. 6, q. oc. 7.

16.— Side-view of a large macramphidisc with spirally twisted anchors; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.

17, 18.— Side-views of large macramphidiscs; with regular anchors; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.

19, 20.— Side-views of a large macramphidisc with regular anchors; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:
19, focussed lower; 20, focussed higher.

21, 22.— Apical views of anchors of large macramphidiscs; magnified 500:
21, u. v. phot. Zeiss, q. monochr. 6, q. oc. 7;
22, phot. Zeiss, apochr. 4, compens. oc. 12.

23–28.— Microhexactines; magnified 500:
23, 24, 26, 28, ordinary microhexactines with strongly and regularly curved rays; phot. Zeiss, apochr. 4, compens. oc. 12;
25, an exceptionally large microhexactine with irregularly curved rays; u. v. phot. Zeiss, q. monochr. 6, q. oc. 7;
27, a microhexactine with rays only slightly curved; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

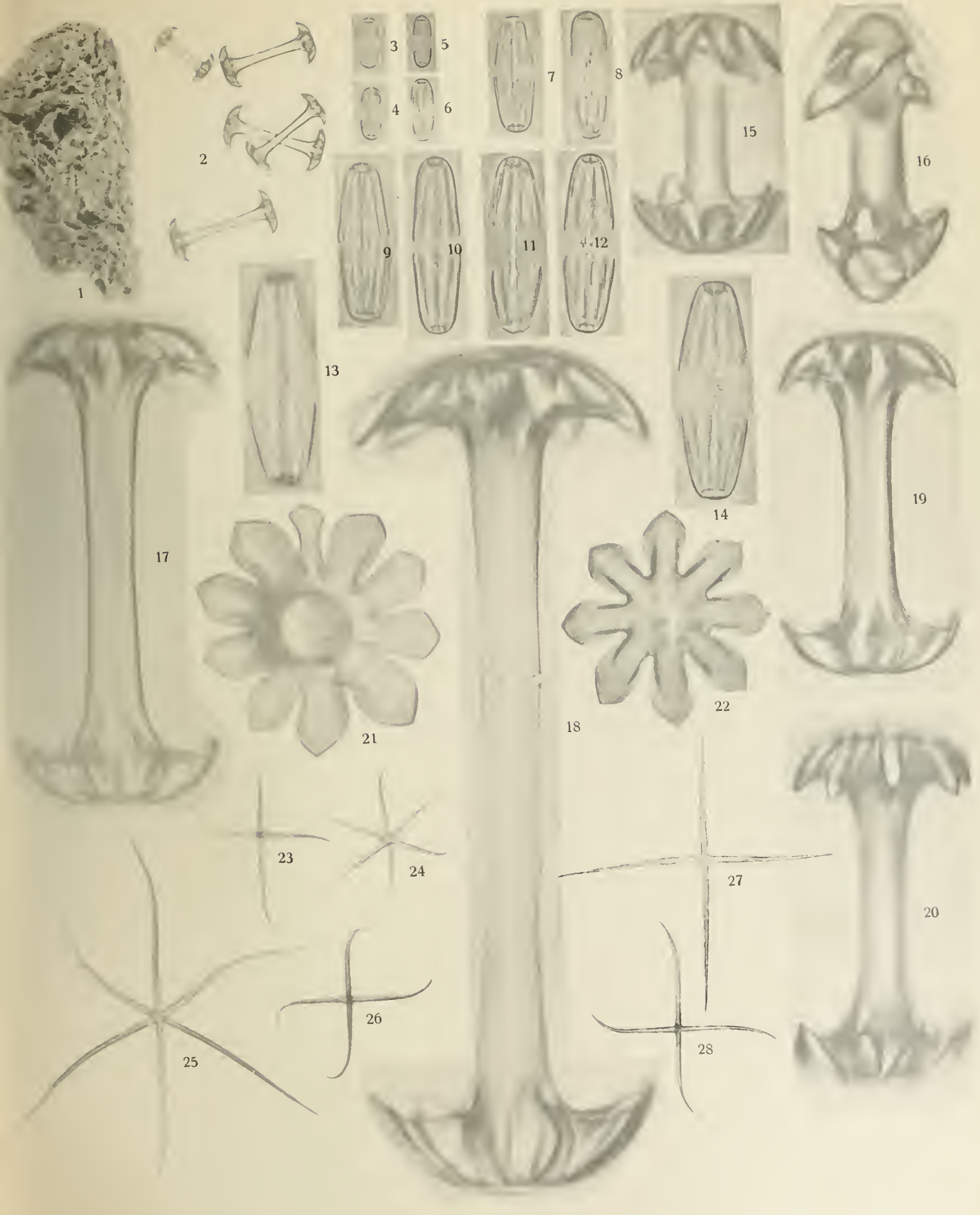


Fig. 1—28 Hyalonema (Phialonema) pateriferum Wilson, form E.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 52.

PLATE 52.

Hyalonema (Phialonema) pateriferum Wilson.

Figs. 1–14, 16, 21–29 — form D.
Figs. 15, 17–19 — form F.
Fig. 20 — form C.

1, 2.— Microhexactines of form D; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.
3–10.— Macramphidiscs of form D; magnified 500:
3–9, phot. Zeiss, apochr. 4, compens. oc. 12;
10, phot. Zeiss, apochr. 4, compens. oc. 6;
3, 4, 9, 10, large macramphidiscs;
5–8, small macramphidiscs.
11–14.— Ordinary pentactine pinules of form D; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
15.— A pentactine pinule with long distal ray of form F; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
16.— A diactine pinule of form D; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
17–19.— Acanthophores of form F; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
17, a diactine;
18, a pentactine;
19, a triactine.
20.— View of the specimen of form C; natural size; phot. Zeiss, anastig. 480/412 mm.
21.— View of the specimen of form D; reduced 1: 0.84; phot. Zeiss, anastig. 480/412 mm.
22, 23.— Parts of radial sections through superficial portions of the marginal region of form D; magnified 30; phot. Zeiss, planar 20 mm.:
22, part of an unstained section;
23, part of a section stained with magenta.
24–29.— Micramphidiscs of form D; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:
24–26, small micramphidiscs;
27–29, large micramphidiscs.

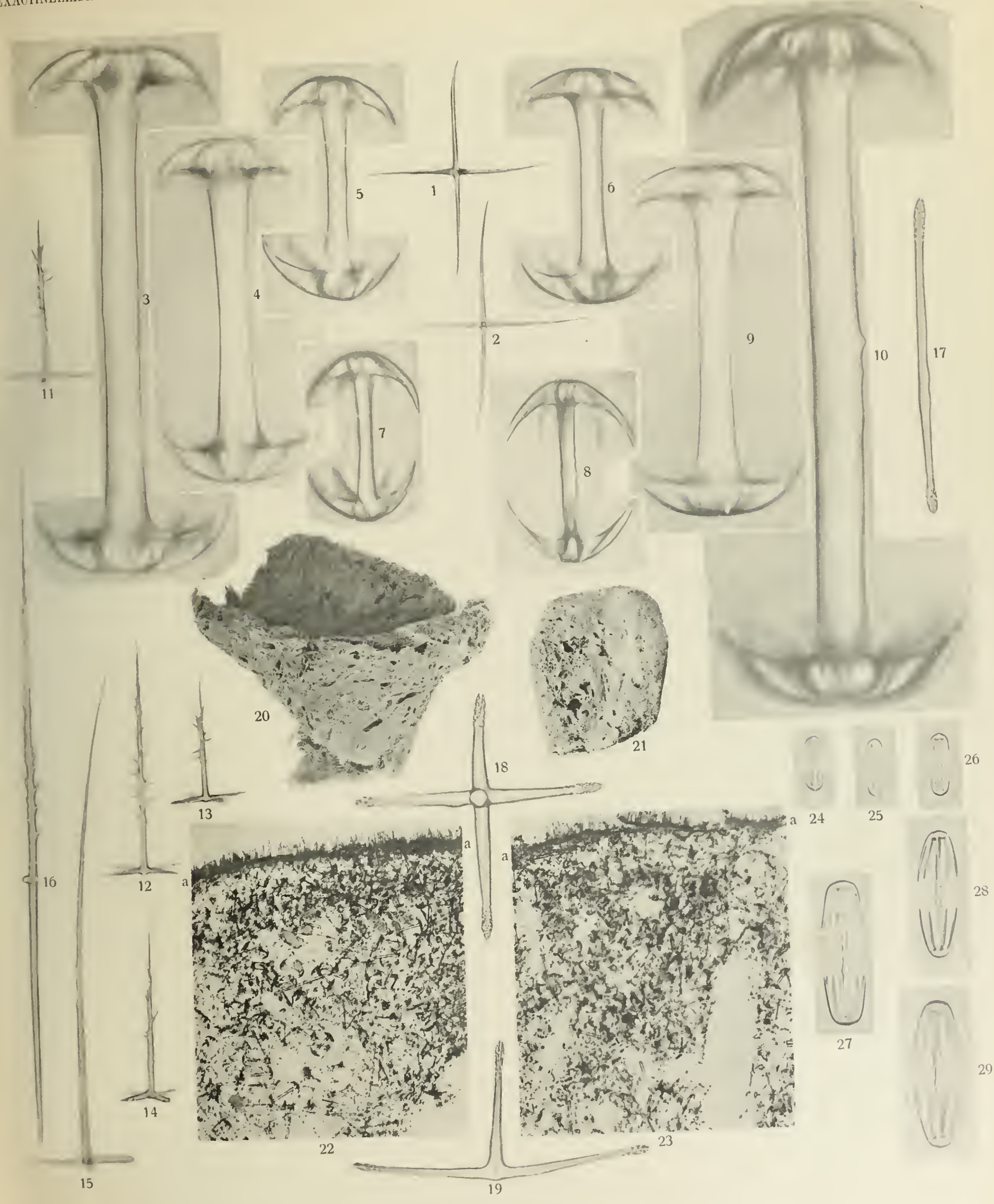


Fig. 1—29 Hyalonema (Phialonema) pateriferum Wilson. 1—14, 16, 21—29 form D; 15, 17—19 form F; 20 form C.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 53.

PLATE 53.

Hyalonema (Hyalonema) polycaulum LENDENFELD.

Figures 1–17.

1–3.— Parts of a macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
 1, part of a terminal anchor, with the shaft in focus;
 2, the central part of the shaft;
 3, part of a terminal anchor with the uppermost teeth in focus.
4.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm.
5, 6.— A large micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
 5, focussed higher; 6, focussed lower.
7.— A small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
8.— A hexactine megasclere; magnified 50; phot. Zeiss, achr. aa., compens. oc. 6.
9–12.— Parts of microhexactines; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
 9, 10, the centrum and one ray of a smaller microhexactine;
  9, focussed higher; 10, focussed lower;
 11, 12, the centrum and one ray of a larger microhexactine;
  11, focussed higher; 12, focussed lower.
13.— Group of macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
14–16.— Microhexactines; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.
17.— A strongly bent rhabd from one of the hard superficial knobs; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

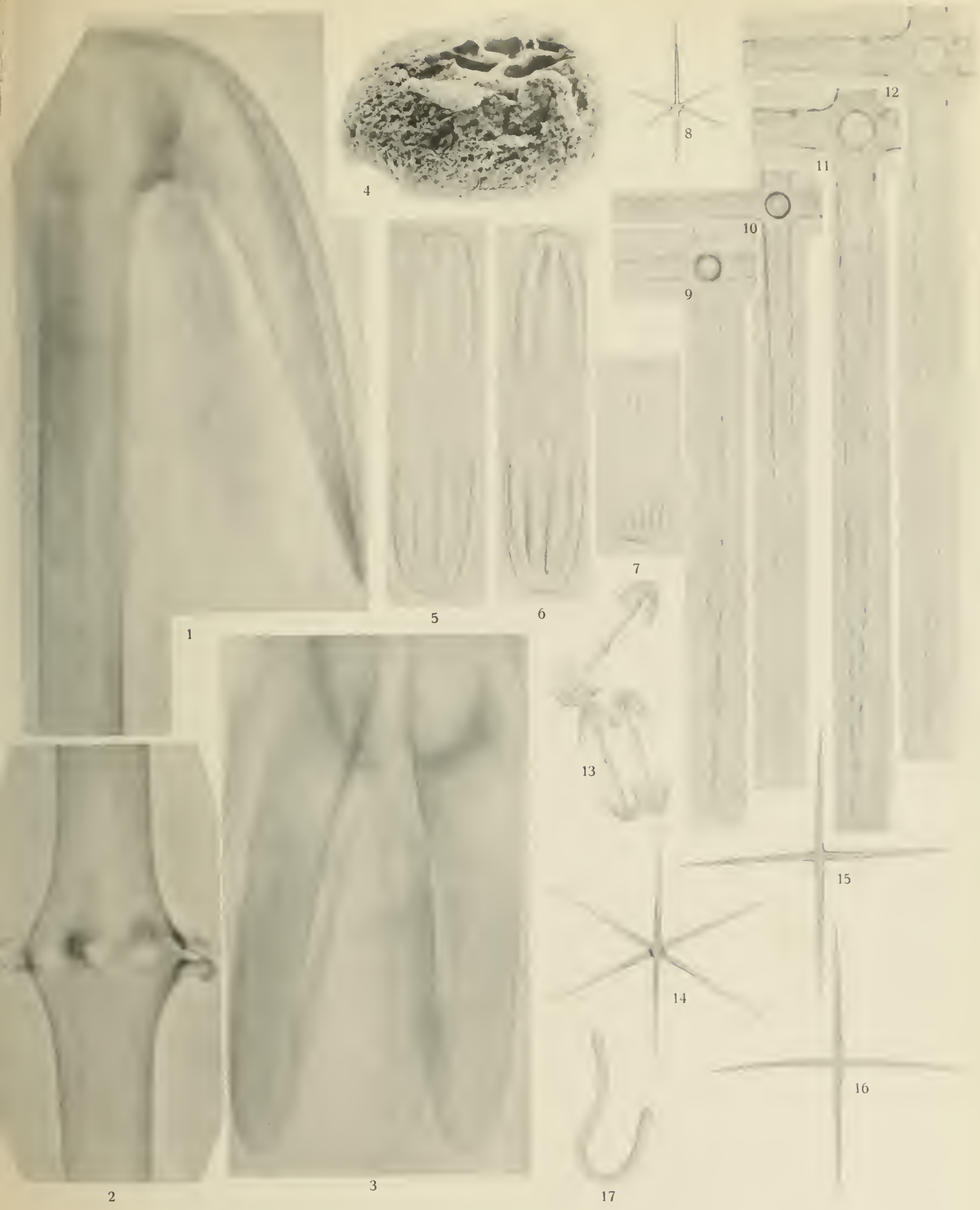


Fig. 1—17 Hyalonema (Hyalonema) polycaulum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 54.

PLATE 54.

Hyalonema (Hyalonema) polycaulum LENDENFELD.

Figures 1–45.

1–15.— Stout-rayed tetractine and monactine to triactine tetractine-derivate acanthophores from the hard superficial knobs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
 1–8, tetractines;
 9, 10, triactines;
 11, a rectangularly bent centrotyle diactine;
 12, a straight centrotyle diactine;
 13–15, tylostyle monactines.

16–20.— Rhabd, apparently diactine-derivate acanthophores of the hard superficial knobs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
 16, 18, 19, cylindrical forms;
 17, 20, centrotyle forms.

21–25.— Small micramphidiscs; magnified 500:
 21, apical view of a terminal anchor; phot. Zeiss, H. I. apochr. 2, compens. oc. 4;
 22, side-view of a micramphidisc; phot. Zeiss, apochr. 4, compens. oc. 12;
 23, 24, side-view of micramphidiscs; phot. Zeiss, H. I. apochr. 2, compens. oc. 4;
 25, group of micramphidiscs from a centrifuge spicule-preparation; phot. Zeiss, apochr. 4, compens. oc. 12.

26, 27.— Large micramphidiscs; magnified 500:
 26, phot. Zeiss, apochr. 4, compens. oc. 12;
 27, phot. Zeiss, H. I. apochr. 2, compens. oc. 4.

28, 29.— Macramphidiscs; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.

30–33.— Small, slender-rayed, long-spined acanthophores from the hard superficial knobs; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

34.— A dermal pinule from one of the hard superficial knobs; magnified 300; phot. Zeiss, apochr. 4; compens. oc. 6.

35.— A dermal pinule; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

36, 37.— Apparently pinule-derivate, spiny pentactine acanthophores from the hard superficial knobs; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

38–40.— Dermal pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

41–45.— Gastral pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

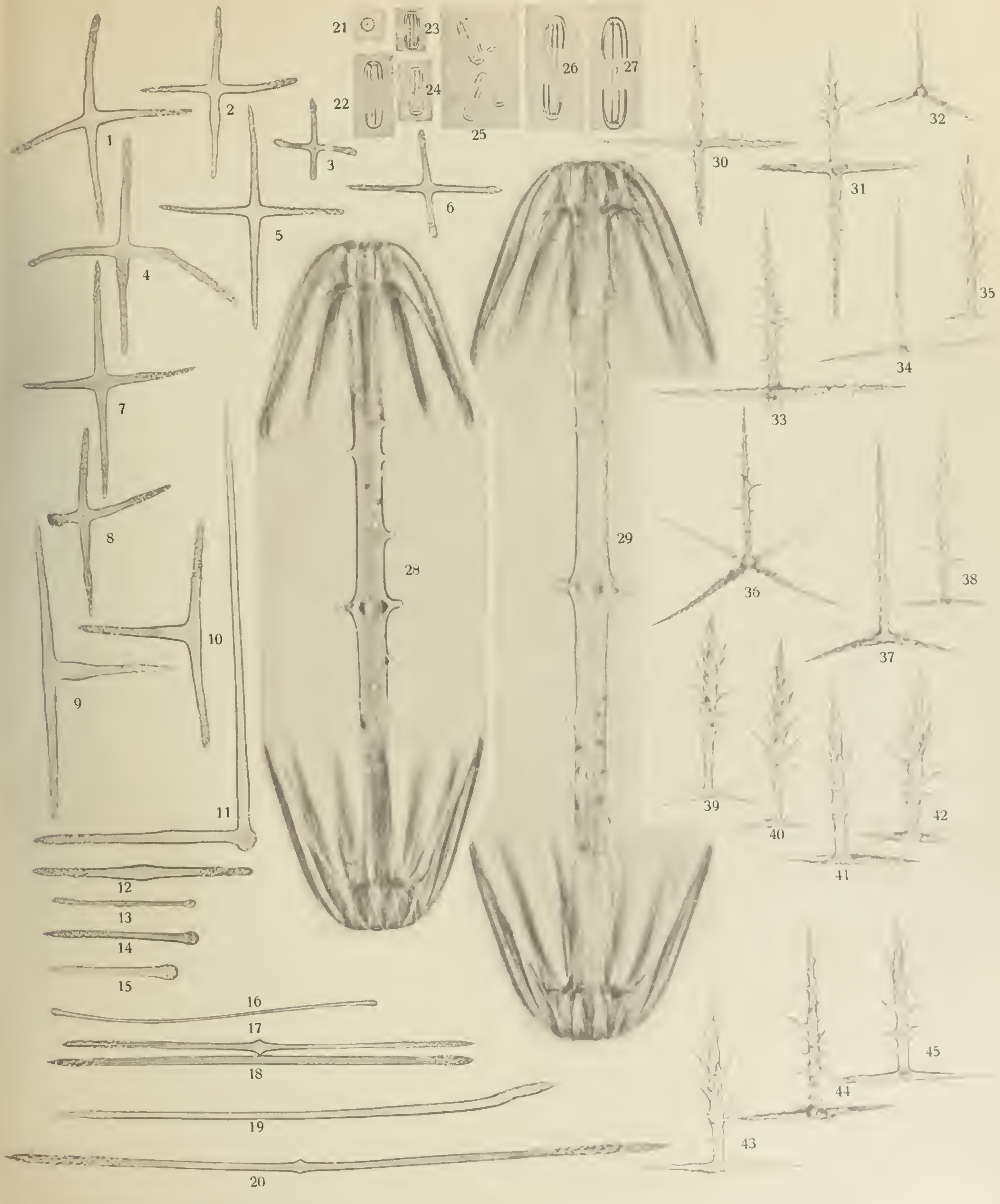


Fig. 1—45 Hyalonema (Hyalonema) polycaulum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 55.

PLATE 55.

Hyalonema (Phialonema) brevancora Lendenfeld.

Figures 1–37.

1.— View of the larger fragment; natural size; phot. Zeiss, anastig. 480/412 mm
2, 3.— Pentactine megascleres; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
4.— An angularly bent diactine megasclere; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
5.— The centrum of the shaft of a macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
6.— One end of an abnormal rhabd; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
7–12.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
    7–9, small micramphidiscs;
    10–12, large micramphidiscs.
13.— A small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
14, 15.— Macramphidiscs; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.
16–18.— A terminal anchor of a macramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
    16, focussed high; 17, focussed intermediate; 18, focussed low.
19, 20.— Part of a distal ray (19) and a whole distal ray (20) of a pinule; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
21–30.— Side-views of pinules; magnified 300; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
    21–28, of pentactine pinules with long-spined distal ray;
    29, of a pentactine pinule with short-spined distal ray;
    30, of a hexactine pinule with long-spined distal ray.
31.— A hexactine megasclere; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
32, 33.— Apical views of the lateral rays of pentactine pinules; magnified 300; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
34, 35.— A whole microhexactine (34) and part of one (35); magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
36, 37.— Parts of microhexactines; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

Fig. 1—37 Hyalonema (Phialonema) brevancora n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 56.

PLATE 56.

Hyalonema (Prionema) azuerone LENDENFELD.

Figure 1.

1.— View of the lower side of the specimen, floating in water and spread out flat; reduced 1: 0.8; phot. Zeiss, anastig. 480/412 mm.

1

Fig. 1 Hyalonema (Prionema) azuerone n. sp.

Lendenfeld photographed.

PLATE 57.

PLATE 57.

Hyalonema (Prionema) azuerone Lendenfeld.

Figures 1–23.

1–5.— Macramphidiscs and parts of such; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:

1, a large macramphidisc with broad anchors; focussed lower (the shaft in focus);

2, the broad terminal anchor represented in fig. 3, focussed high (the uppermost teeth in focus);

3, the broad terminal anchor represented in fig. 2, focussed low (the shaft in focus);

4, one (the upper) terminal anchor of the macramphidisc represented in fig. 5, focussed higher (the uppermost teeth in focus);

5, a large macramphidisc with narrow anchors, focussed lower (the shaft in focus).

6–8.— Mesamphidiscs; magnified 500:

6, 7, medium mesamphidiscs; phot. Zeiss, apochr. 4, compens. oc. 12;

8, large mesamphidisc; phot. Zeiss, apochr. 8, compens. oc. 12.

9–12.— Stout-shafted micramphidiscs; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:

9, a large one;

10–12, small ones.

13–17.— Slender-shafted micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

18.— The central part of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

19–22.— Microhexactines; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

23.— The centrum and one ray of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

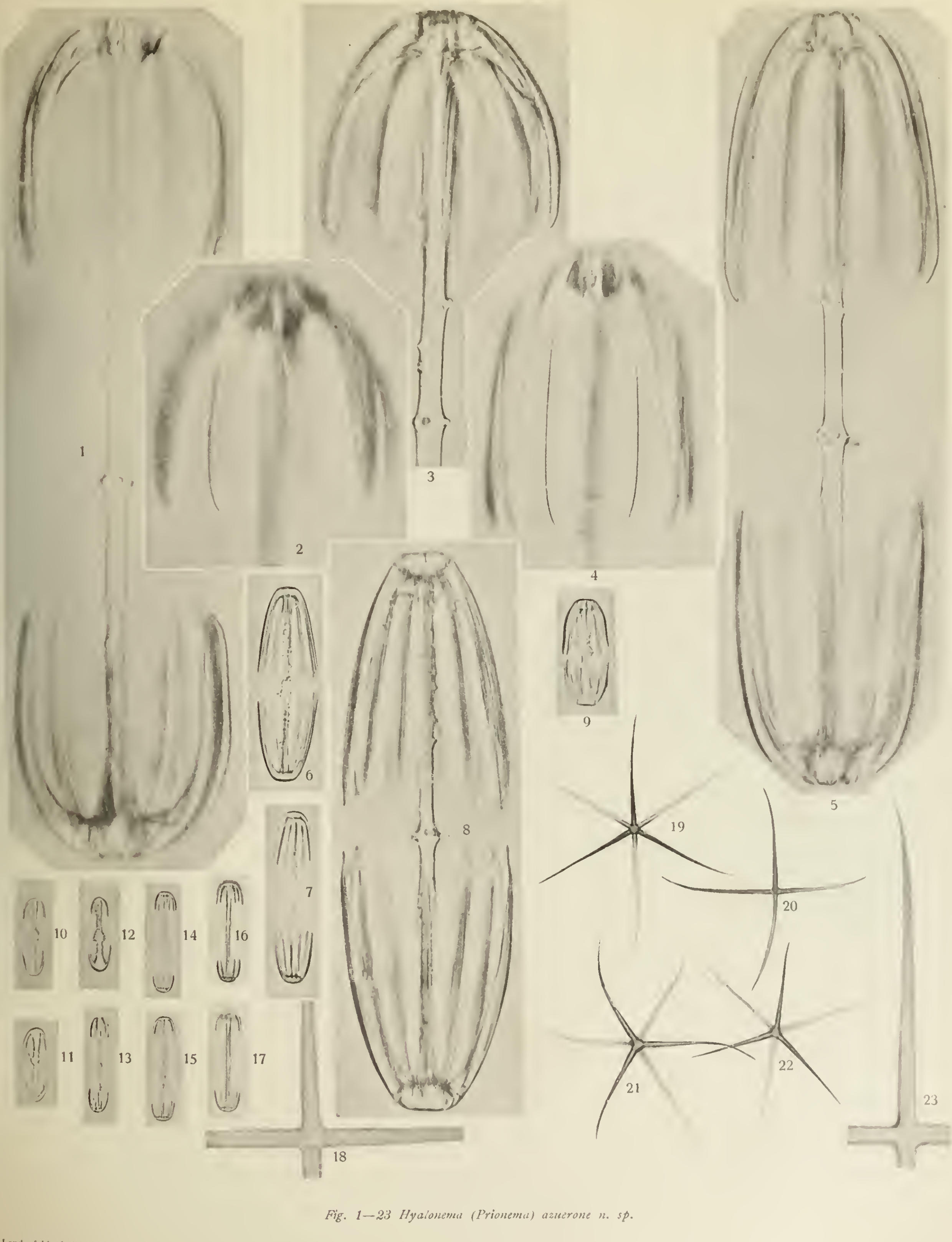


Fig. 1—23 Hyalonema (Prionema) azuerone n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 58

PLATE 58.

Hyalonema (Prionema) azuerone Lendenfeld.

Figures 1–22.

1.— Part of a section through the choanosome, showing a canal-wall; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
 a, canal-wall; b, canalar pinules; c, microhexactines; d, micramphidises.

2.— Part of a section through the choanosome, showing a region particularly rich in small macramphidises; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

3.— Section vertical to the surface through the superficial part of the sponge; magenta; magnified 30; phot. Zeiss, planar 20 mm.:
 a, outer surface with pinule-fur; b, group of flagellate chambers; c, wall of a canal.

4.— Surface-view of a pore-sieve on the lower side of the sponge; magnified 20; phot. Zeiss, planar 20 mm.

5–9.— Parts of anchor-teeth of macramphidises; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
 5, a portion of the middle-part of a tooth;
 6, 7, the end-part of a tooth;
  6, focussed lower; 7, focussed higher;
 8, the end-part of a tooth;
 9, portion of the basal part of a tooth.

10.— Part of the superficial pinule-fur, from a section vertical to the surface; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

11.— Surface-view of a portion of the superficial pinule-fur on the lower side of the sponge; magnified 20; phot. Zeiss, planar 20 mm.

12.— A slender-shafted micramphidise; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

13.— A medium mesamphidise; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

14, 15.— Apical views of the crosses formed by the lateral rays of the superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.

16–22.— Side-views of pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
 16, 19, canalar pinules;
 17, 18, 20–22, superficial pinules.

Fig. 1—22 Hyalonema (Prionema) azuerone n. sp.

Lendenfeld photographed.

PLATE 59.

PLATE 59.

Hyalonema (Prionema) fimbriatum Lendenfeld.

Figures 1–6.

1–3.— Three macramphidiscs with the shaft in focus; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 6.

4–6.— Three anchor-heads of macramphidiscs, with the uppermost teeth in focus; magnified 500:
4, an anchor with teeth terminating with two lobes; phot. Zeiss, apochr. 4, compens. oc. 12;
5, an anchor with normal teeth; phot. Zeiss, apochr. 8, compens. oc. 6;
6, an anchor with the ends of some of the teeth bent towards one side; phot. Zeiss, apochr. 8, compens. oc. 6.
(Figs. 5 and 6 represent the two anchors of the same amphidisc).

Fig. 1-6 *Hyalonema (Prionema) fimbriatum n. sp.*

Lendenfeld photographed.

PLATE 60.

PLATE 60.

Hyalonema (Prionema) fimbriatum LENDENFELD.

Figures 1–34.

1, 2.— Anchors of largest fimbriate amphidiscs with the upper teeth in focus; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6 (fig. 1 is the upper of the two anchors of the amphidisc represented in fig. 3, focussed higher).

3–6.— Largest fimbriate amphidiscs with the shaft in focus; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.

7, 8.— A large fimbriate amphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6: 7, focussed higher, on the uppermost teeth; 8, focussed lower, on the shaft.

9, 10.— A large fimbriate amphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6: 9, focussed higher, on the uppermost teeth; 10, focussed lower, on the shaft.

11, 12.— Large fimbriate amphidiscs; magnified 5000; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

13, 14.— Small fimbriate amphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

15.— A smallest fimbriate amphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

16, 17.— A micramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6: 16, focussed higher; 17, focussed lower.

18–23.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

24.— Group of largest fimbriate amphidiscs of the subgastral zone *in situ* in a section; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

25.— Group of microhexactines in a centrifuge preparation; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

26–30.— Microhexactines; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

31.— A lateral ray of a micropentactine; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

32–34.— The lateral ray-crosses of micropentactines; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

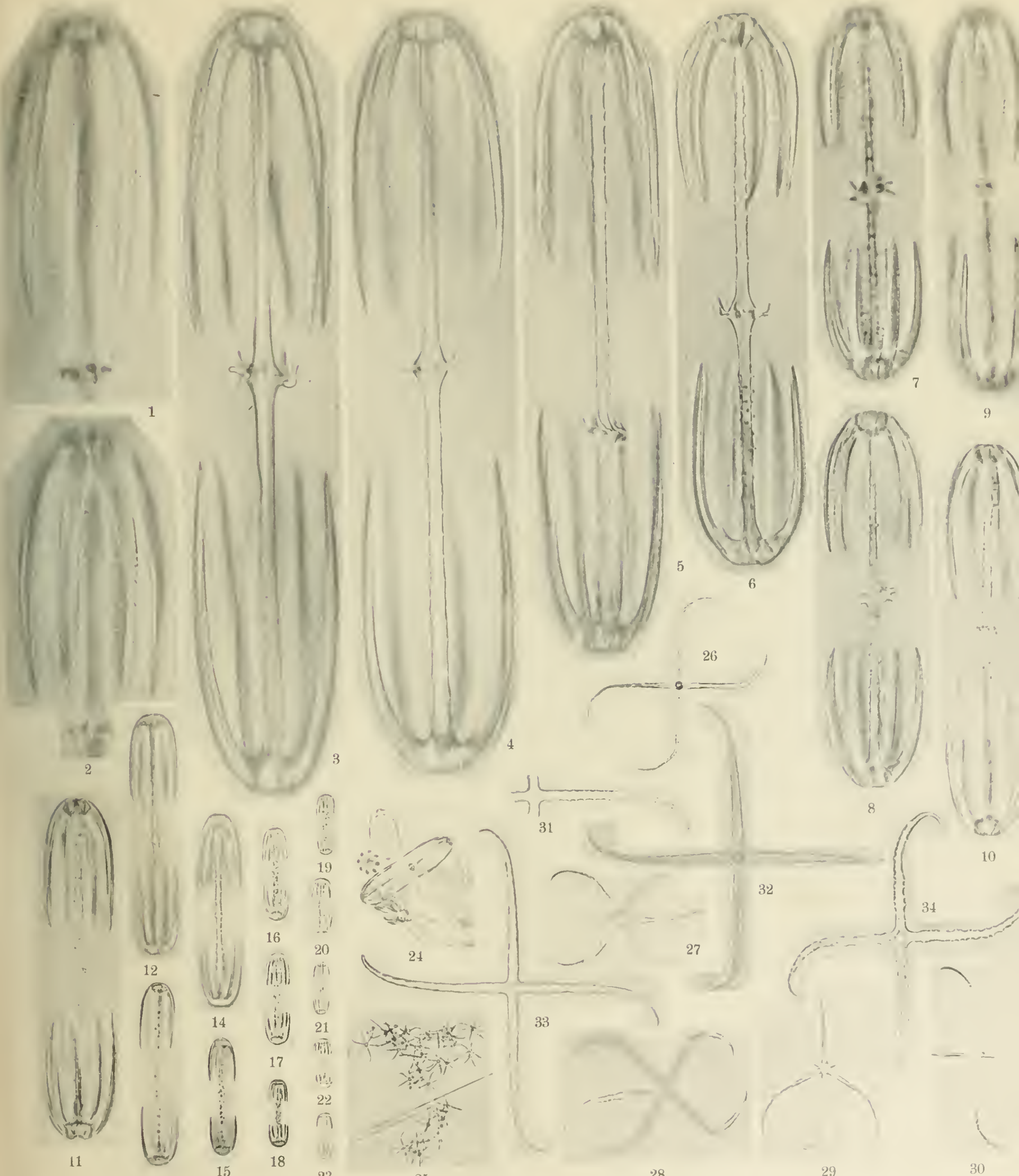


Fig. 1-34 Hyalonema (Prionema) fimbriatum n. sp.

Lendenfeld photographed.

PLATE 61.

PLATE 61.

Hyalonema (Prionema) fimbriatum Lendenfeld.

Figures 1–11.

1–10.— Parts of anchor-teeth of largest fimbriate amphidises; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

1–3, the larger, middle-part of a tooth;

1, focussed low; 2, focussed intermediate; 3, focussed high (intervals 2 μ);

4, 5, the basal part of a tooth;

4, focussed higher; 5, focussed lower;

6, 7, the end-part of a tooth;

6, focussed higher; 7, focussed lower;

8, 9, the basal part of a tooth;

8, focussed higher; 9, focussed lower;

10, the end-part of a tooth.

11.— Part of an anchor of a largest fimbriate amphidise, with the uppermost teeth in focus; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

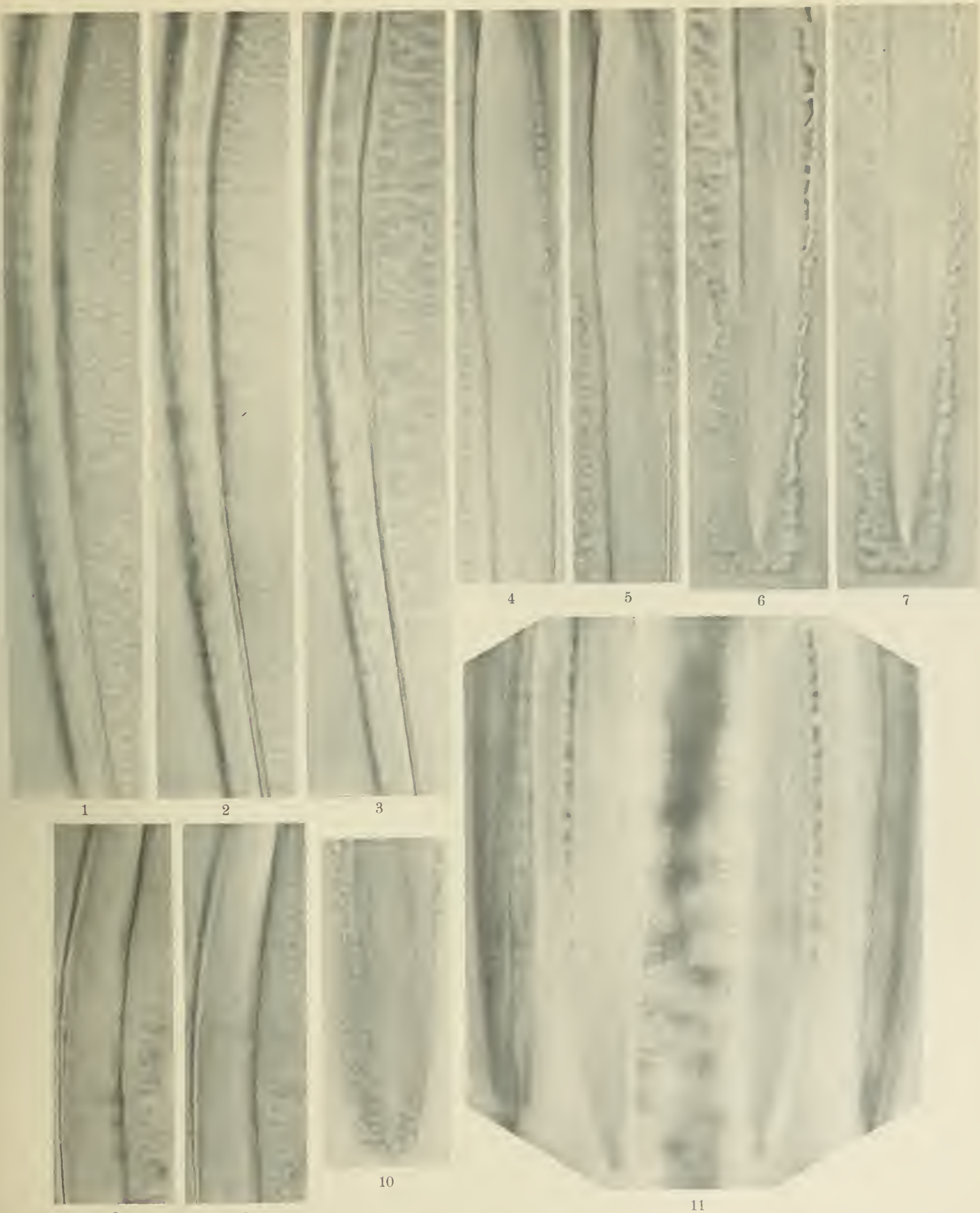


Fig. 1-11 Hyalonema (Prionema) fimbriatum n. sp.

Lendenfeld photographed.

PLATE 62

PLATE 62.

Hyalonema (Prionema) fimbriatum Lendenfeld.

Figures 1–45.

1–4.— Side-views of dermal pinules; magnified 300; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
5–9.— The distal parts of basal anchors; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
10, 11.— Parts of shafts of basal anchors; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
12.— Part of a micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
13, 14.— Micramphidiscs; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
15.— A smallest fimbriate amphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
16–18.— Lateral ray-crosses of dermal pinules; magnified 300; phot. Zeiss, H. I. apochr. 2, comp. oc. 6.
19.— A lateral ray-cross of a canalar pinule; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
20–26.— Slender-rayed, long-spined, tetractine to hexactine acanthophores; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
27.— The central part of the shaft of the largest fimbriate amphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
28.— The central part of a micropentactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
29, 30.— Two of the specimens; reduced 1: 0.92; phot. Zeiss, anastig. 480/412 mm.:
29, an irregularly outlined one seen from below;
30, a regularly outlined one seen from above.
31.— The end-part of an anchor-tooth of a macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.
32–41.— Side-views of canalar pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
42–45.— Parts of microhexactines; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
42, the centrum and one ray of one, focussed lower;
43, the centrum of the same, focussed higher;
44, the centrum and four rays of another;
45, the centrum and two rays of a third.

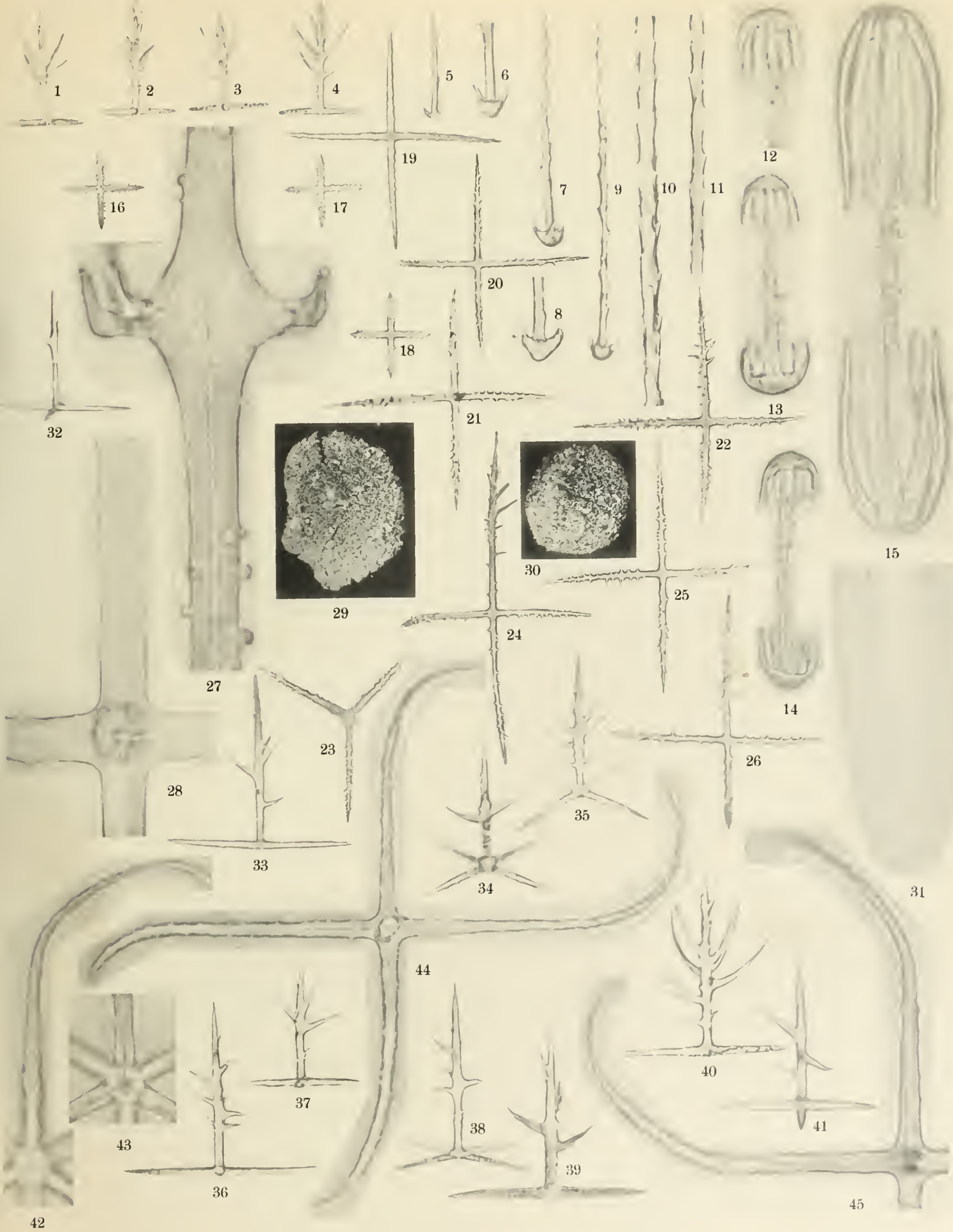


Fig. 1-45 Hyalonema (Prionema) fimbriatum n. sp.

Lendenfeld photographed.

PLATE 63.

PLATE 63.

Hyalonema (Prionema) fimbriatum LENDENFELD.

Figures 1–28.

1–5.— Hexactine megascleres; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.
6–9.— Hypodermal pentactines; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
6, apical view;
7–9, side-views.
10–14.— Rhabd megascleres; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
10, 11, amphiox rhabds;
12–14, rhabds rounded and thickened at one end.
15–28.— Acanthophores; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
15, a small tetractine;
16–18, large tetractines with fairly equal rays;
19, a large tetractine with unequal rays;
20–24, straight or only slightly curved, more or less centrotyle diactines;
25, 26, slender, strongly curved, terminally thickened rhabds;
27, 28, stout, curved, terminally thickened rhabds.

Hyalonema (Hyalonema) placuna LENDENFELD.

Figs. 29–34, 36–41, 51 — form B.
Figs. 35, 42–50 — form A.

29–34.— Mesamphidiscs of form B; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.
35.— A mesamphidisc of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
36–41.— Micramphidiscs of form B; magnified 500:
36, 39, phot. Zeiss, apochr. 4, compens. oc. 12;
37, 38, 40, 41, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
42–45.— Micramphidiscs of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
46, 47.— Centrotyle amphioxes of form A; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
48–50.— Hypodermal pentactines of form A; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
48, an apical view;
49, 50, side-views.
51.— Part of a tetractine mesamphidisc-derivate (tetradisc) of form B; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

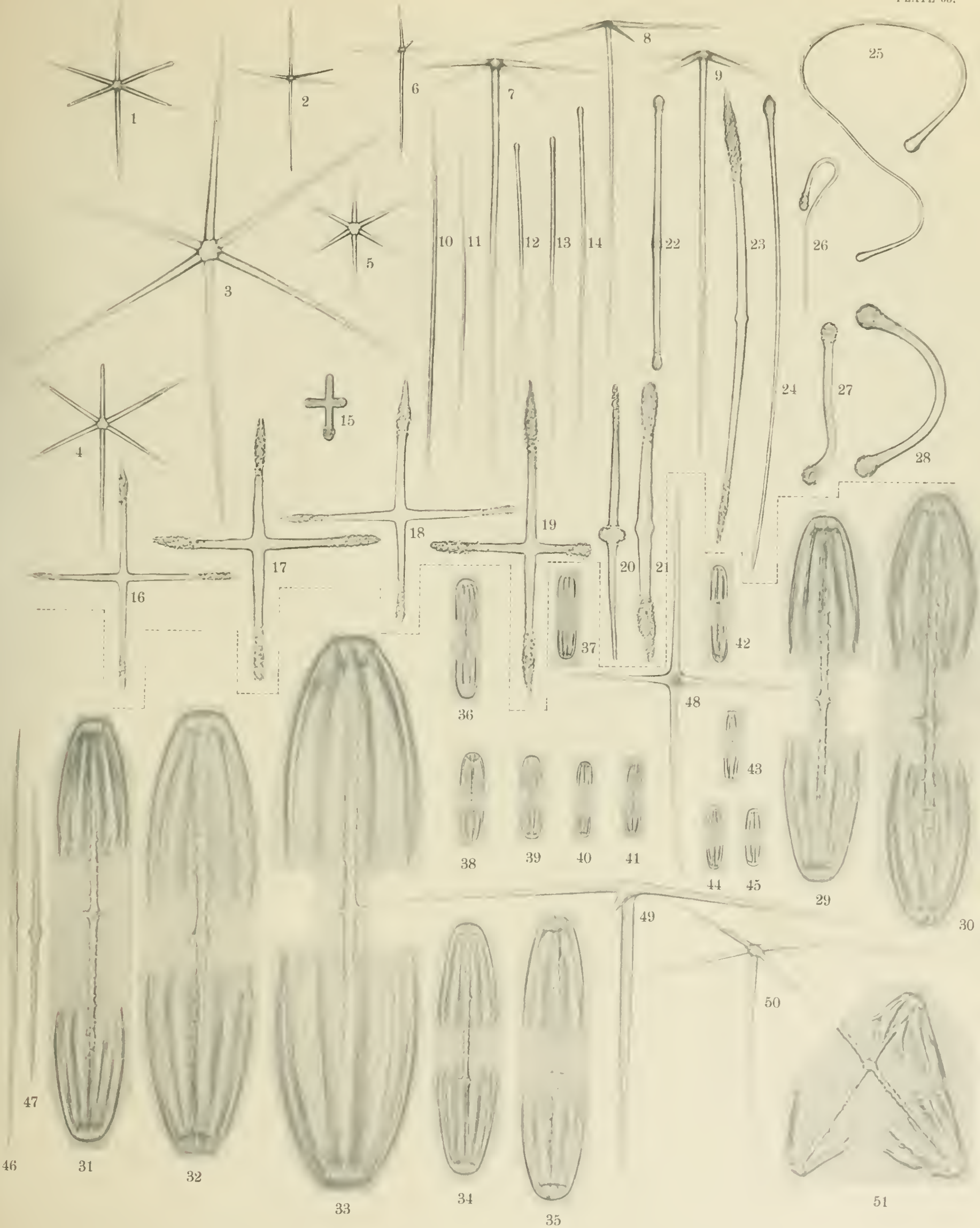


Fig. 1-28 Hyalonema (Prionema) fimbriatum n. sp. Fig. 29-51 Hyalonema (Hyalonema) placuna n. sp. 29-34, 36-41, 51 form B; 35, 42-50 form A.

Lendenfeld photographed.

PLATE 64.

PLATE 64.

Hyalonema (Hyalonema) placuna LENDENFELD.

Figs. 1–3, 5, 6, 9, 10, 12, 17–19 — form B.
Figs. 4, 7, 8, 11, 13–16 — form A.

1.— Centrotyle diactine spicule of form B; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.
2–7.— Microhexactines and pentactine microhexactine-derivates; magnified 500:
2, 6, 7, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
3–5, phot. Zeiss, apochr. 8, compens. oc. 12;
2, 3, 5, 6, of form B;
4, 7, of form A.
8.— Part of a paratangential section of the dermal membrane of form A, showing the lateral ray-crosses of the dermal pinules *in situ*; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
9, 10.— Two lateral ray-crosses of dermal pinules; magnified 300:
9, of form B; phot. Zeiss, apochr. 4, compens. oc. 6;
10, of form B; phot. Zeiss, apochr. 8, compens. oc. 12.
11.— View of the specimen of form A; natural size; phot. Zeiss, anastig. 480/412 mm.
12.— View of the specimen of form B; natural size; phot. Zeiss, anastig. 480/412 mm.
13.— Part of the oscular frill of form A; magnified 30; phot. Zeiss, planar 20 mm.:
a, dermal pinules; b, longitudinal rhabds.
14–19.— Side-views of dermal pinules; magnified 300:
14–16, of form A;
17–19, of form B;
14–17, phot. Zeiss, apochr. 8, compens. oc. 12;
18, 19, phot. Zeiss, apochr. 4, compens. oc. 6.

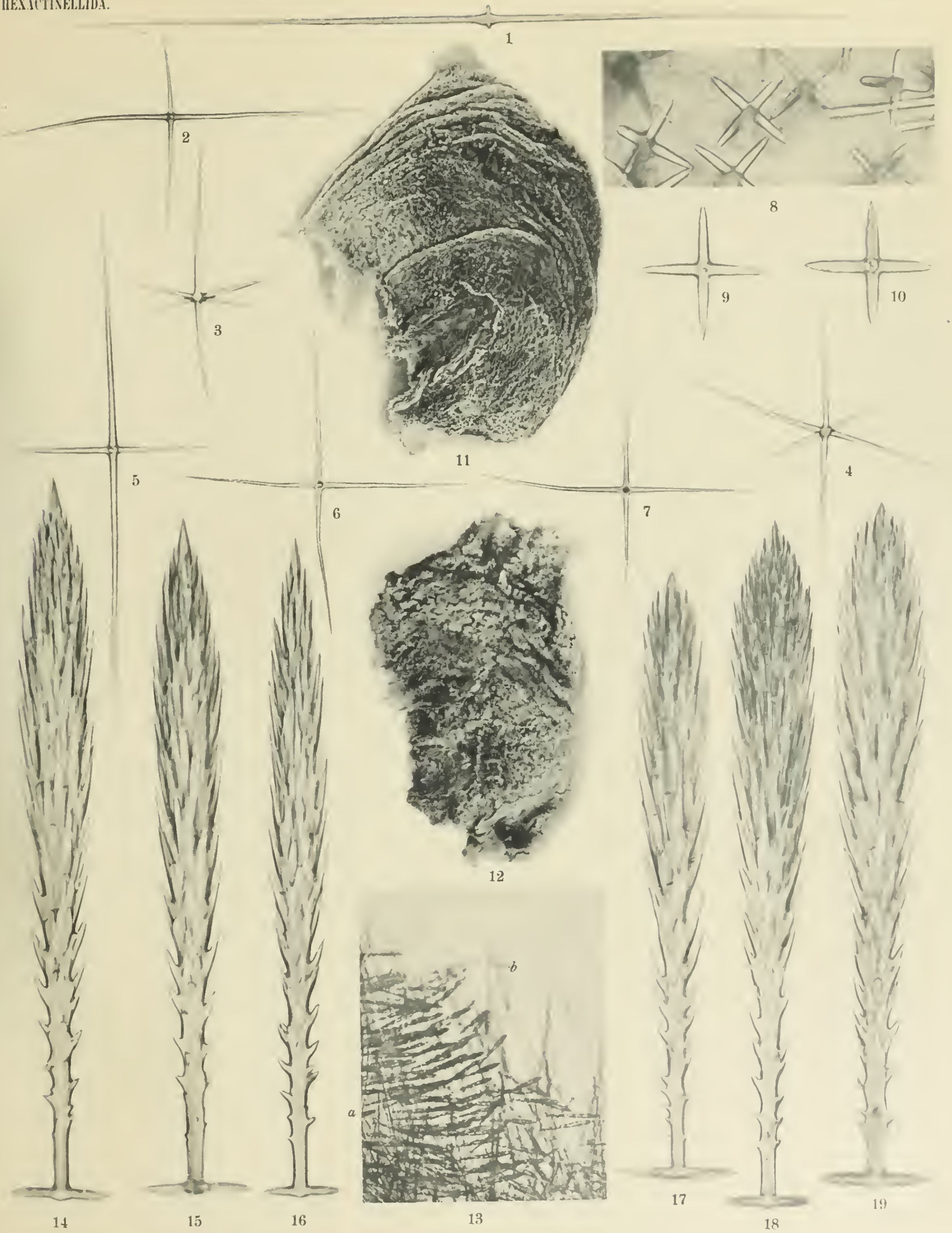


Fig. 1-19 Hyalonema (Hyalonema) placuna n. sp.
1-3, 5, 6, 9, 10, 12, 17-19 form B; 4, 7, 8, 11, 13-16 form A.

Lendenfeld photographed.

PLATE 65.

PLATE 65.

Hyalonema (Hyalonema) placuna LENDENFELD.

Figs. 1, 3–13, 16–18, 23 — form B.
Figs. 2, 14, 15, 19–22 — form A.

1.— A terminal anchor of a macramphidisc of form B, with a supernumerary tooth arising some distance below the others; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

2.— Part of a mesamphidisc of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

3–8.— Parts of a microhexactine of form B; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 3, the centrum and a ray of the spicule, focussed high (the tip of the ray in focus);
- 4, part of the distal portion of the same ray, focussed lower (a region about 17 μ from the tip in focus);
- 5, part of the middle-portion of the same ray, focussed still lower (a region about 32 μ from the tip in focus);
- 6, part of the middle-portion of the same ray, focussed still lower (a region about 42 μ from the tip in focus);
- 7, part of the proximal portion of the same ray, focussed still lower (a region about 53 μ from the tip in focus);
- 8, the basal part of the same ray and the centrum of the spicule, focussed lowest (the base of the ray in focus).

9–12.— Small internal pinules of form B; magnified 300:
- 9, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
- 10–12, phot. Zeiss, apochr. 4, compens. oc. 12.

13–15.— Micramphidiscs; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 13, a micramphidisc of form B;
- 14, a micramphidisc of form A, focussed higher; 15, focussed lower.

16–21.— Internal pinules; magnified 300:
- 16–18, of form B;
- 19–21, of form A;
  - 16, 20, 21, phot. Zeiss, apochr. 8, compens. oc. 12;
  - 17–19, phot. Zeiss, apochr. 4, compens. oc. 6.

22, 23.— Radial sections through a superficial part of the sponge; magnified 30; phot. Zeiss, planar 20 mm.:
- 22, of form A;
- 23, of form B;
  - a, dermal pinule-fur; b, choanosome.

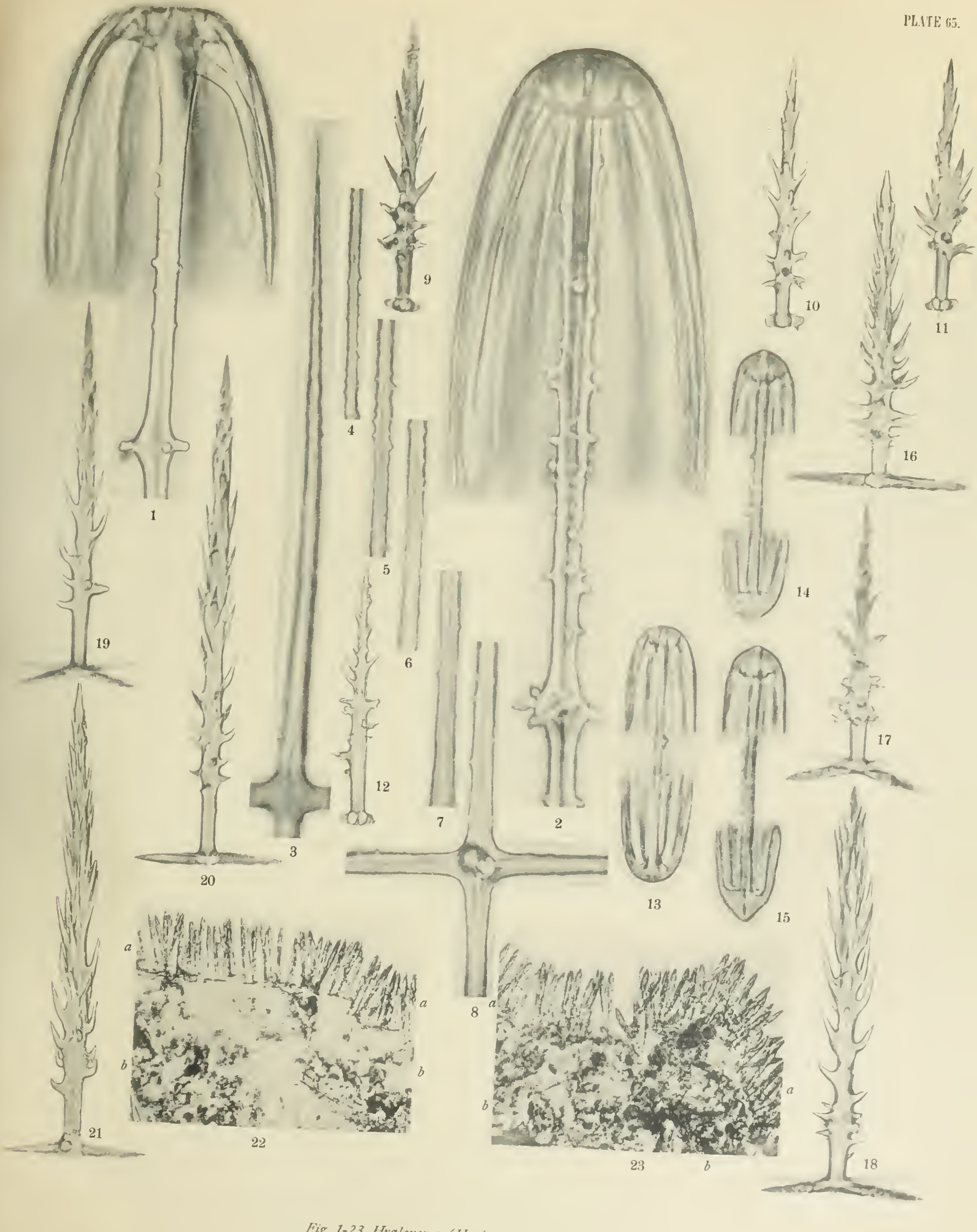


Fig. 1-23 Hyalonema (Hyalonema) placuna n. sp.
1, 3-13, 16-18, 23 form B; 2, 14, 15, 19-22 form A.

Lendenfeld photographed.

PLATE 66.

PLATE 66.

Hyalonema (Hyalonema) placuna LENDENFELD.

Figs. 1, 2, 5 — form A.
Figs. 3, 4, — form B.

1–5.— Macramphidiscs and parts of same; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6:
1, a terminal anchor of a macramphidisc of form A; focussed low (the shaft in focus);
2, the same anchor; focussed high (the upper teeth in focus);
3, a macramphidisc of form B; focussed low (the shaft in focus);
4, the same macramphidisc; focussed high (the upper teeth in focus);
5, a macramphidisc of form A.

Fig. 1-5 Hyalonema (Hyalonema) placuna n. sp.
1, 2, 5 form A; 3, 4 form B.

Lendenfeld photographed.

PLATE 67

PLATE 67.

Hyalonema (Hyalonema) tenuifusum LENDENFELD.

Figs. 1–7, 9, 13–17 — specimen a.
Figs. 8, 10–12, 18–26 — specimen b.

1.— View of specimen a; reduced 1: 0.84; phot. Zeiss, anastig. 480/412 mm.

2–5.— Large macramphidiscs and parts of same of specimen a; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6:

2, a whole macramphidisc focussed low (on the shaft);

3, one of the terminal anchors of the same spicule, focussed high (on the tips of the uppermost teeth);

4, a terminal anchor of another macramphidisc, focussed high (on the tips of the uppermost teeth);

5, the same terminal anchor, focussed low (on the shaft).

6, 7.— Acanthophores of specimen a; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

6, a tetractine;

7, a diactine.

8.— Tetractine microhexactine-derivates of specimen b; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

9.— Microhexactine of specimen a; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

10, 11.— Parts of a tetractine microhexactine-derivate of specimen b; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

10, part of the distal portion of a ray;

11, the central part of the spicule.

12.— The central part with the tyle of a minute centrotyle amphiox of specimen b; magnified 2000, u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

13–26.— Amphidiscs; magnified 500:

13–17, of specimen a;

18–26, of specimen b;

13, 14, 16–21, 25, phot. Zeiss, H. I. apochr. 2, compens. oc. 4;

15, 22–24, 26, phot. Zeiss, apochr. 4, compens. oc. 12;

13, 14, 22–25, small macramphidiscs;

15, 26, large macramphidiscs;

16–21, micramphidiscs.

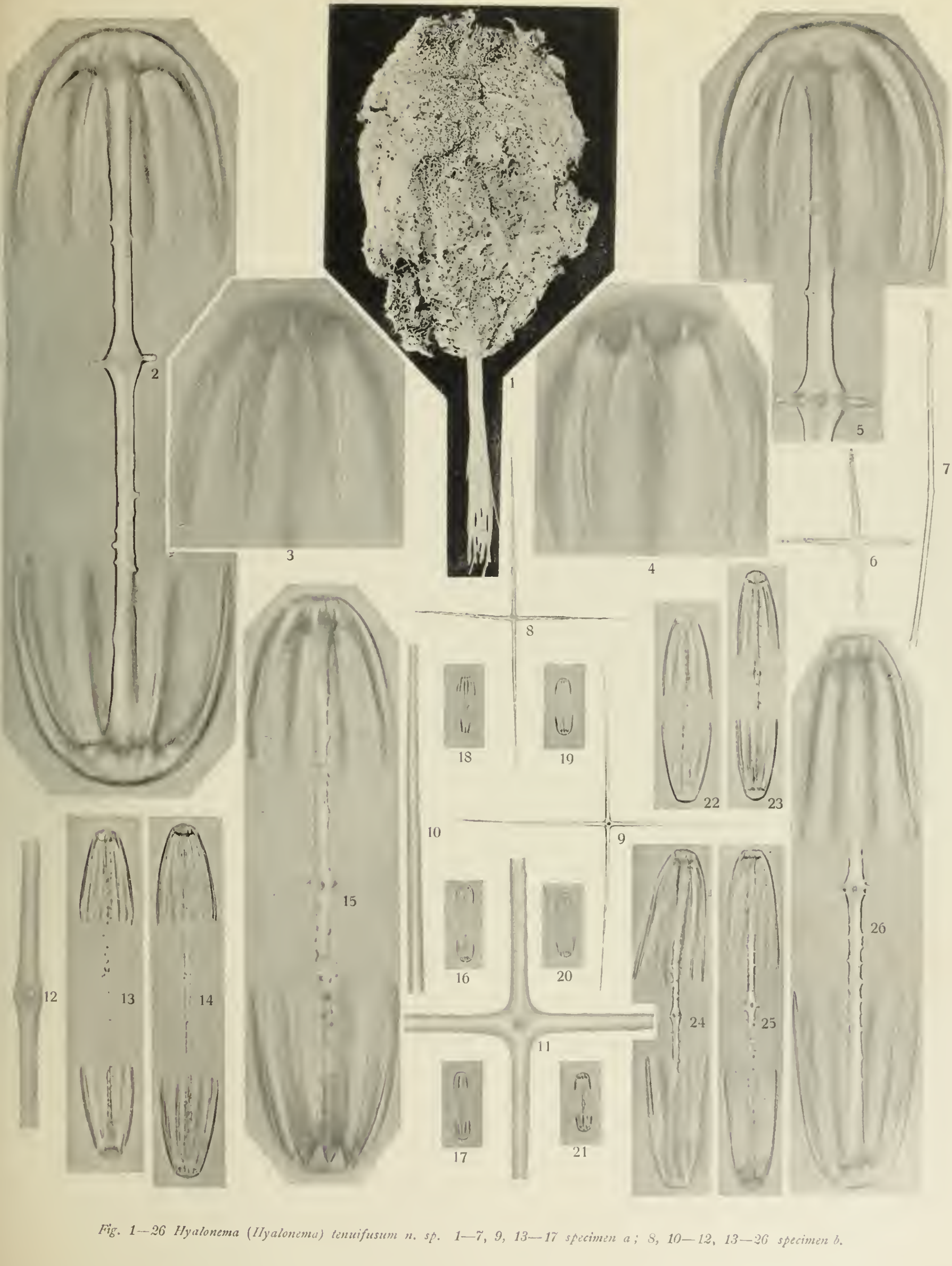


Fig. 1—26 Hyalonema (Hyalonema) tenuifusum n. sp. 1—7, 9, 13—17 specimen a; 8, 10—12, 13—26 specimen b.

Lendenfeld photographed.

PLATE 68.

PLATE 68.

Hyalonema (Hyalonema) tenuifusum Lendenfeld.

Figs. 1, 3–10, 20, 22, 23, 25 — specimen b.
Figs. 2, 11–19, 21, 24 — specimen a.

1.— The end-part of an anchor-tooth of a large macramphidisc of specimen b; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

2–4.— Gastral (and canalar ?) pinules; magnified 300:
- 2, of specimen a; phot. Zeiss, apochr. 16, compens. oc. 12;
- 3, 4, of specimen b; phot. Zeiss, apochr. 8, compens. oc. 12.

5, 6.— Micramphidiscs of specimen b; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

7–9.— Microhexactine-derivates of specimen b; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

10, 11.— Fairly regular microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
- 10, of specimen b;
- 11, of specimen a.

12–15.— Microhexactine-derivates of specimen a; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

16, 17.— Minute centrotyle amphioxes of specimen a; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

18–21.— Side-views of large dermal pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 6:
- 18, 20, 21, pentactine pinules;
- 19, a hexactine pinule;
  - 18, 19, 21, of specimen a;
  - 20, of specimen b.

22, 23.— Parts of the shafts of two small macramphidiscs of specimen b; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

24.— Side-view of a small pentactine dermal pinule of specimen a; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.

25.— Apical view of the lateral rays of a dermal pinule of specimen b; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.

Hyalonema (Hyalonema) sp.

Figs. 26–33. Station 4656.

26.— View of the specimen; reduced 100: 91; phot. Zeiss, anastig. 480/412 mm.

27, 28.— Rhabd acanthophores; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

29, 30.— Two microhexactines:
- 29, magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6;
- 30, magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

31–33.— Tetractine acanthophores; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

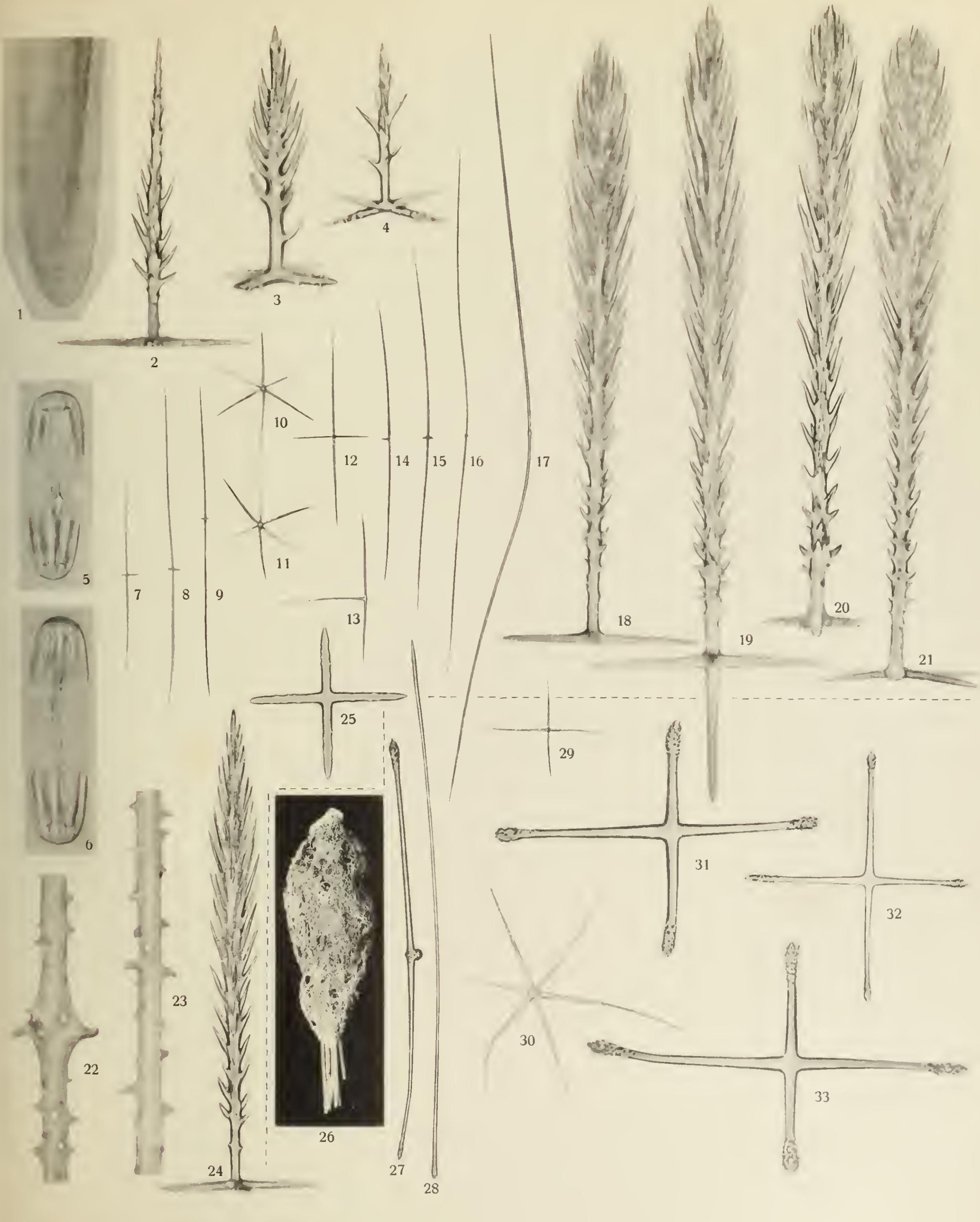


Fig. 1—25 Hyalonema (Hyalonema) tenuifusum n. sp. 1, 3—10, 20, 22, 23, 25 specimen b; 2, 11—19, 21, 24, specimen a.
Fig. 26—33 Hyalonema (Hyalonema) spec. from station 4656.

Lendenfeld photographed.

PLATE 69.

PLATE 69.

Hyalonema (Hyalonema) sp.

Figs. 1–5. Station 4656.

1, 2.— Pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 6.
3–5.— Amphidiscs; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

Hyalonema (Hyalonema) tylostylum Lendenfeld.

Figures 6–25.

6.— A hexactine megasclere; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.
7.— A hypodermal pentactine; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.
8, 9.— Normal tylostyles; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
10.— The tyle-bearing part of an abnormal tylostyle; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
11–13.— Amphiox megascleres; magnified 50; phot. Zeiss, planar 20 mm., compens. oc. 6.
14–25.— Amphidiscs and parts of such; magnified 500:
14, a large macramphidisc; phot. Zeiss, apochr. 8, compens. oc. 12;
15–18, micramphidiscs; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
19, centrum and one anchor of a large macramphidisc; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
20, a small macramphidisc; phot. Zeiss, apochr. 4, compens. oc. 12;
21, a small macramphidisc; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
22, 23, small macramphidiscs; phot. Zeiss, apochr. 4, compens. oc. 6;
24, 25, the central tyle of the shaft of two large macramphidiscs; phot. Zeiss, apochr. 8, compens. oc. 12.

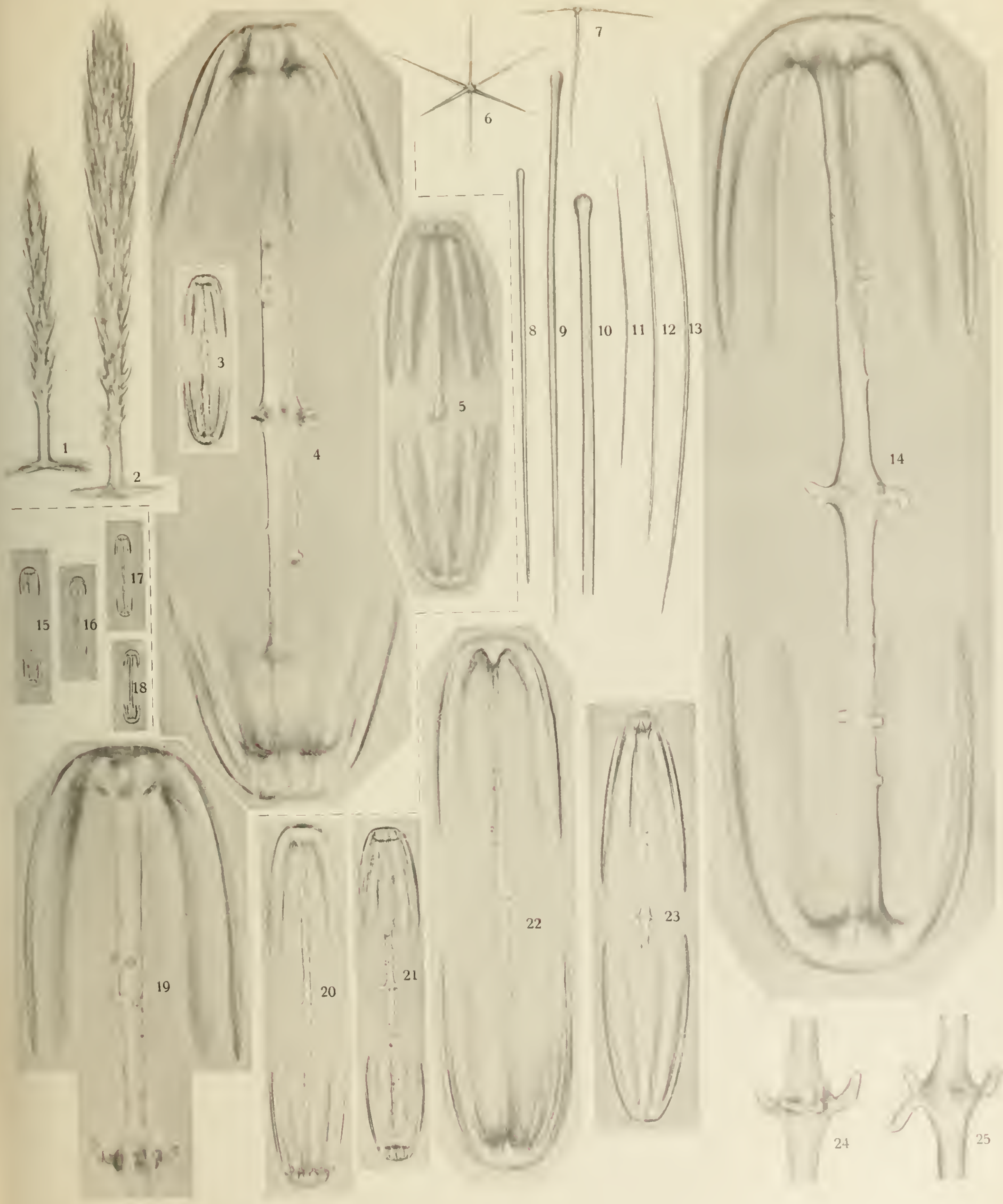


Fig. 1—5 Hyalonema (Hyalonema) spec. from station 4656.
Fig. 6—25 Hyalonema (Hyalonema) tylostylum n. sp.

PLATE 70.

PLATE 70.

Hyalonema (Hyalonema) tylostylum Lendenfeld.

Figures 1–10.

1, 2.— Dermal pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
3.— Part of a radial section through the superficial part of the sponge and the pinule-fur; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
 a, a large macramphidisc; b, dermal pinules.
4.— A microhexactine; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
5.— Group of spicules in a centrifuge spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
 a, microhexactines; b, a micropentactine; c, a micramphidisc.
6.— View of the smaller specimen; reduced 100: 91; phot. Zeiss, anastig. 480/412 mm.
7.— A microhexactine; magnified 200; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
8.— Surface view of the dermal pinule-fur; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
9, 10.— Gastral pinules; magnified 300:
 9, phot. Zeiss, apochr. 8, compens. oc. 12;
 10, phot. Zeiss, apochr. 4, compens. oc. 6.

Hyalonema (Prionema) pinulifusum Lendenfeld.

Figures 11–24.

11–24.— Pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
 11–14, small, probably canalaria;
 15–19, large;
 20–24, medium.

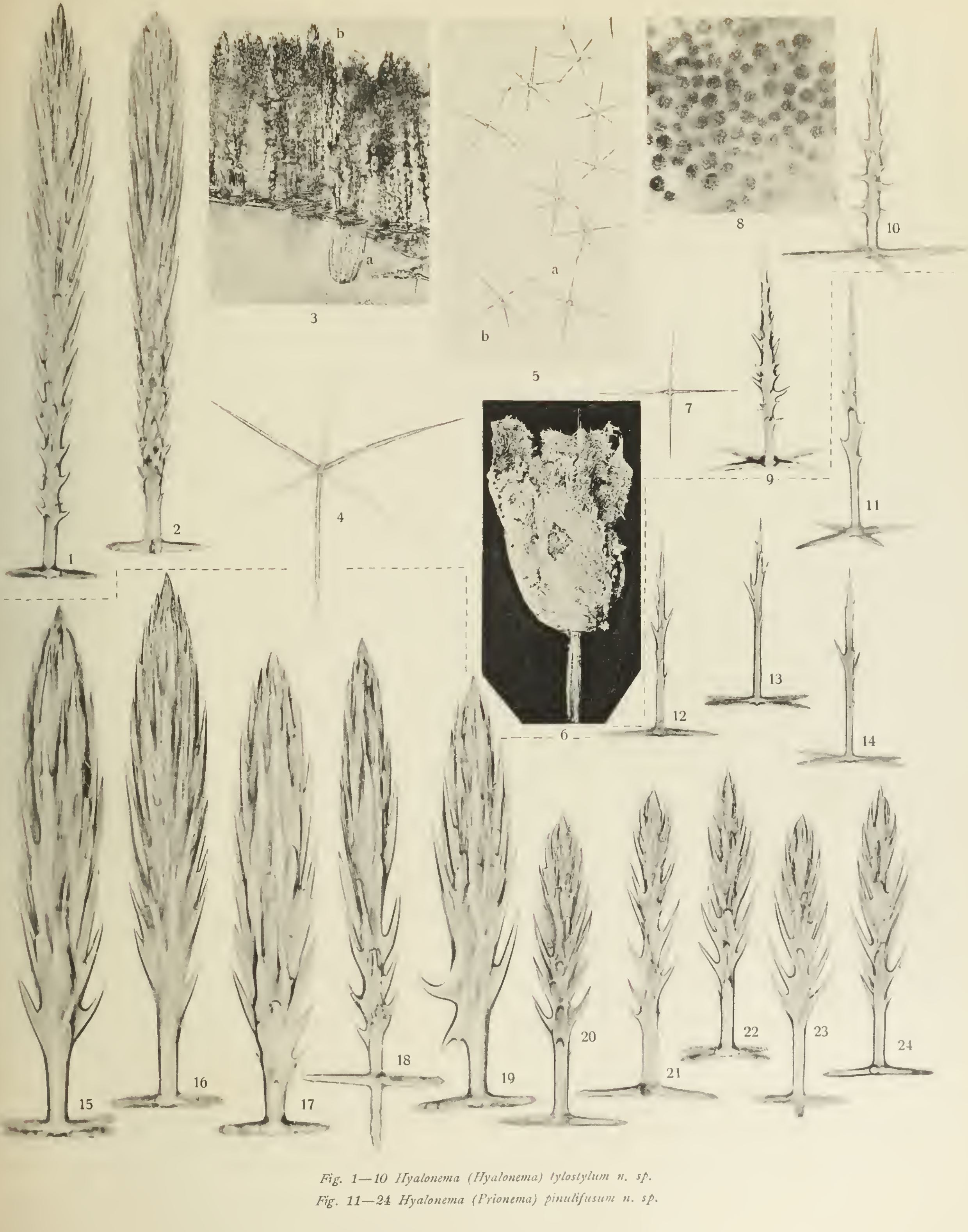


Fig. 1—10 Hyalonema (Hyalonema) tylostylum n. sp.
Fig. 11—24 Hyalonema (Prionema) pinulifusum n. sp.

Lendenfeld photographed.

PLATE 71.

PLATE 71.

Hyalonema (Prionema) pinulifusum Lendenfeld.

Figures 1–11.

1–3.— A microhexactine; magnified 500; phot. Zeiss. H. I. apochr. 2, compens. oc. 6:
1, focussed high (on the tips of the three upwardly directed rays); 2, focussed intermediate (on the centre of the spicule); 3, focussed low (on the tips of the three downwardly directed rays).
4.— Part of a microhexactine; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
5–8.— Macramphidiscs and parts of such; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6:
5, a whole one;
6, 7, the centrum and one anchor of two others;
8, a tooth seen nearly *en face*.
9.— Group of microhexactines from a spicule-preparation; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
10.— A micropentactine; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
11.— The tip of the distal ray of a large pinule; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.

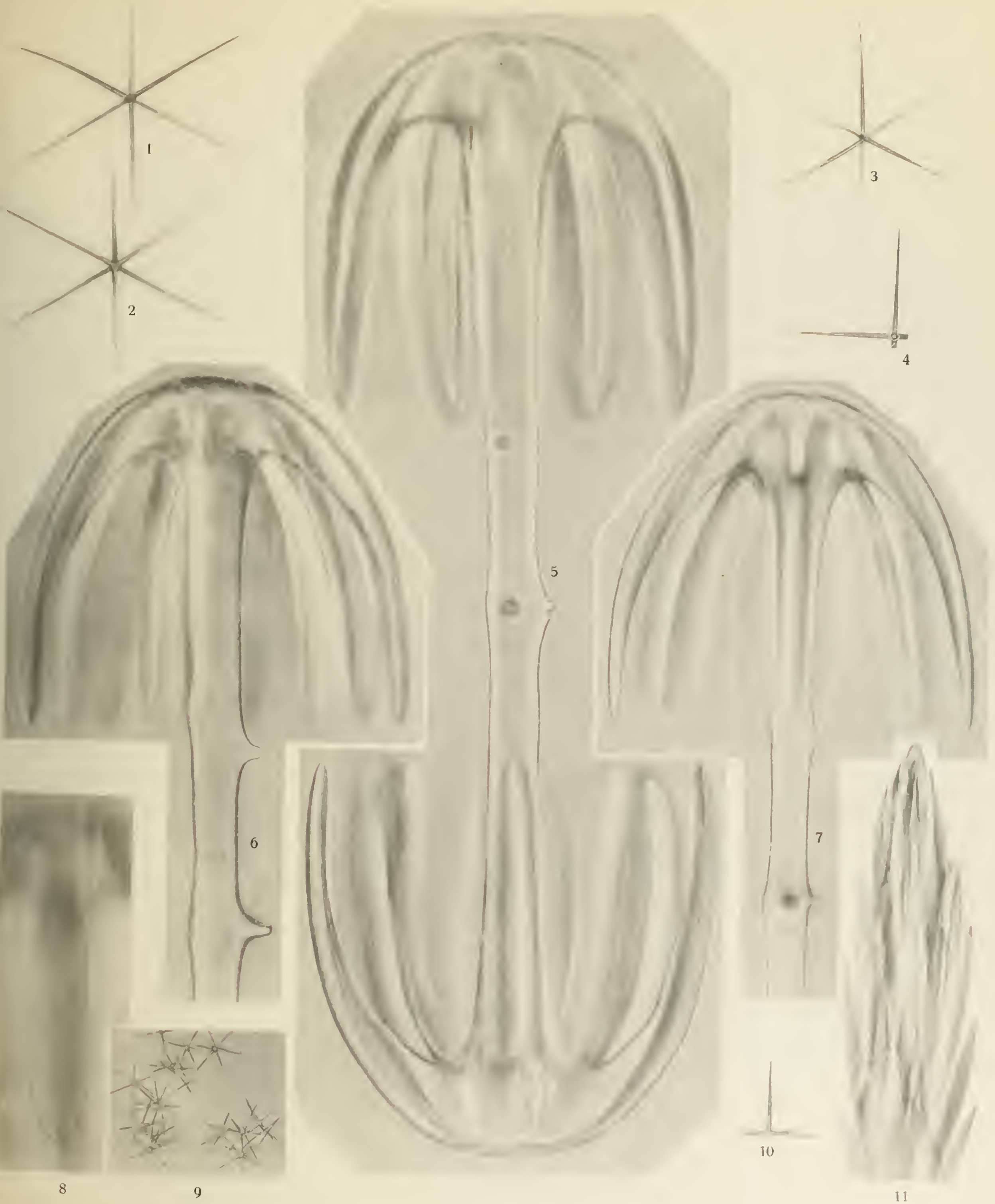


Fig. 1—11 Hyalonema (Prionema) pinulifusum n. sp.

Lendenfeld photographed.

PLATE 72.

PLATE 72.

Hyalonema (Prionema) pinulifusum Lendenfeld.

Figures 1–15.

1, 2.— A large mesamphidisc with serrated teeth; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6: 1, focussed high (on the upper anchor-teeth); 2, focussed lower (on the axis of the shaft).

3–8.— Mesamphidiscs with smooth teeth, and parts of such; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:

3, a large one;

4, 5, the centrum and one anchor of two large ones;

6–8, small ones.

9–15.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

9–14, small ones with long anchors;

15, a large one with short anchors.

Hyalonema (Prionema) agujanum tenuis Lendenfeld.

Figs. 16, 22, 26 — form B.
Figs. 17–21, 23–25, 27 — form A.

16–18.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:

16, of form B;

17, 18, of form A.

19.— A hypodermal pentactine of form A; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.

20.— Part of an axial, longitudinal section of form A showing the gastral pinule-fur; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

21–25.— Pinules; magnified 300:

21, 23–25, of form A; phot. Zeiss, apochr. 4, compens. oc. 6;

22, of form B; phot. Zeiss, apochr. 8, compens. oc. 12.

26, 27.— Hexactine megascleres; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:

26, of form B;

27, of form A.

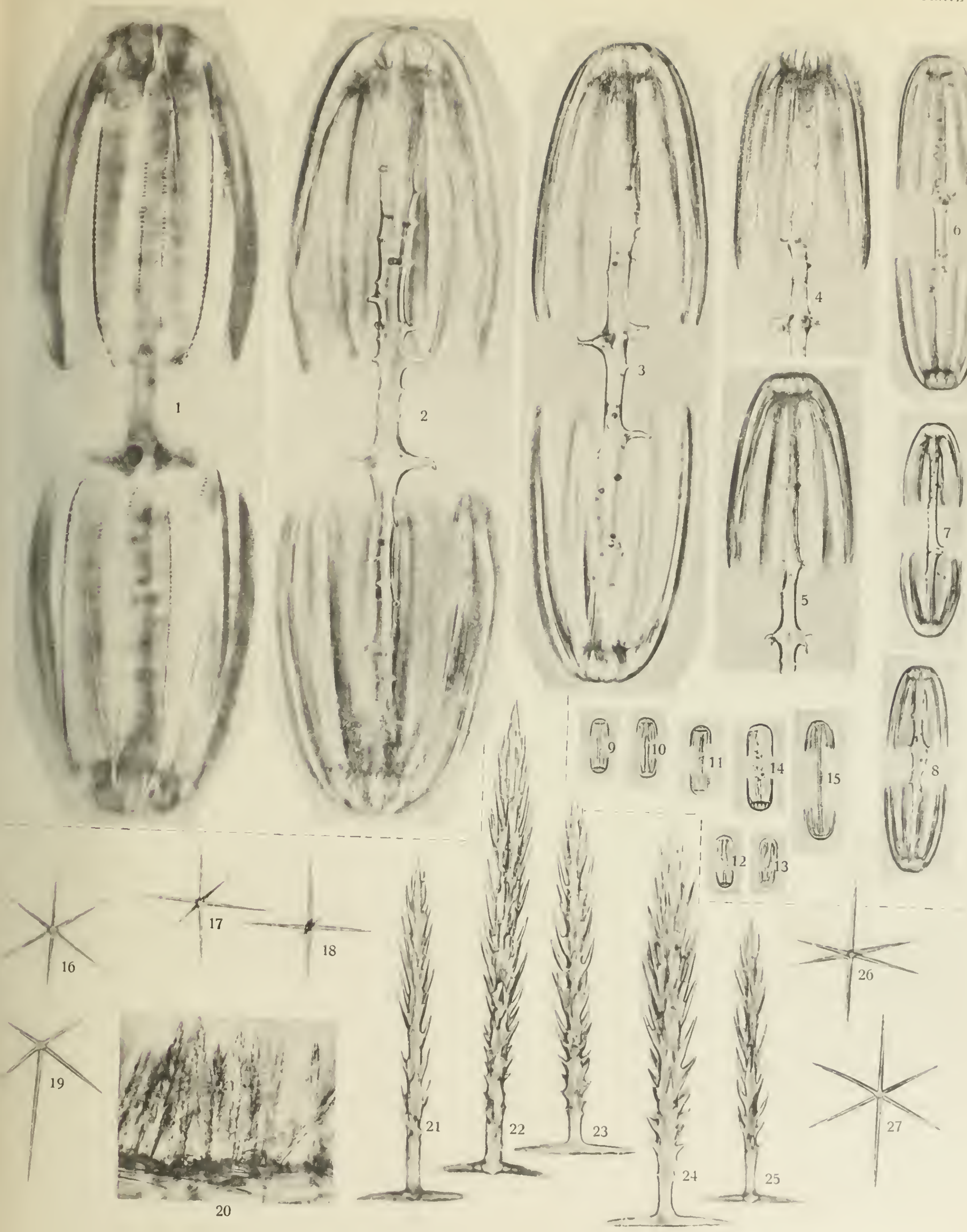


Fig. 1—15 Hyalonema (Prionema) pinulifusum n. sp.
Fig. 16—27 Hyalonema (Prionema) agujanum n. sp. var. tenuis. 16, 22, 26 form B; 17—21, 23—25, 27 form A

Lendenfeld photographed.

PLATE 73.

PLATE 73.

Hyalonema (Prionema) agujanum tenuis Lendenfeld.

Figs. 1–6 — form A.
Fig. 7 — form B.

1.— Front-view of the tip of a tooth of a macramphidisc of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

2, 3.— Front-view of the tip of a tooth of a macramphidisc of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:

2, focussed lower; 3, focussed higher.

4.— Half of a macramphidisc of form A; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

5–7.— Macramphidiscs; magnified 500:

5, 6, of form A;

7, of form B;

5, phot. Zeiss, apochr. 8, compens. oc. 8;

6, 7, phot. Zeiss, apochr. 4, compens. oc. 6.

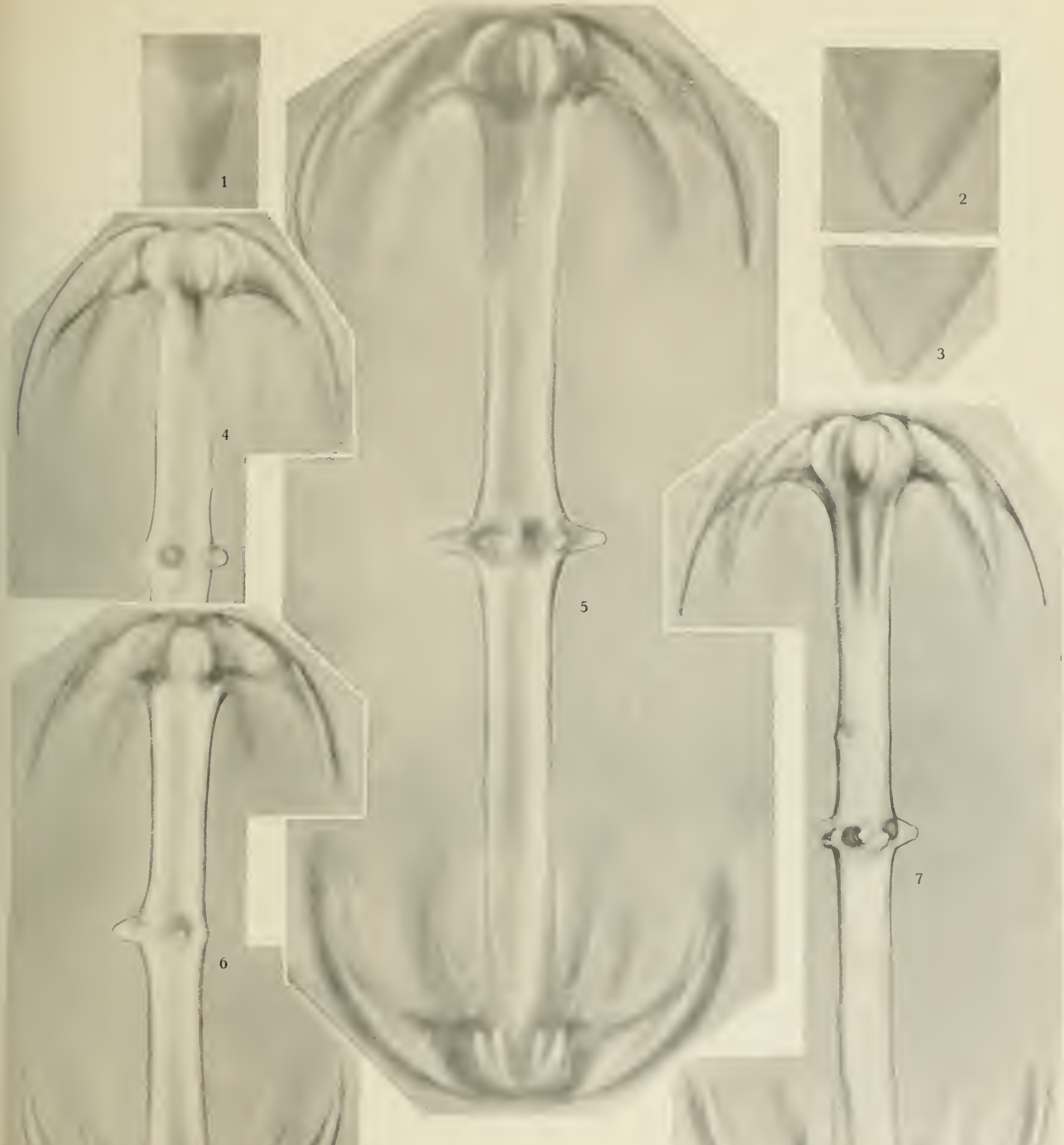


Fig. 1—7 Hyalonema (Prionema) agujanum n. sp. var. tenuis. 1—6 form A; 7 form B.

Lendenfeld photographed.

PLATE 74.

PLATE 74.

Hyalonema (Prionema) agujanum tenuis Lendenfeld.

Figs. 1–5, 8 — form A.
Figs. 6, 7, 9 — form B.

1, 2.— Two anchor-teeth of large serrated mesamphidiscs of form A; magnified 500:
- 1, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
- 2, phot. Zeiss, apochr. 4, compens. oc. 12.

3, 4.— A large serrated mesamphidisc of form A; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6:
- 3, focussed lower (the centre of the shaft in focus); 4, focussed higher (the uppermost teeth in focus).

5.— A large serrated mesamphidisc of form A; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6.

6, 7.— A large serrated mesamphidisc of form B; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
- 6, focussed lower (the centre of the shaft in focus); 7, focussed higher (the uppermost teeth in focus).

8, 9.— The terminal anchors of two large serrated mesamphidiscs with the uppermost teeth in focus; magnified 500:
- 8, of form A; phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
- 9, of form B; phot. Zeiss, apochr. 8, compens. oc. 12.

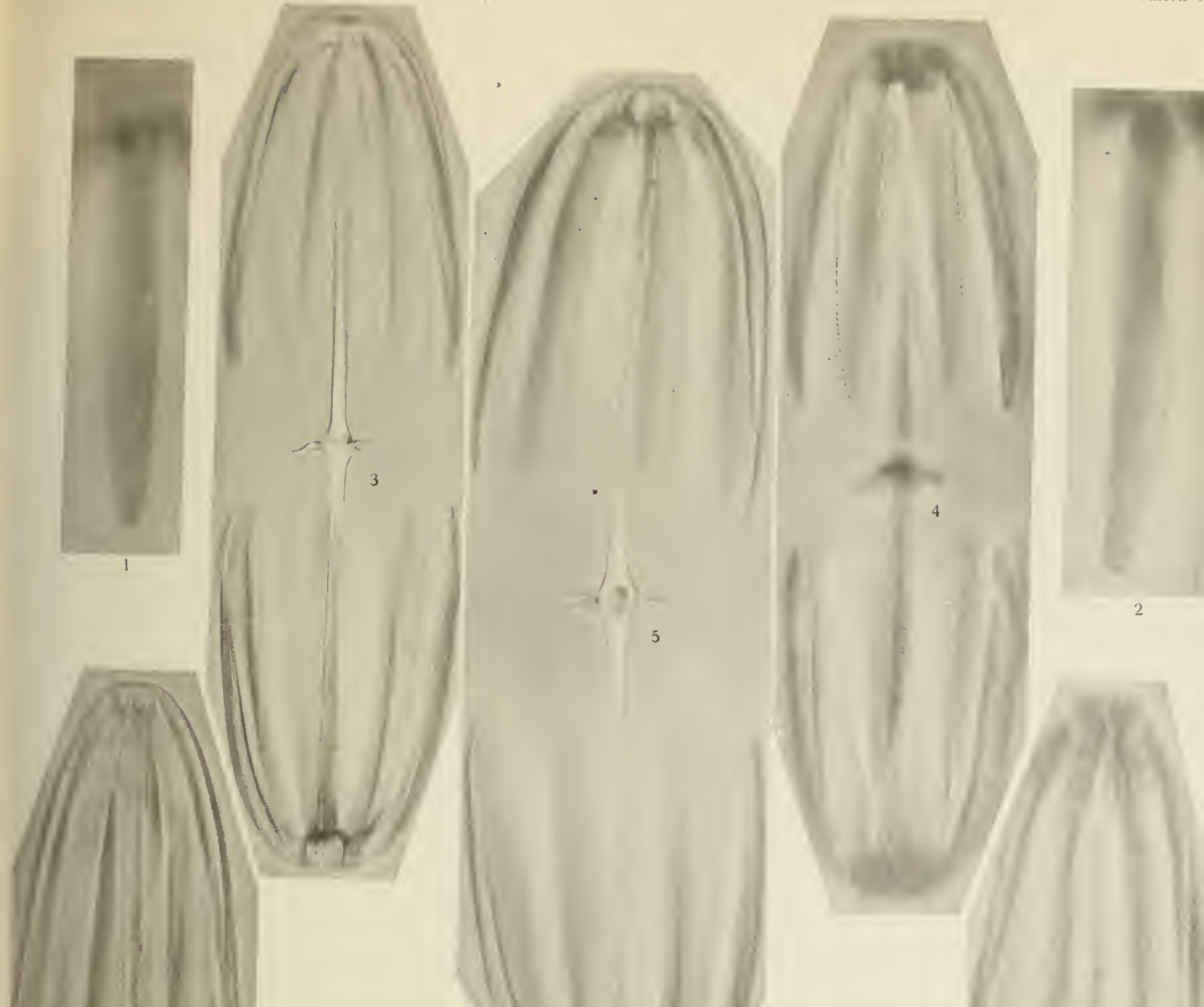


Fig. 1—9 Hyalonema (Prionema) agujanum n. sp. var. tenuis. 1—5, 8 form A. 6, 7, 9 form B.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 75.

PLATE 75.

Hyalonema (Prionema) agujanum tenuis Lendenfeld.

Figs. 1–13, 15, 17, 19–27, 29–37 — form A.
Figs. 14, 16, 18, 28 — form B.

1, 2.— A small serrated mesamphidisc of form A; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:
  1, focussed higher (the uppermost teeth in focus); 2, focussed lower (the centre of the shaft in focus).

3–21.— Macramphidiscs; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6:
  3–13, 15, 17, 19–21, of form A;
  14, 16, 18, of form B.

22, 23.— A small serrated mesamphidisc of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  22, focussed higher (the uppermost teeth in focus); 23, focussed lower (the centre of the shaft in focus).

24–27.— Micramphidiscs of form A; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

28–30.— Three specimens; natural size; phot. Zeiss, anastig. 480/412 mm.:
  28, form B;
  29, 30, form A.

31–34.— Two micramphidiscs of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  31–33, a smaller one:
    31, focussed high; 32, focussed intermediate; 33, focussed low;
  34, a larger one.

35–37.— An abnormal macramphidisc of form A; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:
  35, focussed low; 36, focussed intermediate; 37, focussed high.

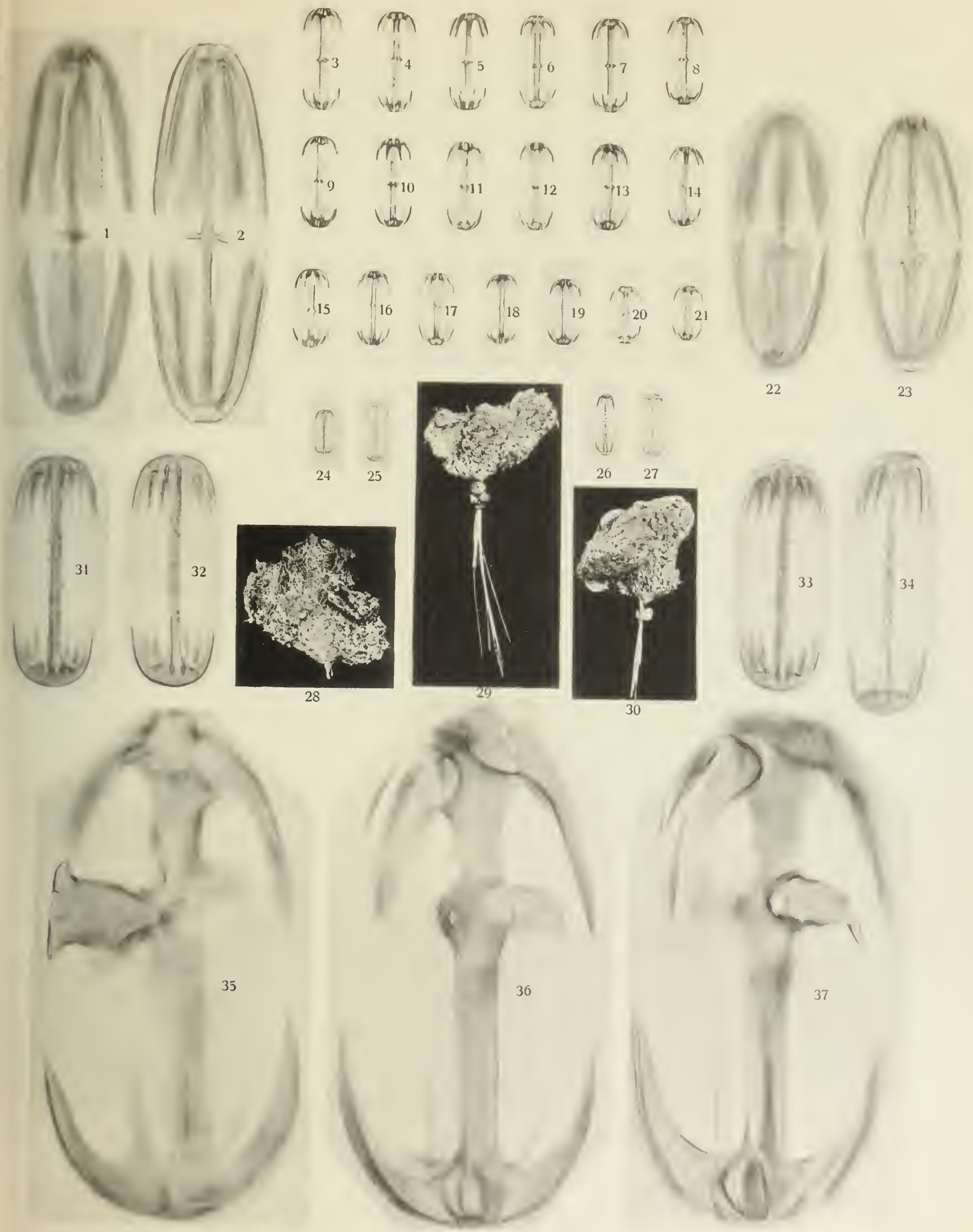


Fig. 1—37 Hyalonema (Prionema) agujanum n. sp. var. tenuis. 1—13, 15, 17, 19—27, 29—37 *form A*: 14, 16, 18, 28 *form B*.

endenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 76.

PLATE 76.

Hyalonema (Prionema) agujanum tenuis LENDENFELD.

Figs. 1–7, 11, 12, 15–36 — form A.
Figs. 8–10, 13, 14 — form B.

1.— The centrum and one ray of a microhexactine of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

2, 3.— Micramphidiscs of form A; magnified 500:
- 2, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
- 3, phot. Zeiss, apochr. 4, compens. oc. 12.

4–6.— Portions of transverse sections of a Palythoa polyp attached to the stalk of a specimen of form A; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

7.— Axial, longitudinal section through the upper part of the stalk with Palythoa attached, and the lower part of the body of form A; magnified 6; phot. Zeiss, planar 50 mm.

8–14.— Acanthophores from the sponge; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
- 8, a small regular tetractine of form B;
- 9, a large regular pentactine of form B;
- 10, a large irregular tetractine of form B;
- 11, 12, small regular tetractines of form A;
- 13, a large regular tetractine of form B;
- 14, a large diactine of form B.

15–32.— Acanthophores and other sponge-spicules formed in a Palythoa polyp on the stalk of a specimen of form A; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
- 15, 16, short diactines, much more spiny at the ends than in the middle;
- 17–20, short and stout rod-shaped spicules; uniformly spined throughout;
- 21, 22, small stout triactines; uniformly spined throughout;
- 23–30, small stout tetractines, uniformly spined throughout;
- 31, a small only terminally spined tylostyle;
- 32, a minute pentactine.

33.— The tip of an anchor-tooth of a large serrated mesamphidisc of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

34.— Transverse section through the upper part of a Palythoa polyp attached to the stalk of a specimen of form A; magnified 30; phot. Zeiss, planar 20 mm.

35, 36.— The end-part of an anchor-tooth of a large mesamphidisc of form A; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
- 35, focussed higher; 36, focussed lower.

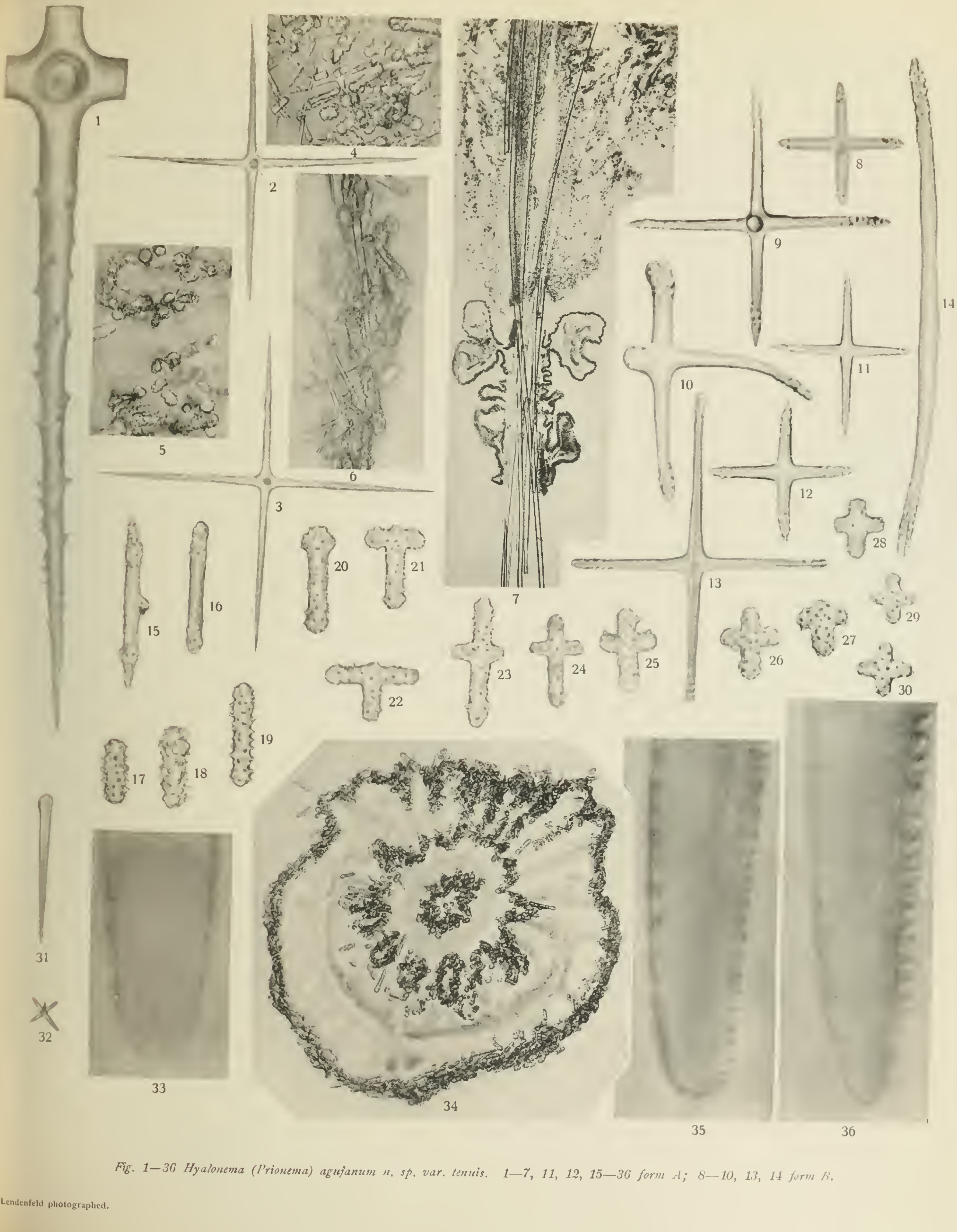


Fig. 1—36 Hyalonema (Prionema) agujanum n. sp. var. tenuis. 1—7, 11, 12, 15—36 form A; 8—10, 13, 14 form B.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 77.

PLATE 77.

Hyalonema (Prionema) agujanum lata Lendenfeld.

Figures 1–10.

1.— The greater part of the shaft and one terminal anchor of a macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

2, 3.— Half (one terminal anchor) of an ordinary, large serrated mesamphidisc; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 6:

2, focussed higher (on the uppermost teeth); 3, focussed lower (on the shaft).

4, 5.— An ordinary, small serrated mesamphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

4, focussed higher (on the uppermost teeth); 5, focussed lower (on the centre of the shaft).

6, 7.— A large, broad-anchored mesamphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:

6, focussed higher (on the uppermost teeth); 7, focussed lower (on the centre of the shaft).

8.— Micramphidisc; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.

9, 10.— Apical view of a terminal anchor of a macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:

9, focussed low (on the tips of the teeth); 10, focussed high (on the web connecting the teeth basally).

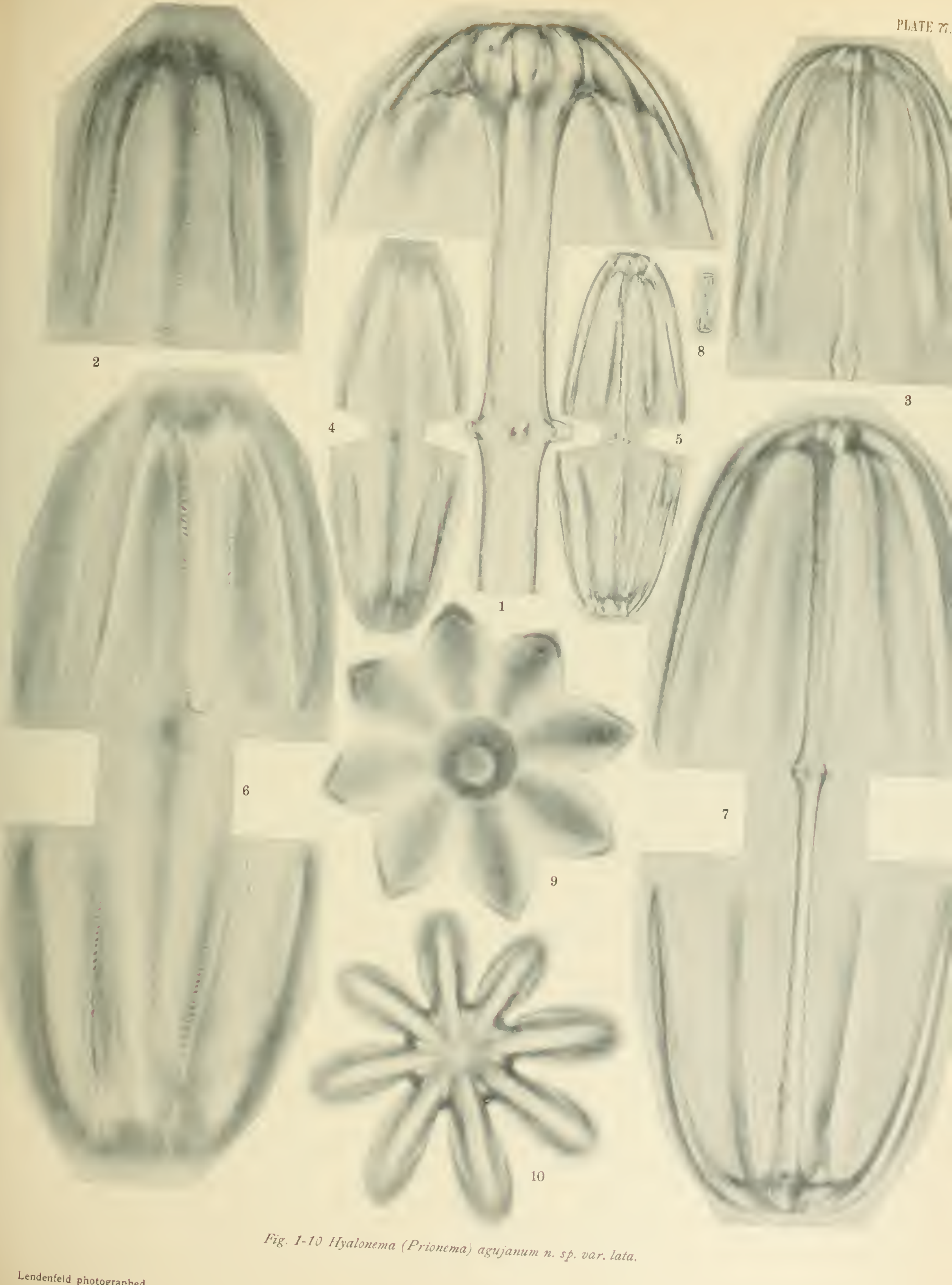


Fig. 1-10 Hyalonema (Prionema) agujanum n. sp. var. lata.

Lendenfeld photographed

PLATE 78.

PLATE 78.

Hyalonema (Prionema) agujanum lata LENDENFELD.

Figures 1–15.

1, 2.— Parts of stalk-spicules; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
3.— A diactine pinule; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
4.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm.
5–7.— Microhexactines; magnified 200; phot. Zeiss, apochr. 4, compens. oc. 6.
8.— A microhexactine; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
9–11.— Pentactine pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
12–15.— Macramphidiscs; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.

Hyalonema (Hyalonema) grandancora LENDENFELD.

Figures 16–45.

16–19.— Macramphidiscs; magnified 50; phot. Zeiss, achr. aa, compens. oc. 6.
20.— Transverse section through the upper part of a Palythoa polyp attached to the stalk of the sponge; magnified 30; phot. Zeiss, planar 20 mm.
21–40.— Uniformly and densely spined acanthophores from the Palythoa polyps; attached to the stalk; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
(Each vertical pair of views represents the same spicule; the upper views of the pairs, figs. 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, are focussed high, the views beneath these, figs. 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, are focussed low; thus 21 and 22 represent the same spicule, 23 and 24, and so on).
41–45.— Pinules; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6:
42, 43, gastral pinules;
41, 44, 45, dermal pinules.

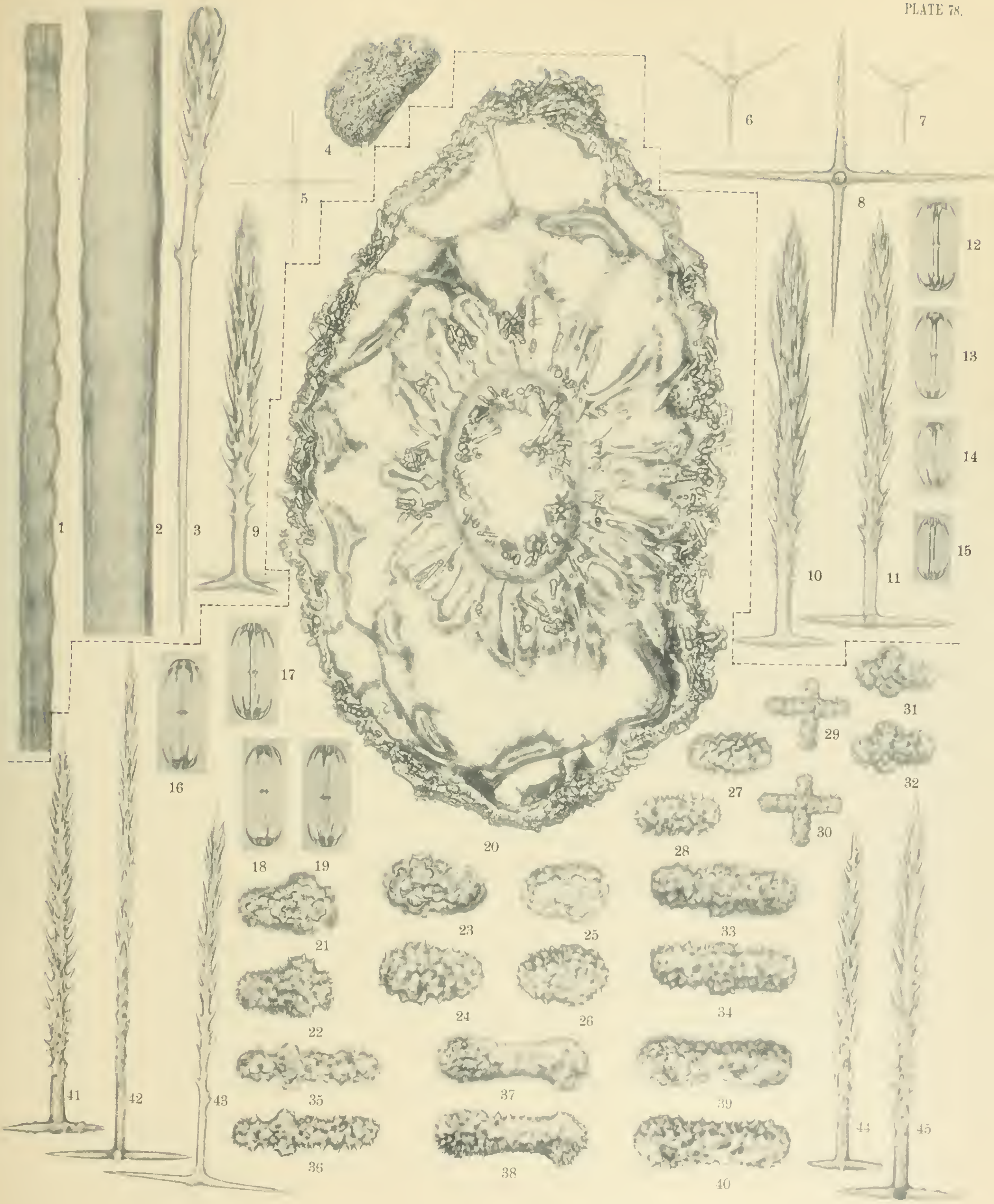


Fig. 1-15 Hyalonema (Prionema) agujanum n. sp. var. lata.
Fig. 16-45 Hyalonema (Hyalonema) grandancora n. sp.

Lendenfeld photographed

PLATE 79.

PLATE 79.

Hyalonema (Hyalonema) grandancora LENDENFELD.

Figures 1–26.

1, 2.— Macramphidiscs; magnified 500:
  1, phot. Zeiss, apochr. 8, compens. oc. 12;
  2, phot. Zeiss, apochr. 8, compens. oc. 8.
3–11.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
12.— View of the sponge; reduced 1: 0.85; phot. Zeiss, anastig. 480/412 mm.
13–19.— Hexactine megascleres; magnified 30; phot. Zeiss, planar 20 mm.
20.— Apical view of the lateral ray-cross of a dermal pinule; magnified 300; phot. Zeiss, apochr. 4, compens. oc. 6.
21–23.— Microhexactines; magnified 500:
  21, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
  22, 23, phot. Zeiss, apochr. 4, compens. oc. 12.
24, 25.— Large micramphidiscs; magnified 500:
  24, phot. Zeiss, apochr. 4, compens. oc. 12;
  25, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
26.— Part of a terminal anchor of a macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

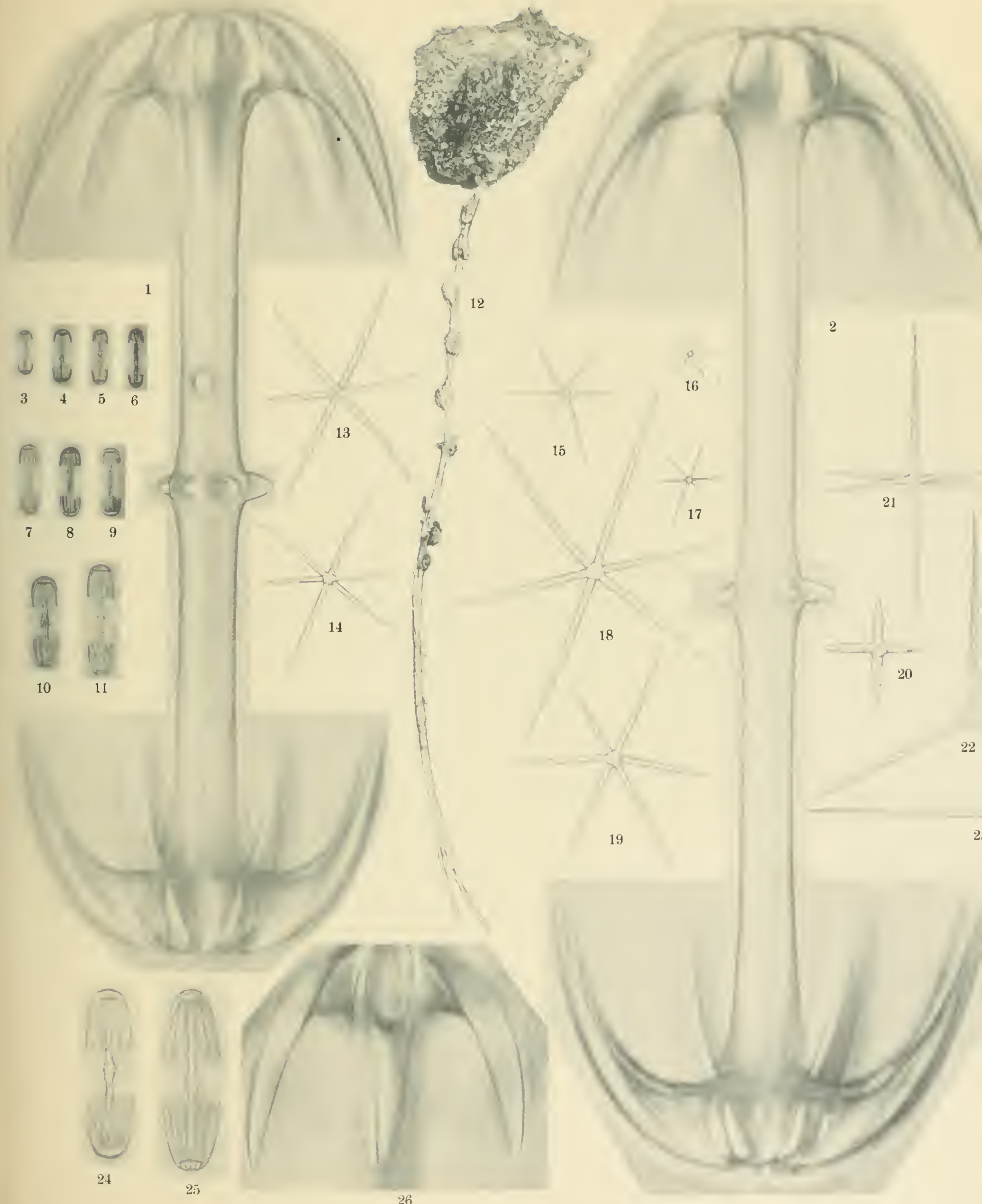


Fig. 1-26 Hyalonema (Hyalonema) grandancora n. sp.

Lendenfeld photographed

PLATE 80.

PLATE 80.

Hyalonema (Hyalonema) sp.

Figures 1–16. Station 3684 (A. A. 17).

1, 2.— Parts of two macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 6.
3.— A micramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
4.— A microhexactine; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
5–9.— Macramphidiscs; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 2.
10.— The end-part of an anchor-tooth of a macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
11, 12.— An anchor of a stalk-spicule; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6: 11, focussed lower (the shaft in focus); 12, focussed higher (the end-parts of the uppermost anchor-teeth in focus).
13.— An acanthophore; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
14.— A pentactine pinule with short distal ray; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
15.— Part of a group of diactine pinules *in situ* in a section; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
16.— A pentactine pinule with long distal ray; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.

Fig. 1-16 Hyalonema (Hyalonema) spec. from station 3684 [AA 17].

Lendenfeld photographed

PLATE 81.

PLATE 81.

Hyalonema (Leptonema) campanula Lendenfeld.

Figures 1–26.

1, 2.— Parts of a diactine pinule; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
 1, the middle- and end-parts of the distal ray;
 2, the central part of the spicule. (The lower end of fig. 1 fits on to the upper end of fig. 2).
3–6.— Microhexactines; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12:
 3, a larger one, focussed lower; 4, focussed higher; 5, a smaller one, focussed lower; 6, focussed higher.
7–10.— Macramphidiscs, and a part of one, magnified 500:
 7, 8, phot. Zeiss, apochr. 8, compens. oc. 12;
 9, 10, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
  7, a macramphidisc with straight shaft;
  8, a macramphidisc with strongly bent shaft;
  9, a macramphidisc with slightly bent shaft, focussed low (on the shaft);
  10, the lower of the two anchors of the spicule represented in fig. 9 focussed higher (on the tips of the upper teeth).
11.— Part of a stalk-spicule; magnified 30; phot. Zeiss, planar 20 mm.
12, 13.— Two pentactine pinules with long and slender distal ray; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
14.— Part of a group of diactine pinules; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
15.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm.
16–18.— Three pentactine pinules with long and slender rays; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 6.
19, 20.— Apical views of the lateral rays of two pentactine megascleres; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 2.
21, 22.— Micramphidiscs; magnified 500; phot. Zeiss, apochr. 4, compens. oc. 12.
23, 24.— Mesamphidiscs; phot. Zeiss, apochr. 8, compens. oc. 12.
25, 26.— Pentactine pinules with short and stout distal ray from the basal part of the sponge; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
 25, a single one;
 26, a group *in situ* in a section.

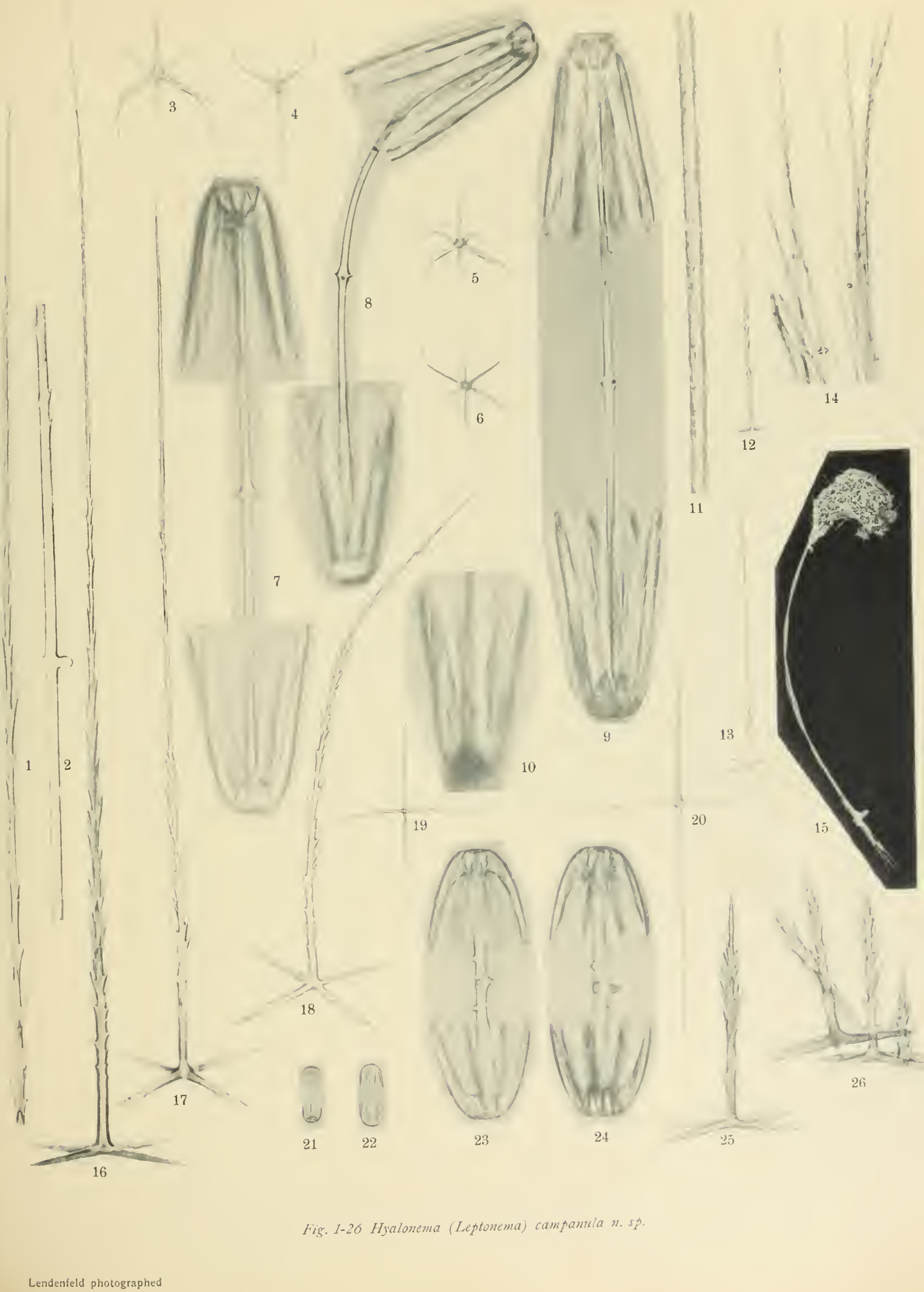


Fig. 1-26 Hyalonema (Leptonema) campanula n. sp.

Lendenfeld photographed

PLATE 82.

PLATE 82.

Hyalonema (Oonema) bianchoratum pinulina LENDENFELD.

Figs. 1–23 — specimen b.
Figs. 24–34 — specimen a.

1.—Side-view of specimen b; reduced 1:0.72; phot. Zeiss, anastig. 480/412 mm. (The stalk is broken at its point of origin. It lay loose in the bottle with the sponge-body. It fitted well to a broken stump of a stalk in the latter, and in all probability belonged to the sponge-body. I fixed it to the stump and photographed body and stalk together).

2–5.— Parts of microhexactines of specimen b; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

6–9.— Two microhexactines of specimen b; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
6, microhexactine focussed lower (on the three lower rays); 7, focussed higher (on the three upper rays); 8, another microhexactine focussed lower (on the three lower rays); 9, focussed higher (on the three upper rays).

10–12.— Parts of the centrum and one ray of a microhexactine of specimen b; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
10, focussed high (the centrum and basal part of the ray);
11, focussed lower (the whole ray and the centrum);
12, focussed still lower (the distal part of the ray).

13–19.— More or less centrotyle amphioxes from the gastral region of specimen b; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4.

20.— Group of microhexactines from a spicule-preparation of specimen b; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

21–34.— Pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
21–30, 32–34, side-views;
31, apical view of the lateral rays;
21–23, of specimen b;
24–34, of specimen a;
21, 23–28, 34, basal dermal pinules;
22, 31–33, ordinary dermal pinules;
29, 30, gastral pinules.

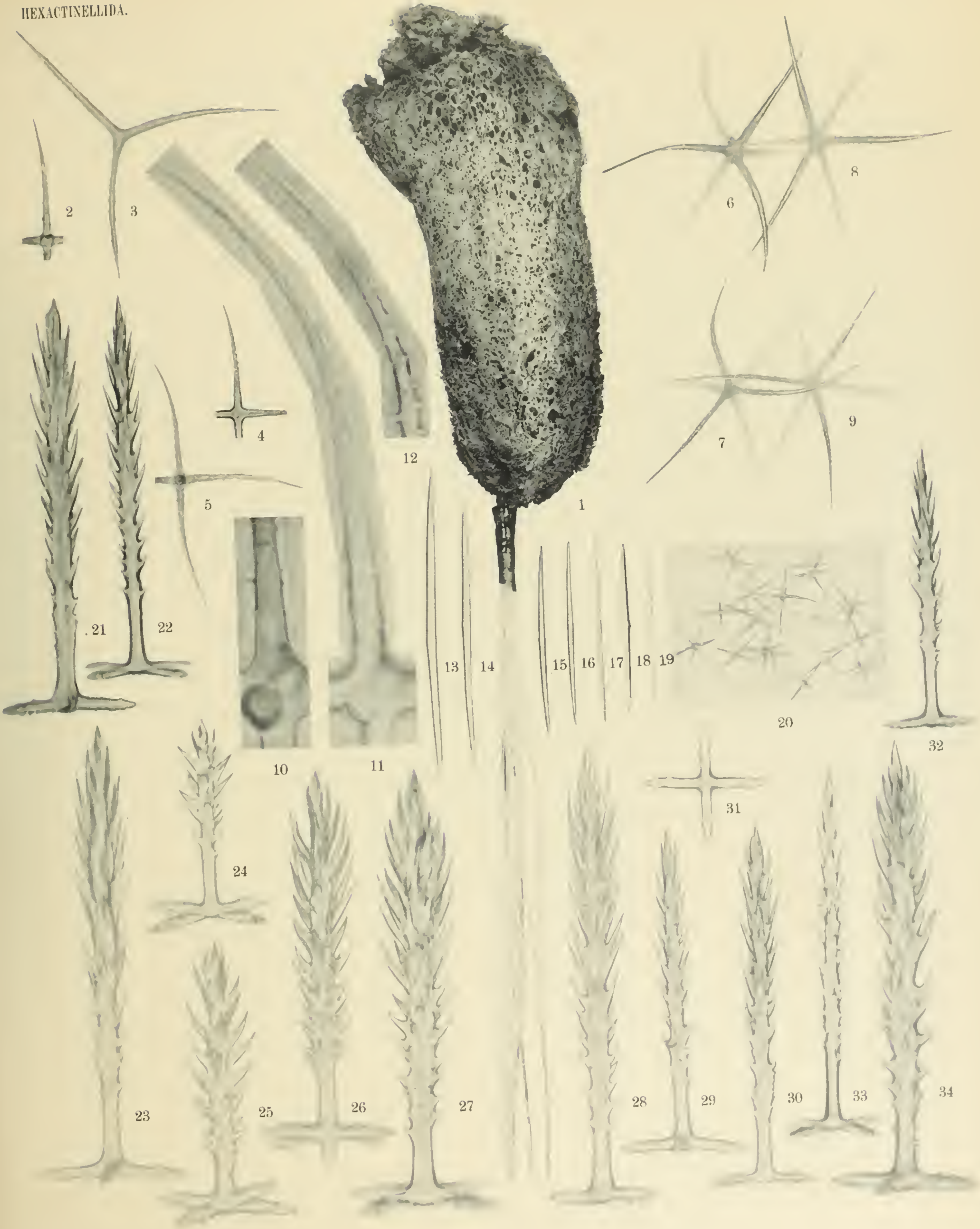


Fig. 1-34 Hyalonema (Oonema) bianchoratum, Wilson var. pinulina n. var.
1-23 specimen b; 24-34 specimen a.

Lendenfeld photographed

PLATE 83.

PLATE 83.

Hyalonema (Oonema) bianchoratum pinulina Lendenfeld.

Figs. 1–23, 60, 62–64, 68 — specimen b.
Figs. 24–59, 61, 65–67 — specimen a.

1–35.— Acanthophores; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
1–23, from the basal part of the body of specimen b;
24–35, from the basal part of the body of specimen a.

36–44.— Acanthophores from the Palythoa attached to the stalk of specimen a; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

45.— Part of a section vertical to the gastral surface of specimen a; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, surface (zone of the paratangential rays of the pinules); b, pinules; c, a small macramphidisc.

46–59.— Acanthophores from the Palythoa attached to the stalk of specimen a; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
46, 51, 55, 56, 59, tetractines (stauractines);
47, 48, 52, 57, 58, rhabds;
49, a rhabd, focussed lower; 50, focussed higher;
53, a very short and stout rhabd, focussed lower; 54, focussed higher.

60.— Part of the dermal surface of specimen b; magnified 5; phot. Zeiss, planar 50 mm.:
a, symbiotic polyps.

61.— Part of the gastral sieve-membrane of specimen a; magnified 30; phot. Zeiss, planar 20 mm.

62.— Part of the dermal sieve-membrane of specimen b; magnified 30; phot. Zeiss, planar 20 mm.

63, 64.— Choanosomal hexactine megascleres of specimen b; magnified 20; phot. Zeiss, planar 20 mm.

65–68.— Superficial pentactine megascleres; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4:
65–67, subdermal pentactines of specimen a;
68, a subgastral pentactine of specimen b.

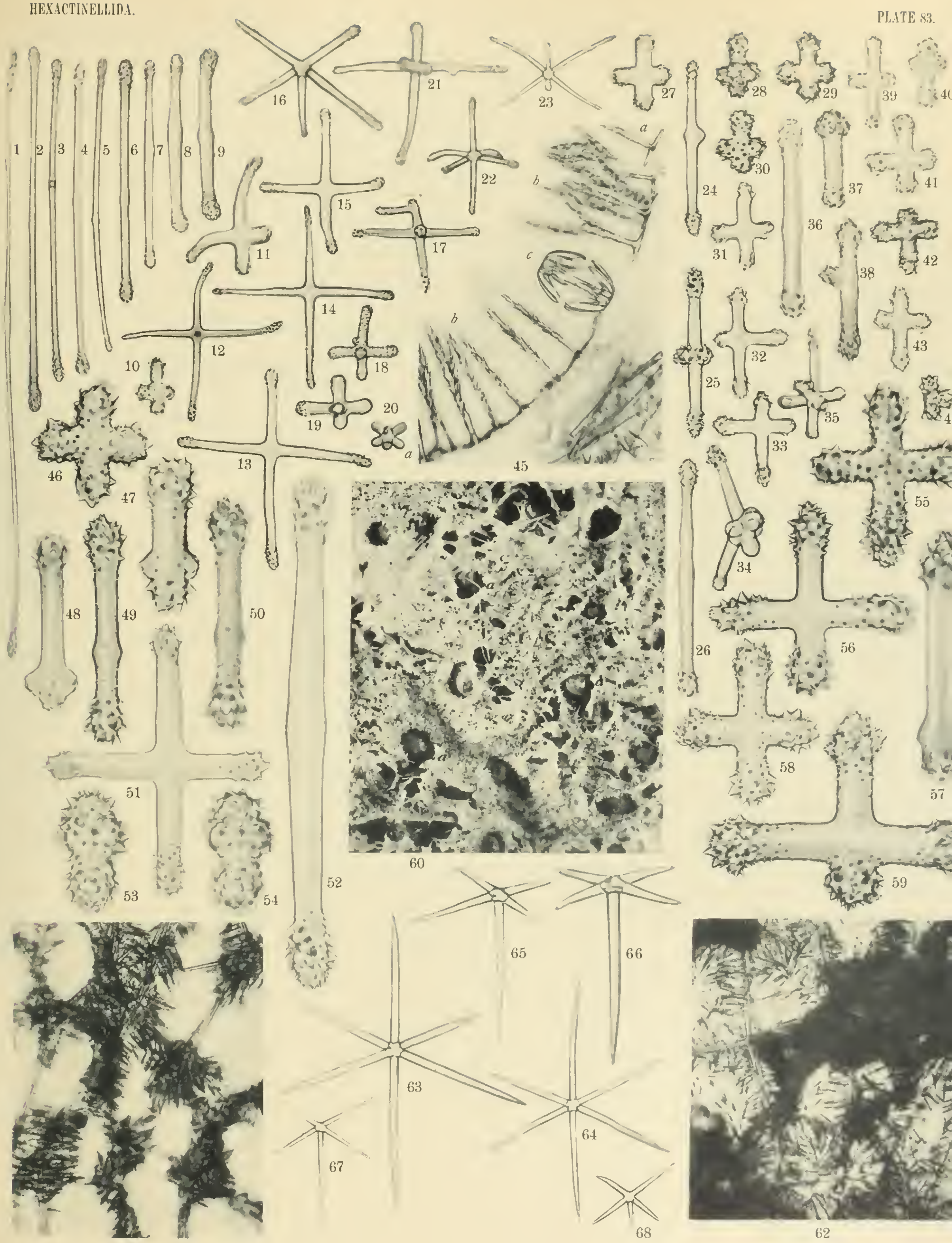


Fig. 1-68 · *Hyalonema (Oonema) bianchoratum Wilson, var. pinulina n. var.*
1-23, 60, 62-64, 68 specimen b; 24-59, 61, 65-67 specimen a.

Lendenfeld photographed

PLATE 84.

PLATE 84.

Hyalonema (Oonema) bianchoratum pinulina Lendenfeld.

Figs. 1–10, 15, 26, 27, 30–32 — specimen a.
Figs. 11–14, 16–25, 28, 29 — specimen b.

1.— Part of a transverse section of one of the Palythoa polyps attached to the stalk of specimen a; magnified 30; phot. Zeiss, planar 20 mm.

2.— Part of a section of the choanosome of specimen a; magenta; magnified 30; phot. Zeiss, planar 20 mm.: a, flagellate chambers.

3–13.— Small macramphidises from the gastral zone, magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:

3–10, of specimen a;

11–13, of specimen b.

14.— Transverse section of one of the polyps imbedded in the body of specimen b; magnified 30; phot. Zeiss, planar 20 mm.

15.— A small micramphidisc of specimen a; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

16–25.— Small micramphidises of specimen b; magnified 500:

16, 21, phot. Zeiss, apochr. 4, compens. oc. 12;

17–20, 22–25, phot. Zeiss, II. 1. apochr. 2, compens. oc. 6.

26, 27.— A terminal anchor of a small macramphidisc of specimen a seen from within; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:

26, focussed lower (on the base of the teeth);

27, focussed higher (on the tips of the teeth).

28–32.— Side-views of small macramphidises; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:

28, a macramphidisc of specimen b, focussed lower (the shaft in focus);

29, the same macramphidisc focussed higher (the tip of the upper teeth in focus);

30, a macramphidisc of specimen a, focussed lower (the shaft in focus);

31, the same macramphidisc, focussed higher (the tip of the upper teeth in focus);

32, another macramphidisc of specimen a.

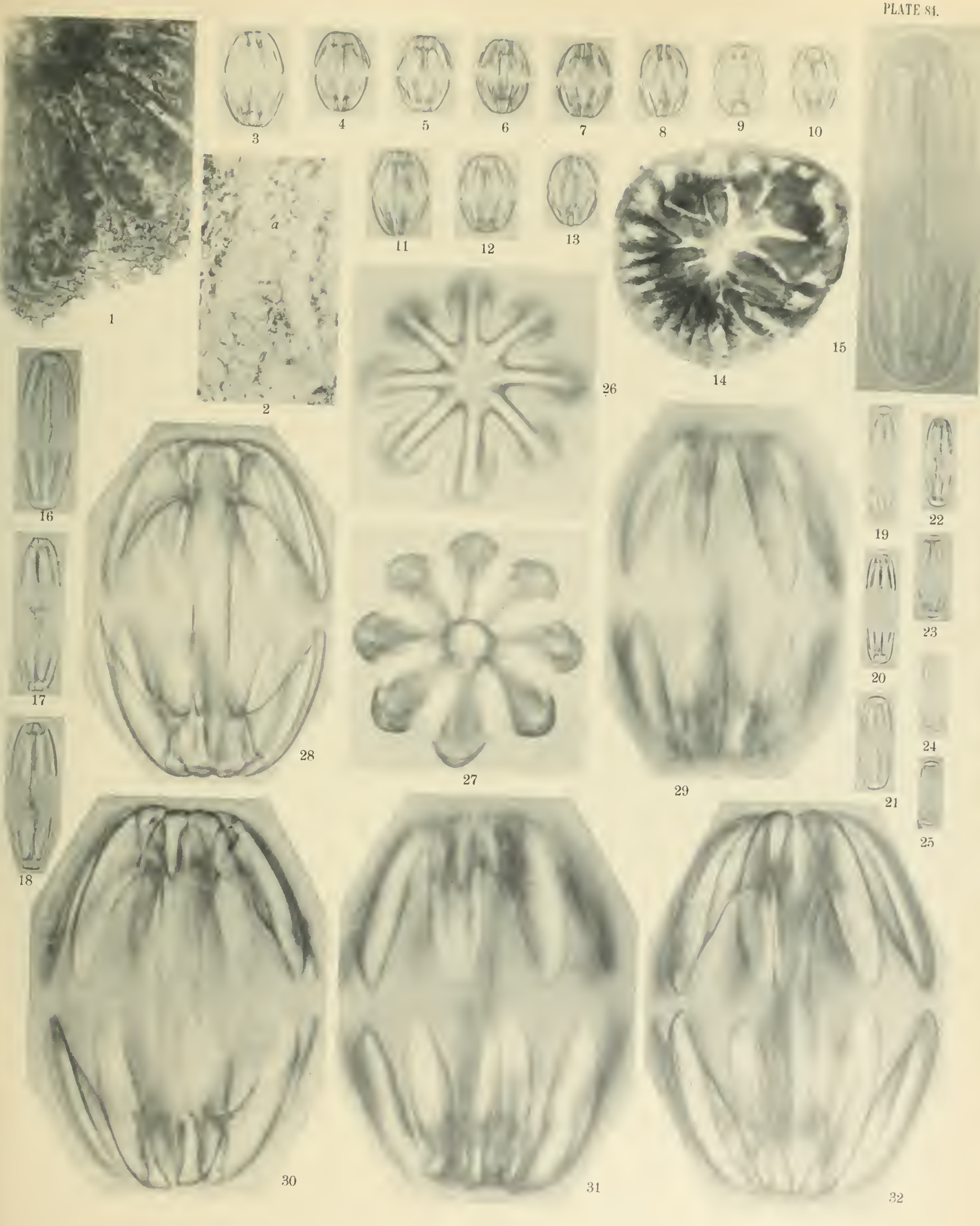


Fig. 1-32 Hyalonema (Oonema) bianchoratum Wilson, var. pinulina n. var.
1-10, 15, 26, 27, 30-32 specimen a; 11-14, 16-25, 28, 29 specimen b.

Lendenfeld photographed

PLATE 85.

PLATE 85.

Hyalonema (Oonema) bianchoratum pinulina Lendenfeld.

Figs. 1, 4–7 — specimen b.
Figs. 2, 3, 8 — specimen a.

1.— A large macramphidise from the choanosome of specimen b; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 8.
2–7.— Large macramphidises from the choanosome; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
2, 3, of specimen a;
4–7, of specimen b.
8.— An abnormal small macramphidise from the choanosome of specimen a; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

Hyalonema (Oonema) sequoia Lendenfeld.

Figures 9–21.

9–19.— Acanthophores; magnified 200:
9–14, 16–19, short-rayed di- to pentactines; phot. Zeiss, apochr. 8, compens. oc. 6;
15, a long-rayed diactine; phot. Zeiss, apochr. 8, compens. oc. 4.
20, 21.— Hexactine megascleres; magnified 20; phot. Zeiss, planar 20 mm.

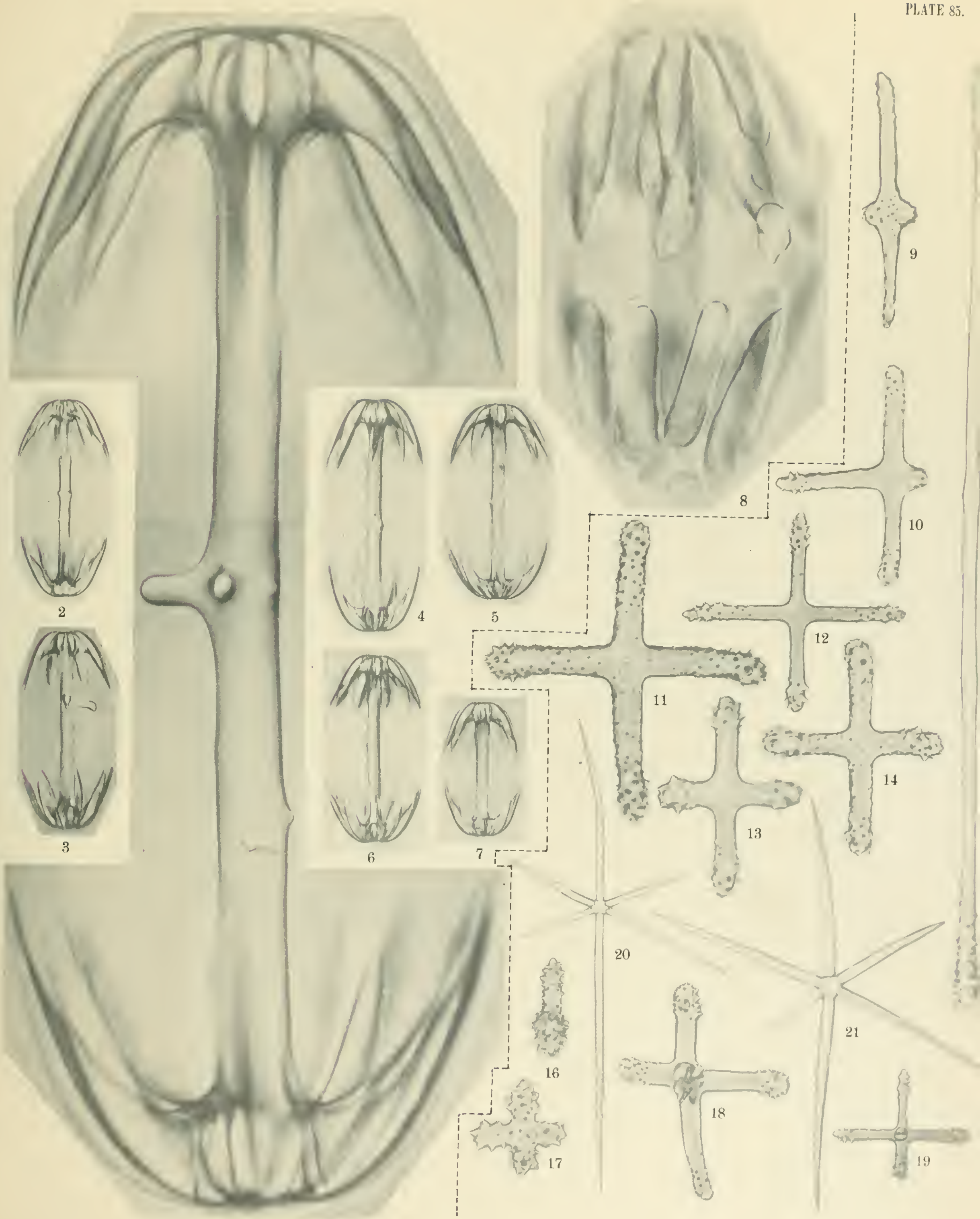


Fig. 1-8 Hyalonema (Oonema) bianchoratum Wilson, var. pinulina n. var.
1, 4-7 specimen b; 2, 3, 8 specimen a.
Fig. 9-21 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 86.

PLATE 86.

Hyalonema (Oonema) sequoia LENDENFELD.

Figures 1–36.

1–6.— Large macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
7.— Portion of the gastral sieve; magnified 20; phot. Zeiss, planar 20 mm.
8.— View of the specimen; reduced 1: 0.83; phot. Zeiss, anastig. 480/412 mm.
9.— A ray of a microhexactine; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
10.— A monactine microhexactine-derivate; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
11, 12.— Part of a microhexactine; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  11, a whole ray, focussed higher;
  12, the distal part of the same ray, focussed lower.
13–26.— Large superficial pinules; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 4:
  13, a hexactine one;
  14–26, pentactine ones.
27–34.— Small macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
35, 36.— Microhexactines; magnified 500:
  35, a small one; phot. Zeiss, apochr. 8, compens. oc. 12;
  36, a large one; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

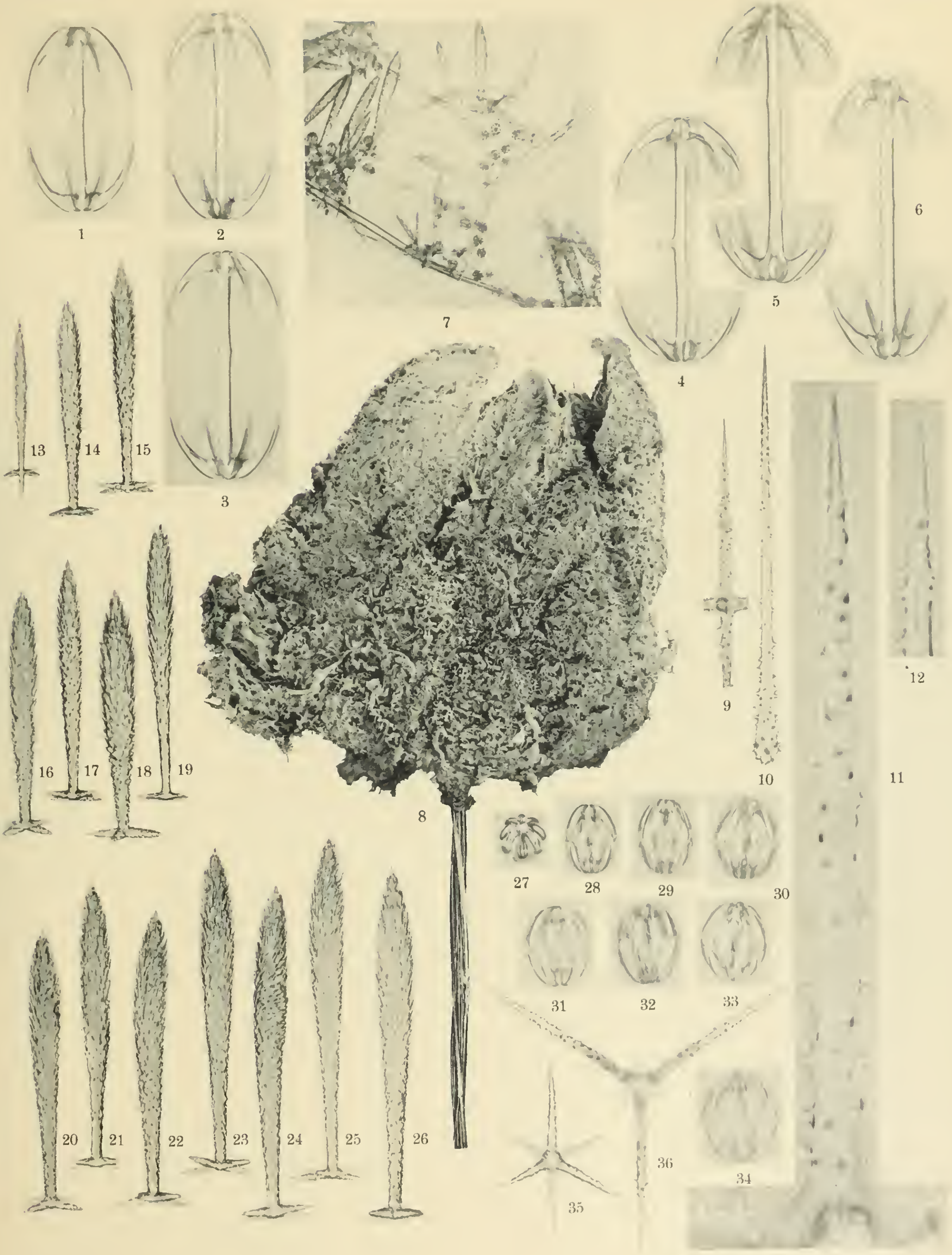


Fig. 1-36 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 87.

PLATE 87.

Hyalonema (Oonema) sequoia Lendenfeld.

Figures 1–7.

1–7.— Parts of large superficial pinules, and a whole one; magnified 300:

1, a portion of the middle-part of one, where the spines are straight and upwardly directed; phot. Zeiss, apochr. 8, compens. oc. 12;

2, a portion of the middle-part of one, where the spines are strongly oblique, all twisted in the same direction; phot. Zeiss, apochr. 8, compens. oc. 12;

3, a whole one; phot. Zeiss, apochr. 8, compens. oc. 6:

3a, the distal part;

3b, the proximal part (there is no overlapping and nothing missing; the upper end of fig. 3b fits exactly on the lower end of fig. 3a).

4, 5, the distal end of one, with the spines very irregular at one point of the upper surface; phot. Zeiss, apochr. 8, compens. oc. 12:

4, focussed higher; 5, focussed lower.

6, 7, the distal end of one, with the spine very irregular at one point of the side (profile); phot. Zeiss, apochr. 8, compens. oc. 12:

6, focussed higher; 7, focussed lower.

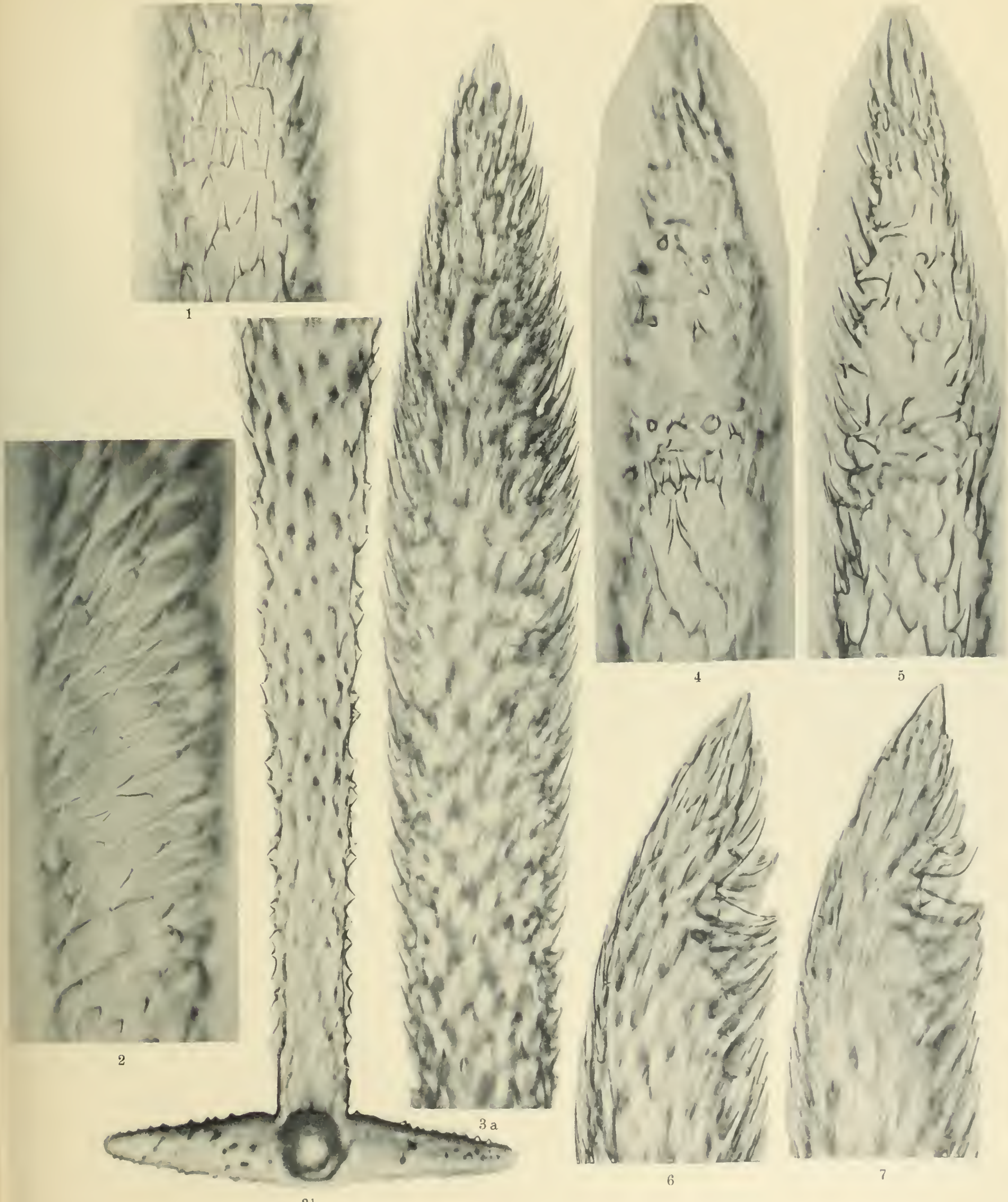


Fig. 1-7 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 88.

PLATE 88.

Hyalonema (Oonema) sequoia Lendenfeld.

Figures 1–13.

1–4.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

5, 6.— Small microhexactine-derivate pinule-like hexactine canalars; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.

7–10.— Small superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
- 7–9, pentactine ones;
- 10, a hexactine one.

11–13.— Superficial pentactine pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 6:
- 11a, 12a, 13a, the distal parts of three;
- 11b, 12b, 13b, the proximal parts of the same (three; there is no overlapping and nothing missing. the upper ends of figs. 11b, 12b, and 13b fit exactly on the lower ends of figs. 11a, 12a, and 13a respectively);
  - 11, a medium-sized one;
  - 12, 13, large ones.

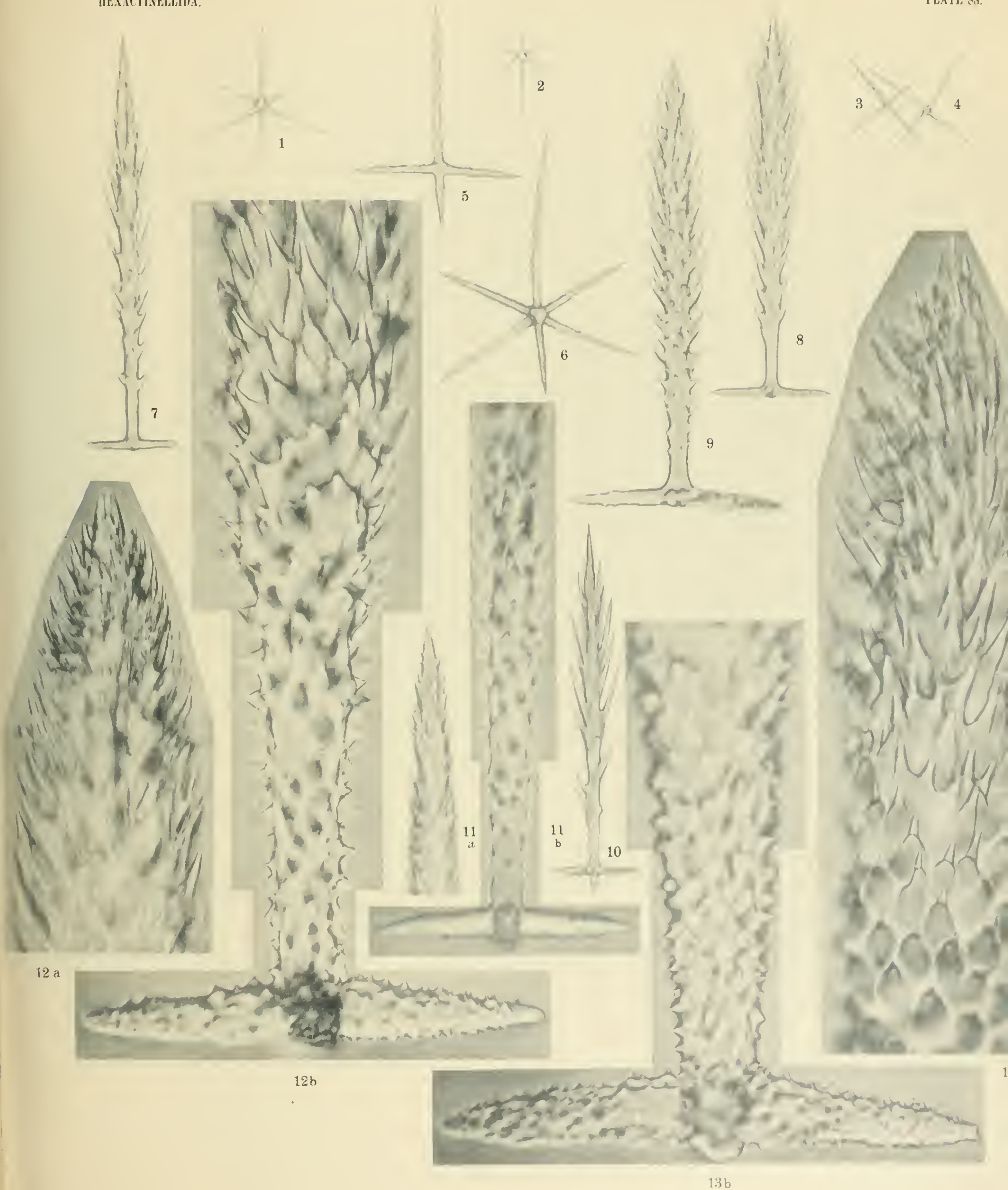


Fig. 1-13 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 89

PLATE 89.

Hyalonema (Oonema) sequoia LENDENFELD.

Figures 1–36.

1–5.— Large superficial amphioxes (tignules); magnified 20; phot. Zeiss, planar 20 mm.

6–14.— Large micramphidiscs; magnified 500:

6, 7, 9–14, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;

8, phot. Zeiss, apochr. 8, compens. oc. 12.

15.— Group of spicules from a spicule-preparation of the superficial part of the body; magnified 20; phot. Zeiss, planar 20 mm.:

a, slender amphioxes; b, stout amphioxes; c, large superficial pinules; d, small macramphidiscs; e, large amphidiscs, probably of *Hyalonema agassizi* and foreign to the sponge, which are remarkably frequent.

16–19.— An abnormal amphidisc with reduced anchors; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:

16, one end, focussed high;

17, the whole spicule, focussed lower; 18, focussed still lower;

19, the other end, focussed lowest.

20–30.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

31, 32.— End-parts of anchor-teeth of large macramphidiscs; magnified 500:

31, phot. Zeiss, apochr. 8, compens. oc. 12;

32, phot. Zeiss, apochr. 8, compens. oc. 6.

33.— A somewhat abnormal small macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

34.— A small micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10.

35, 36.— An abnormal small macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:

35, focussed higher; 36, focussed lower.

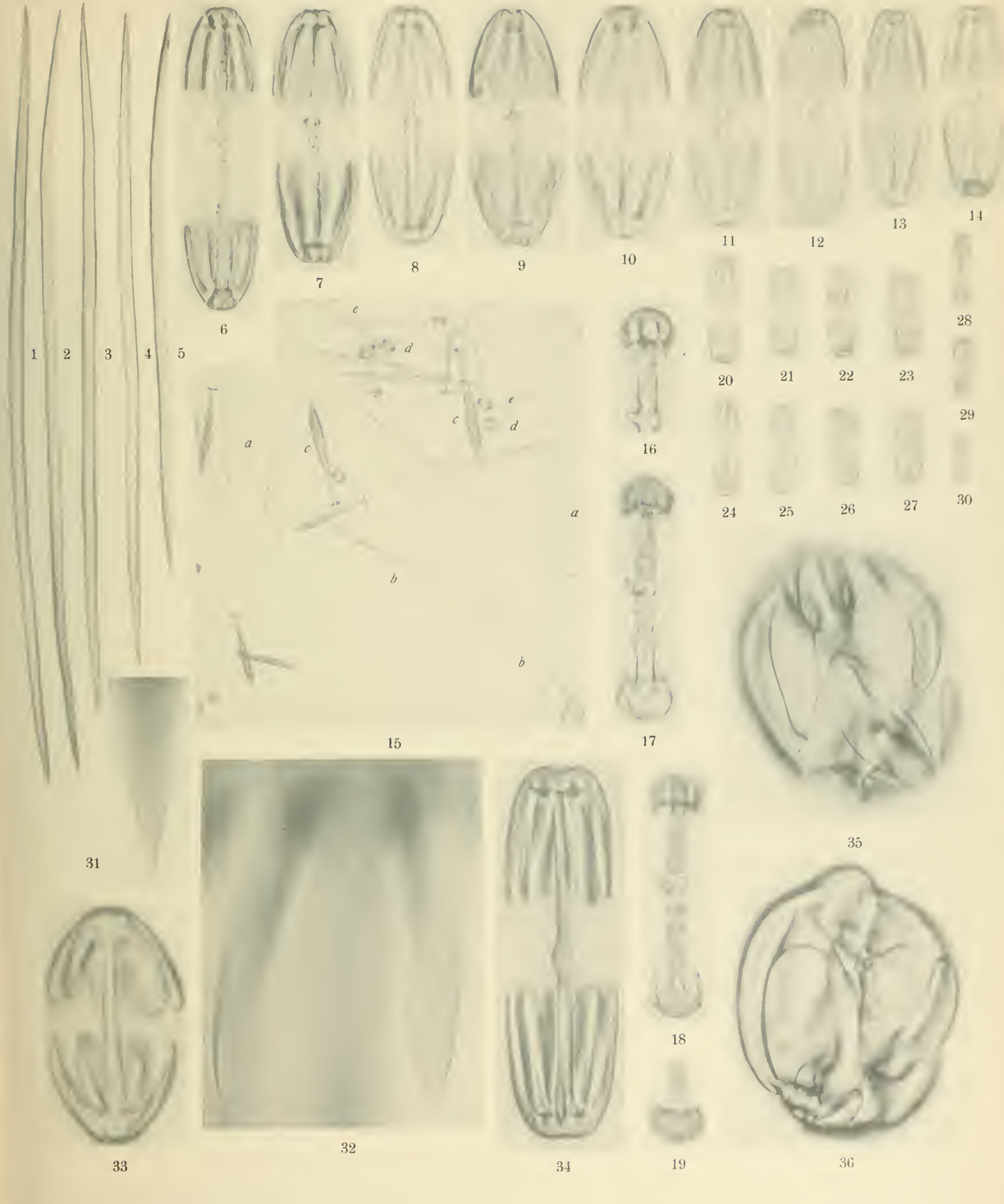


Fig. 1-36 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 90.

PLATE 90.

Hyalonema (Oonema) sequoia LENDENFELD

Figures 1–10.

1–10.—Small macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
1, 3, 5, 7, 9, focussed high (the upper teeth in focus);
2, 4, 6, 8, 10, the same spicules focussed low (the shaft in focus);
1, 2, a small one;
3, 4, a medium-sized slender one;
5, 6, a medium-sized broad one with partly irregular anchor-teeth;
7, 8, a large one;
9, 10, a medium-sized broad one with regular anchor-teeth.

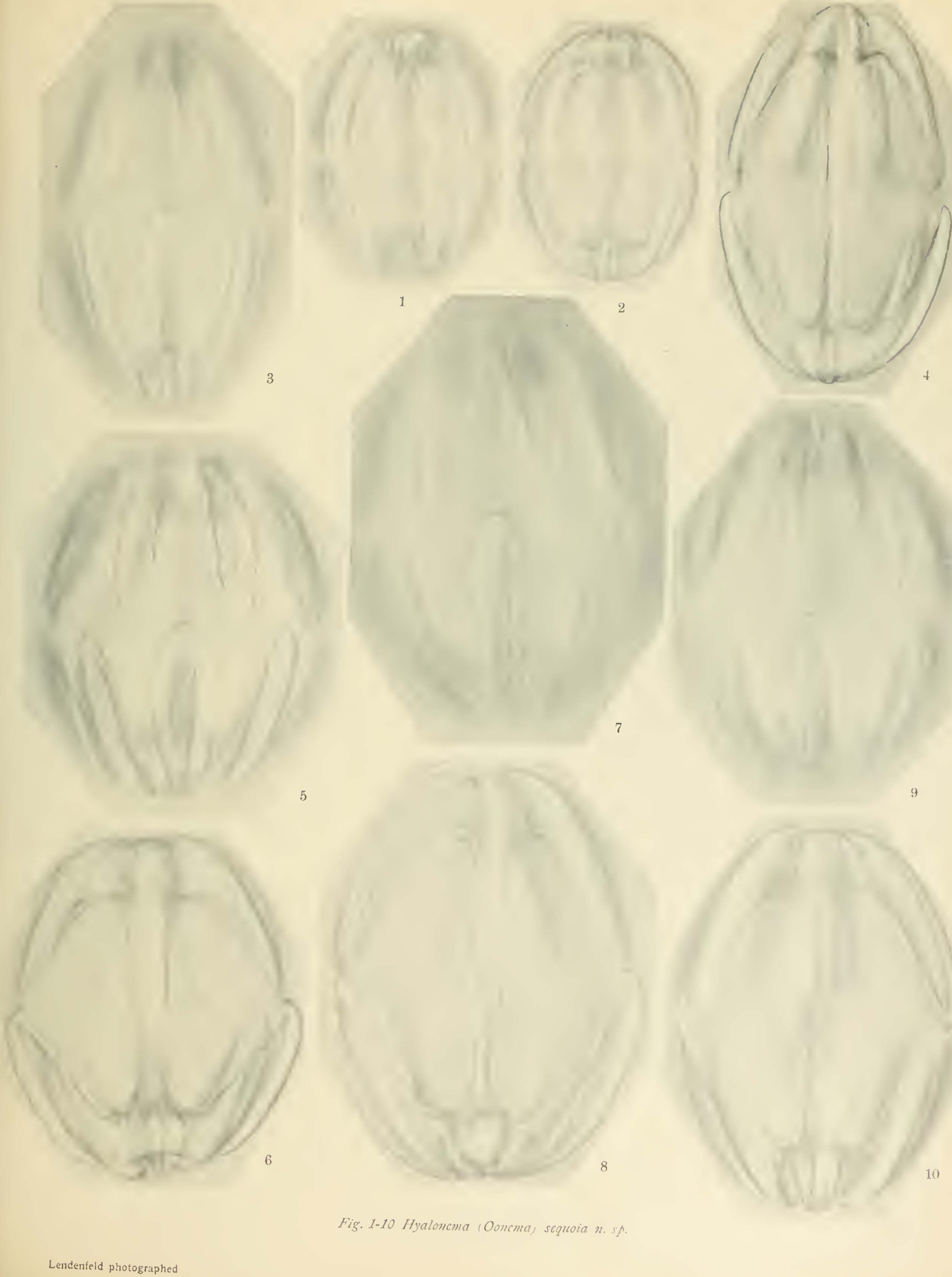


Fig. 1-10 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 91

PLATE 91.

Hyalonema (Oonema) sequoia LENDENFELD.

Figures 1–6.

1–6.— Parts of large macramphidiscs; magnified 500:
1–4, phot. Zeiss, apochr. 8, compens. oc. 12;
5, 6, phot. Zeiss, apochr. 8, compens. oc. 6;
1–3, parts of terminal anchors, showing irregular teeth;
4, a regular terminal anchor;
5, 6, the shaft and half of the terminal anchors of two regular ones.

Fig. 1-6 Hyalonema (Oonema) sequoia n. sp.

Lendenfeld photographed

PLATE 92.

PLATE 92.

Hyalonema (Oonema) crassipinulum Lendenfeld.

Figures 1–23.

1–7.— Superficial pinules; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 2:
- 1–5, gastral pinules;
- 6, 7, dermal pinules.

8.— Portion of the lower layer (without the pinules) of the gastral membrane; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

9–11.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

12–15.— Parts of microhexactines (13–15) and a whole one (12); magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

16, 17.— Canalar pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
- 16, a pentactine one;
- 17, a hexactine one.

18–21.— Side-views of superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 6:
- 18, a dermal pinule;
- 19–21, gastral pinules.

22, 23.— The basal part of a gastral superficial pinule with the distal ray broken off rather short, seen from above; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
- 22, focussed higher, an optical transverse section of the distal ray;
- 23, focussed lower, the lateral rays.

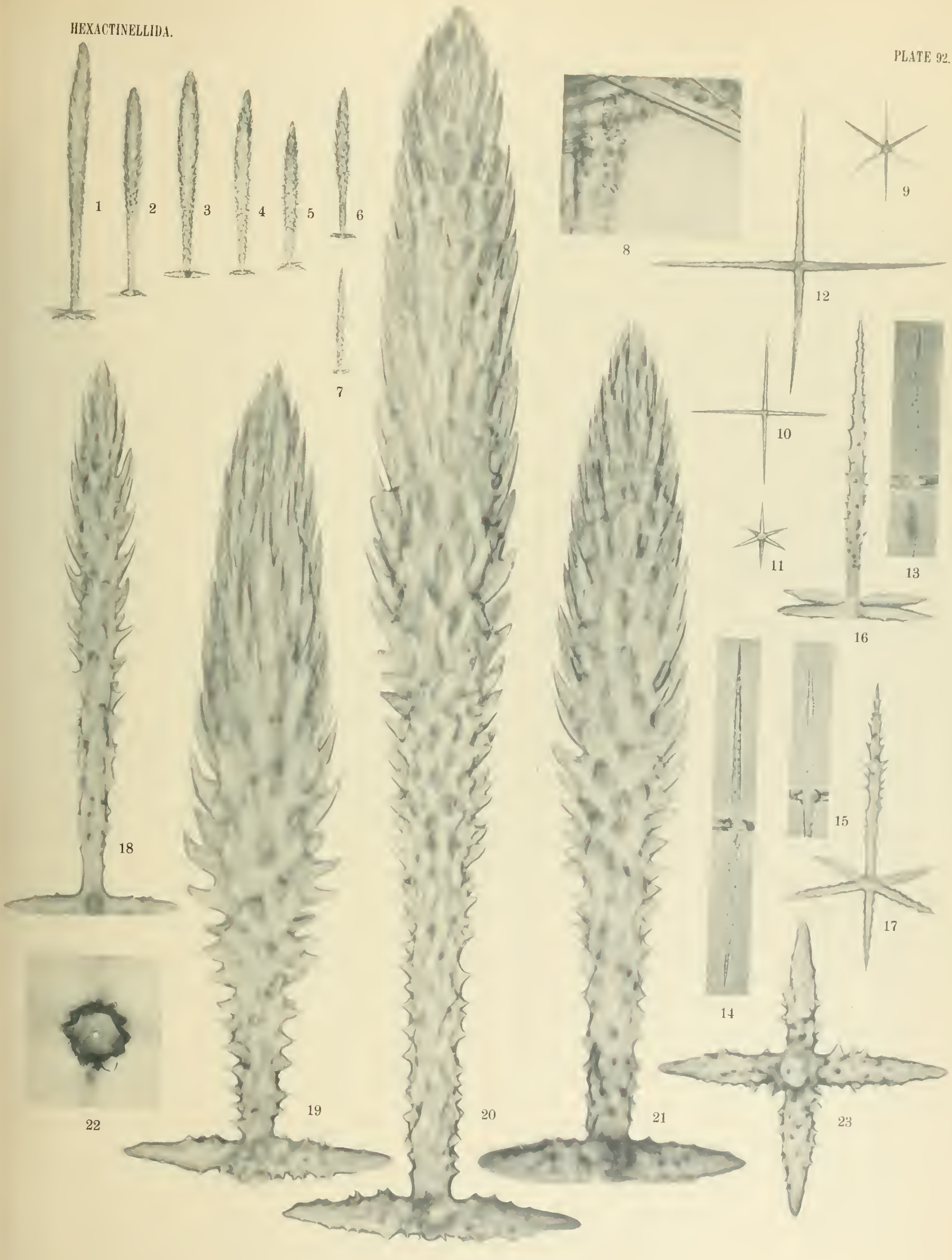


Fig. 1-23 Hyalonema (Oonema) crassipinulum n. sp.

Lendenfeld photographed

PLATE 93.

PLATE 93.

Hyalonema (Oonema) crassipinulum LENDENFELD.

Figures 1–10.

1, 2.— Slender small macramphidises; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
3–8.— Three broad small macramphidises; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
 3, a middle-sized one, focussed high (on the uppermost teeth);
 4, the same spicule focussed low (on the shaft);
 5, a small one, focussed high (on the uppermost teeth);
 6, the same spicule focussed low (on the shaft);
 7, a large one, focussed high (on the uppermost teeth);
 8, the same spicule focussed low (on the shaft).
9.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm.
10.— A large macramphidise; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

Fig. 1-10 Hyalonema (Oonema) crassipinulum n. sp.

Lendenfeld photographed

PLATE 94.

PLATE 94.

Hyalonema (Oonema) crassipinulum Lendenfeld.

Figures 1–33.

1–4.— Small macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
  1–3, broad ones;
  4, a narrow one.
5–11.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
12, 13.— A micramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  12, focussed higher (on the uppermost teeth);
  13, focussed lower (on the shaft).
14–23.— Acanthophores from the Palythoa attached to the stalk; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
24–33.— Acanthophores from the sponge-body; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

Hyalonema (Oonema) densum Lendenfeld.

Figures 34–42.

34–36.— Acanthophores; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
37–39.— Two whole microhexactines and part of one; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
40.— Part of a microhexactine; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
41, 42.— Radial sections through the choanosome; magenta:
  41, magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6;
  42, magnified 30; phot. Zeiss, planar 20 mm.

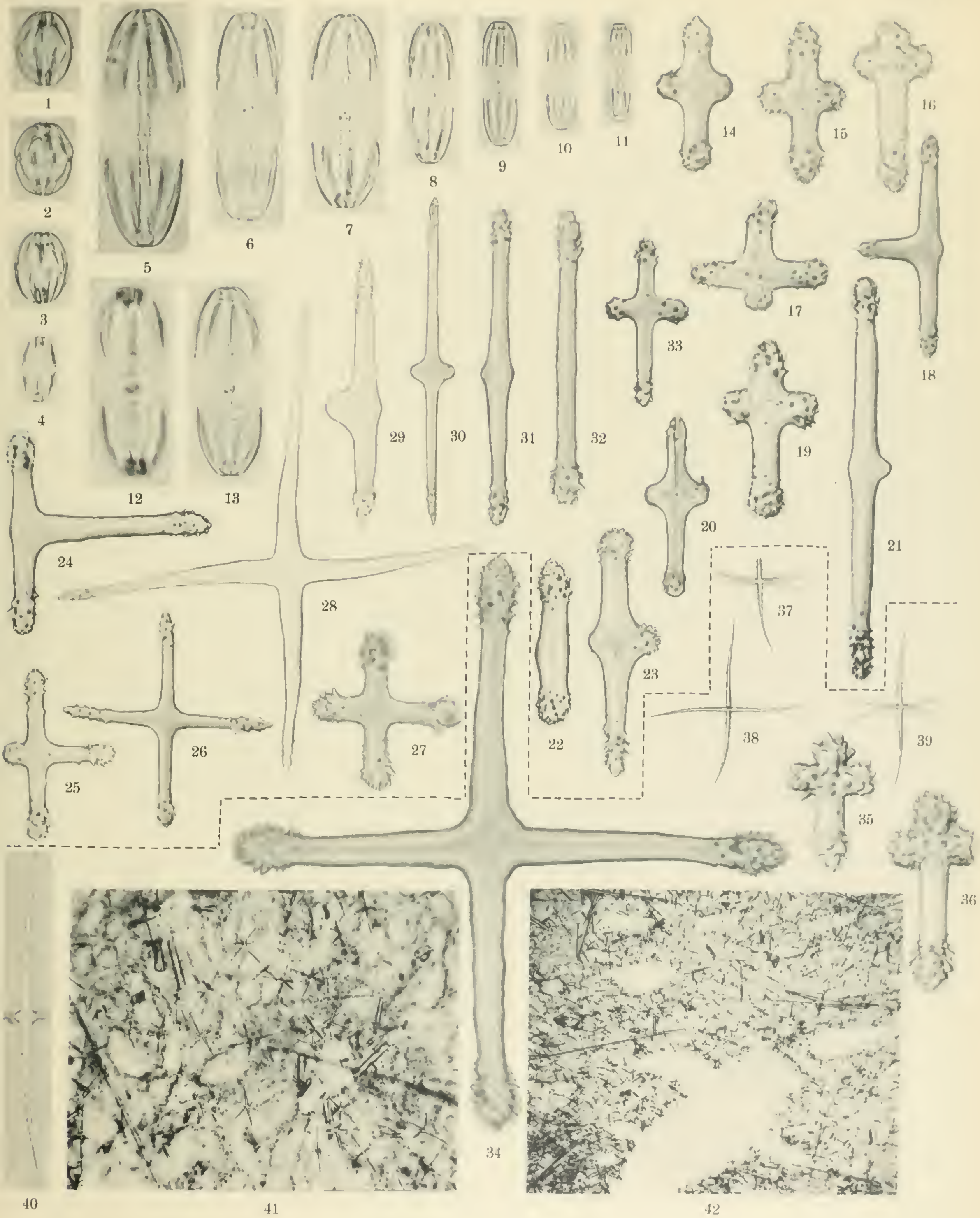


Fig. 1-33 Hyalonema (Oonema) crassipinulum n. sp.; Fig. 34-42 Hyalonema (Oonema) densum n. sp.

Lendenfeld photographed

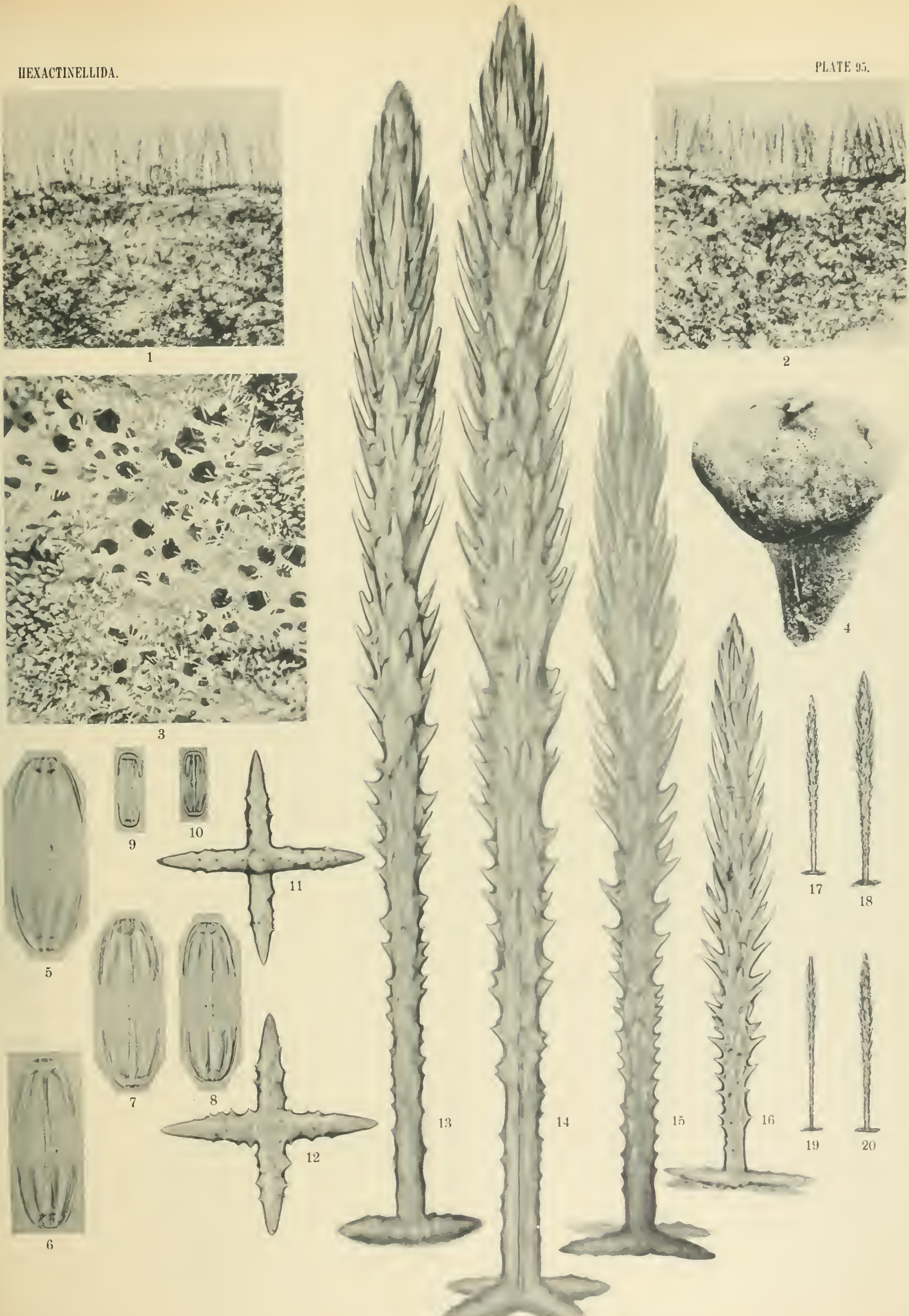
PLATE 95.

PLATE 95.

Hyalonema (Oonema) densum Lendenfeld.

Figures 1–20.

1.— Radial section through the dermal membrane and the underlying part of the choanosome; magnified 30; phot. Zeiss, planar 20 mm.
2.— Radial section through the gastral membrane and the underlying part of the choanosome; magnified 30; phot. Zeiss, planar 20 mm.
3.— View of part of the gastral surface; magnified 8; phot. Zeiss, planar 50 mm.
4.— View of the specimen; reduced 1: 0.89; phot. Zeiss, anastig. 480/412 mm.
5–10.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  5–8, large micramphidiscs;
  9, 10, small micramphidiscs.
11, 12.— Apical views of the lateral rays of gastral pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
13–16.— Side-views of superficial pinules; magnified 300:
  13, 14, gastral pinules; phot. Zeiss, apochr. 16, compens. oc. 12;
  15, a dermal pinule; phot. Zeiss, apochr. 8, compens. oc. 12;
  16, a gastral pinule; phot. Zeiss, apochr. 8, compens. oc. 12.
17–20.— Superficial pinules; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 2:
  17, 18, gastral pinules;
  19, 20, dermal pinules.



Lendenfeld photographed

Fig. 1-20 Hyalonema (Oonema) densum n. sp.

PLATE 96.

PLATE 96.

Hyalonema (Oonema) densum LENDENFELD.

Figures 1–14.

1–7.— Small macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
8, 9, 14.— Large macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
10, 11.— A larger small macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12: 10, focussed high (on the uppermost teeth); 11, focussed low (on the shaft).
12, 13.— Two smaller small macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

Fig. 1-14 Hyalonema (Oonema) densum n. sp.

Lendenfeld photographed

PLATE 97

PLATE 97.

Hyalonema (Oonema) henshawi Lendenfeld.

Figures 1–36.

1–5.— Superficial pinules; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 2:
  1, 3–5, gastral pinules;
  2, a dermal pinule.
6.— A canalar pinule; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
7–14.— Macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
  7–12, side-views;
  13, 14, apical views.
15.— View of the specimen; natural size; phot. Zeiss, anastig. 480/412 mm.
16–28.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  16–20, large micramphidiscs;
  21–28, small micramphidiscs.
29–31.— Superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12:
  29, 30, gastral pinules;
  31, a dermal pinule.
32.— Part of a gastral pore-sieve; magnified 20; phot. Zeiss, planar 20 mm.
33, 34.— Parts of microhexactines; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
35, 36.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

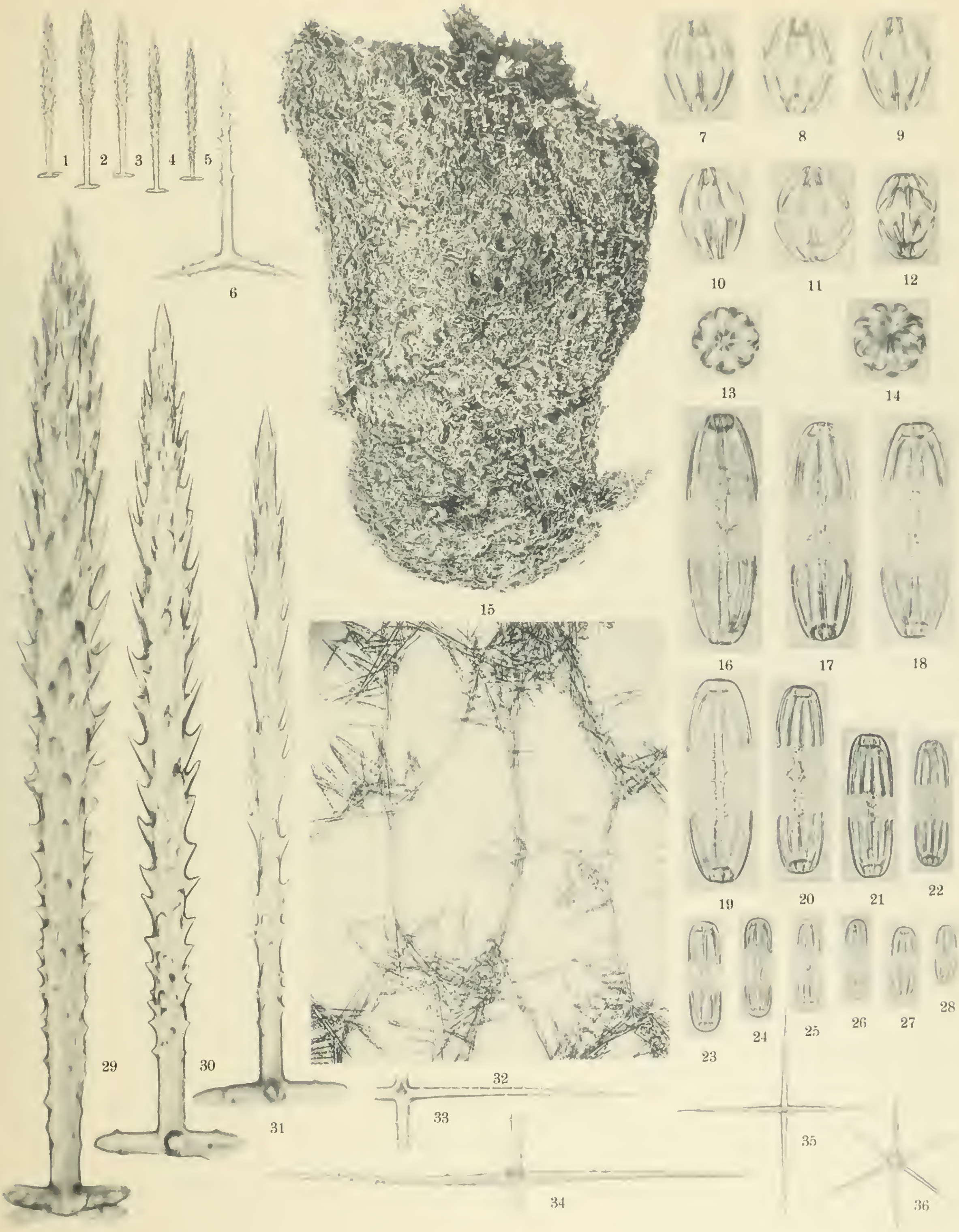


Fig. 1-36 Hyalonema (Oonema) henshawi n. sp.

Lendenfeld photographed

PLATE 98.

PLATE 98.

Hyalonema (Oonema) henshawi Lendenfeld.

Figures 1–7.

1–6.— Side-views of macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
1, a middle-sized one, focussed high (on the uppermost teeth); 2, focussed lower (on the shaft);
3, a small one, focussed high (on the uppermost teeth); 4, focussed lower (on the shaft);
5, a large one, focussed high (on the uppermost teeth); 6, focussed lower (on the shaft).
7.— Apical view of a middle-sized macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

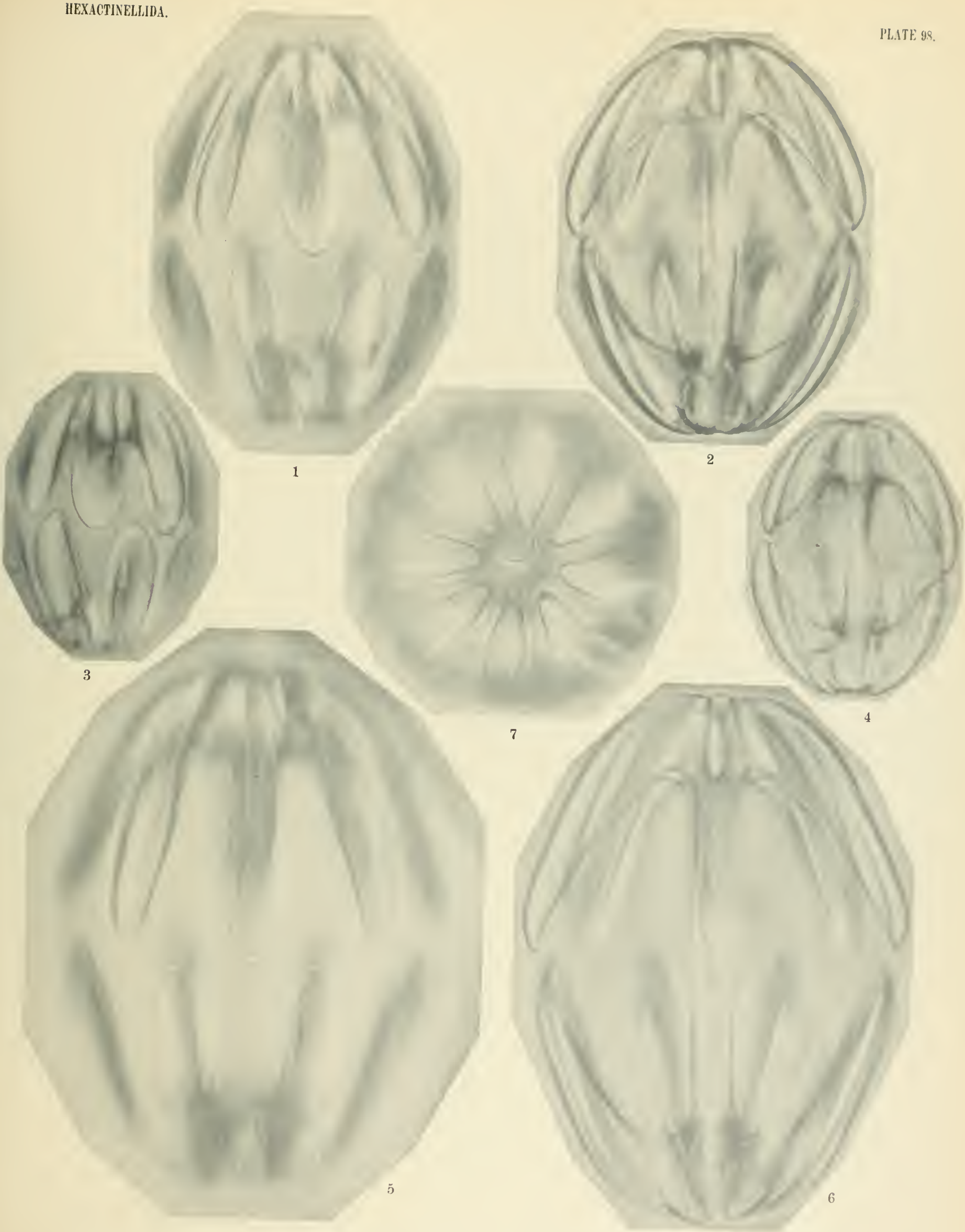


Fig. 1-7 Hyalonema (Oonema) henshawi n. sp.

Lendenfeld photographed

PLATE 99

PLATE 99.

Hyalonema (Skianema) aequatoriale LENDENFELD.

Figures 1–37.

1, 2.— Apical view of a large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12: 1, focussed higher; 2, focussed lower.
3–10.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
11–16.— Large micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6: 11–13, focussed high (on the uppermost teeth); 14–16, focussed lower (on the shaft) (11 = 14; 12 = 15; 13 = 16).
17.— View of the specimen; reduced to 1 : 0.9; phot. Zeiss, anastig. 480/412 mm.
18.— A middle-sized, somewhat irregular macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
19, 20.— A small irregular macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12: 19, focussed higher; 20, focussed lower.
21–24.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
25–28.— Gastral superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
29–31.— Dermal superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
32–35.— Parts of microhexactines; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
36.— Apical view of the lateral ray-cross of a gastral superficial pinule; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
37.— Part of a terminal anchor (two teeth) of a large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

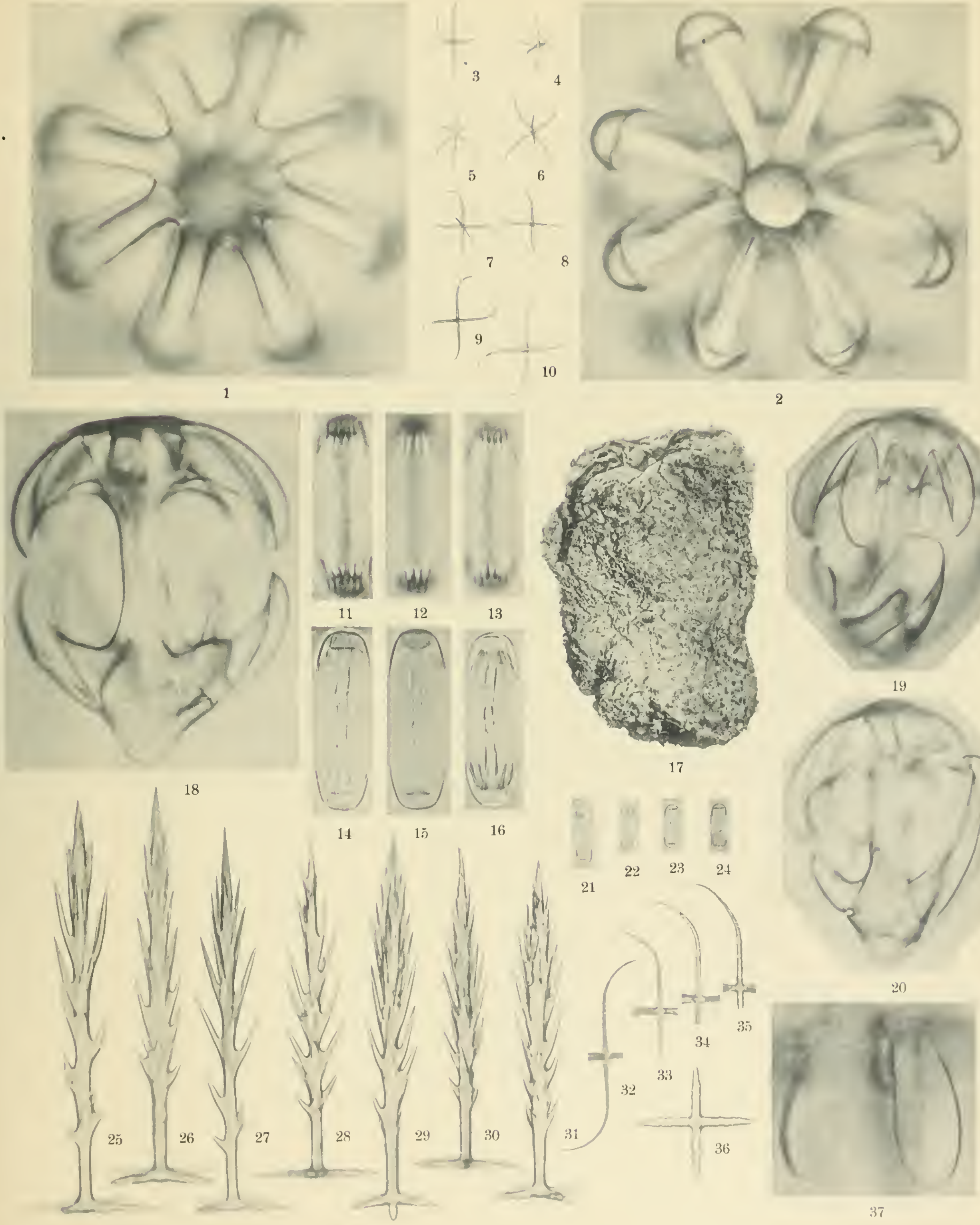


Fig. 1-37 Hyalonema (Skianema) aequatoriale n. sp.

Lendenfeld photographed

PLATE 100.

PLATE 100.

Hyalonema (Skianema) aequatoriale LENDENFELD.

Figures 1–12.

1, 2.— A slender small macramphidisc; magnified 500 ; phot. Zeiss, apochr. 8, compens. oc. 12: 1, focussed high (on the uppermost teeth); 2, focussed lower (on the shaft).
3, 4.— A broad small macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12: 3, focussed high (on the uppermost teeth); 4, focussed low (on the shaft).
5.— A large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
6, 7.— A large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12: 6, focussed high (on the uppermost teeth); 7, focussed lower (on the shaft).
8–11.— Large macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
12.— A small macramphidisc; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

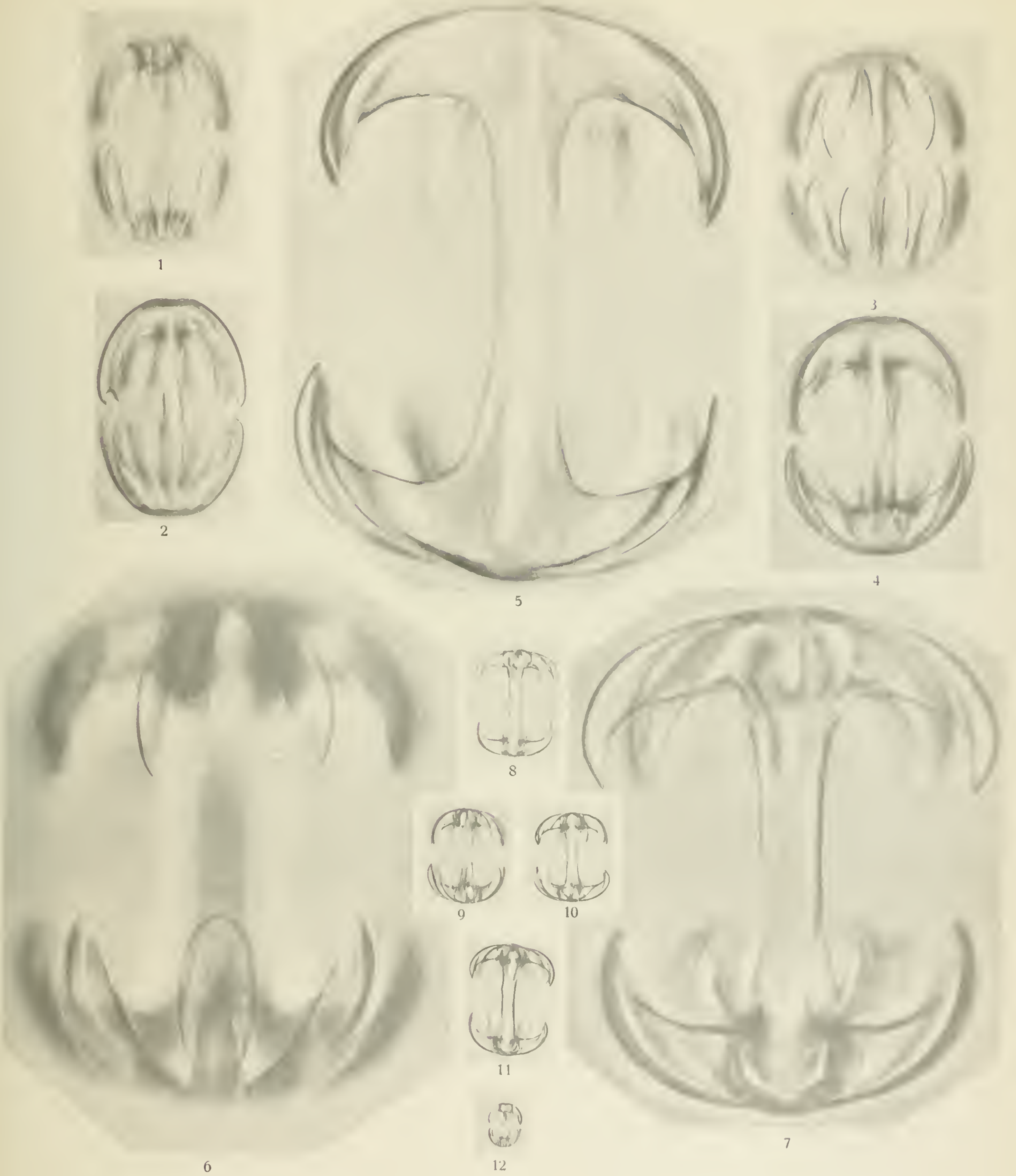


Fig. 1—12 Hyalonema (Skianema) aequatoriale n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 101.

PLATE 101.

Hyalonema (Skianema) aequatoriale Lendenfeld.

Figures 1–3.

1.— Radial section through the marginal part of the sponge; magnified 20; phot. Zeiss, planar 20 mm.: a, gastral face; b, dermal face.

2.— Radial section through the gastral membrane and the adjacent parts of the choanosome; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
a, gastral pinule-fur; b, gastral membrane; c, small macramphidiscs protruding over the gastral membrane; d, large macramphidiscs in the subgastral region.

3.— Paratangential section through the gastral membrane, containing the zone occupied by the lateral rays of the pinules.

Hyalonema (Skianema) umbraculum Lendenfeld.

Figures 4–17.

4–7.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

8, 9.— An abnormal large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
8, focussed high (on the uppermost teeth); 9, focussed lower (on the shaft).

10.— Half (one anchor) of an abnormal large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

11–13.— Parts of microhexactines (11, 13) and a whole one (12); magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

14.— A diactine microhexactine-derivate; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.

15–17.— Acanthophores; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

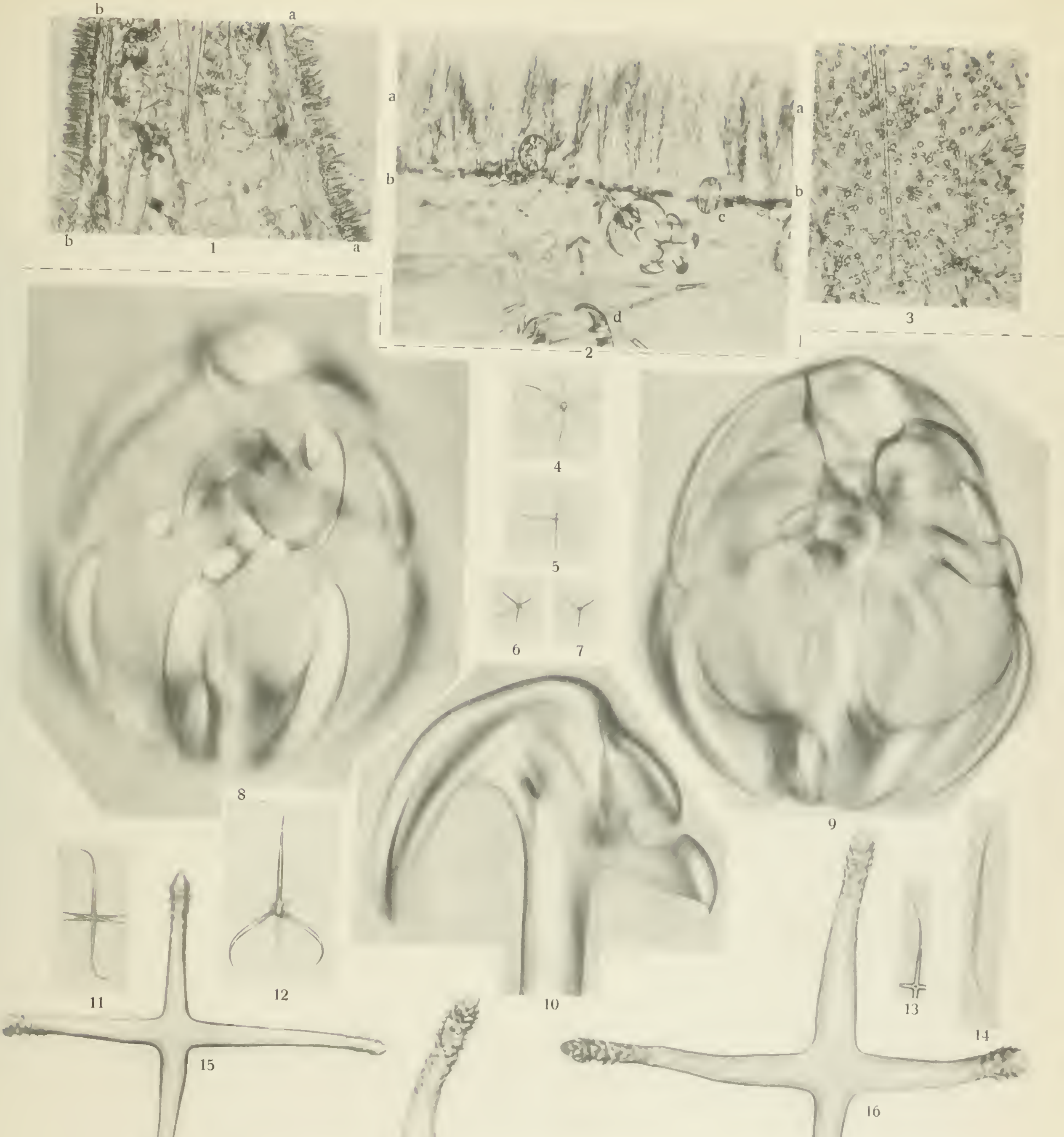


Fig. 1–3 Hyalonema (Skianema) aequatoriale n. sp.
Fig. 4–17 Hyalonema (Skianema) umbraculum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 102.

PLATE 102.

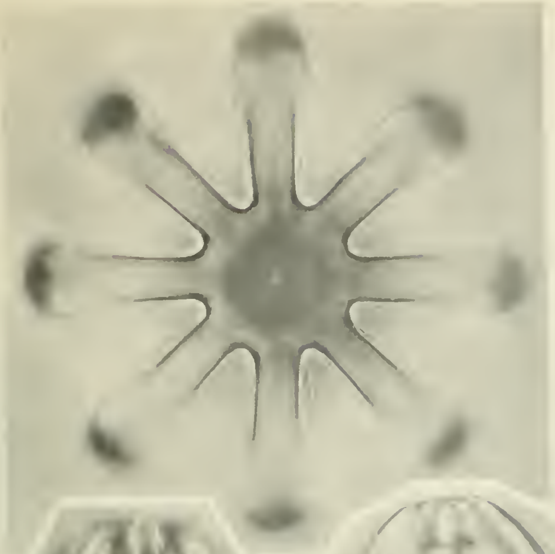
Hyalonema (Skianema) umbraculum LENDENFELD.

Figures 1–8.

1, 2.— Apical view of a large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
1, focussed higher; 2, focussed lower.

3–6.— Small macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
3, 5, focussed high (on the uppermost teeth); 4, 6, focussed lower (on the shaft) (3 = 4; 5 = 6).

7, 8.— A large macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
7, focussed high (on the uppermost teeth); 8, focussed lower (on the shaft).



1

2

3

4

5

6

7

8

Fig. 1—8 Hyalonema (Skianema) umbraculum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 103.

PLATE 103.

Hyalonema (Skianema) umbraculum Lendenfeld.

Figures 1–36.

1–8.— Large macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
  1, 3, 5, 7, focussed high (on the uppermost teeth); 2, 4, 6, 8, focussed lower (on the shaft) (1 = 2; 3 = 4; 5 = 6; 7 = 8).
9–13.— Superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
14–23.— Large macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
  14–21, side-views;
  22, an oblique view;
  23, an apical view.
24–26.— Small macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.
27–29.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
30–34.— Large micramphidiscs; magnified 500:
  30–32, 34, phot. Zeiss, H. I. apochr. 2, compens. oc. 6;
  33, phot. Zeiss, apochr. 4, compens. oc. 12.
35, 36.— A large micramphidisc; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6:
  35, focussed high (on the uppermost teeth); 36, focussed lower (on the shaft).

Hyalonema (Thallonema) geminatum Lendenfeld.

Figures 37–62.

37, 38.— One anchor and part of the shaft of a large micramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
  37, focussed lower (on the shaft); 38, focussed high (on the uppermost teeth).
39–44.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.
45–48.— Parts of microhexactines (47, 48) and two whole ones (45, 46); magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
49–52.— Small micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
53–57.— Large micramphidiscs; magnified 500:
  53, phot. Zeiss, apochr. 8, compens. oc. 12;
  54–57, phot. Zeiss, H. I. apochr. 2, compens. oc. 6.
58–62.— Superficial pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.

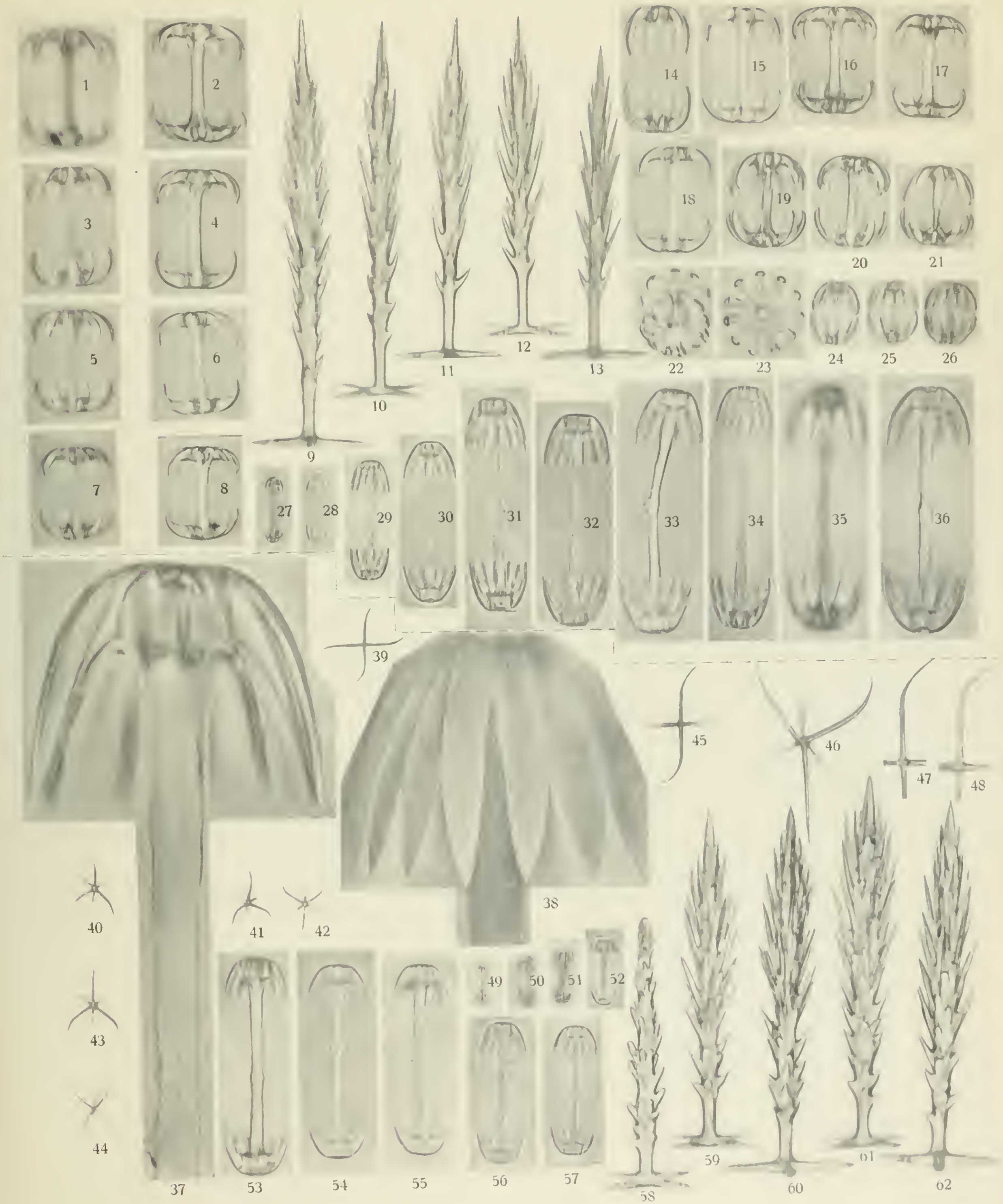


Fig. 1—36 Hyalonema (Skianema) umbraculum n. sp.
Fig. 37—62 Hyalonema (Thallonema) geminatum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 104.

PLATE 104.

Hyalonema (Thallonema) geminatum Lendenfeld.

Figures 1–14.

1–4.— Parts of anchors of large geminate macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

5.— A large macramphidisc with the teeth of one anchor geminate; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

6, 7.— A simple large macramphidisc; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
6, focussed high (on the uppermost teeth); 7, focussed lower (on the shaft).

8.— A geminate large macramphidisc; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6.

9, 10.— Small macramphidiscs; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
9, apical view;
10, side view.

11, 12.— A large geminate macramphidisc; magnified 100; phot. Zeiss, apochr. 16, compens. oc. 6:
11, focussed high (on the uppermost teeth); 12, focussed lower (on the shaft).

13, 14.— A small macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
13, focussed high (on the uppermost teeth); 14, focussed lower (on the shaft).

Fig. 1—14 Hyalonema (Thallonema) geminatum n. sp.

endenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 105.

PLATE 105.

Hyalonema (Thallonema) geminatum LENDENFELD.

Figures 1–14.

1–14.— Large geminate macramphidiscs; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6.

Fig. 1–14 Hyalonema (Thallonema) geminatum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 106.

PLATE 106.

Euretid. Station 4641.

Figures 1–3.

1.— Part of the gastral face of the skeleton of the tube-wall; magnified 30; phot. Zeiss, planar 20 mm.
2.— Part of the dermal face of the skeleton of the tube-wall; magnified 30; phot. Zeiss, planar 20 mm.
3.— View of the skeleton; natural size; phot. Zeiss, anastig. 480/412 mm.

Hyalonema (Prionema) crassum LENDENFELD.

Figures 4–37.

4–12.— Microhexactines; magnified 200; phot. Zeiss, apochr. 8, compens. oc. 6:
 4–6, the same microhexactine;
  4, focussed high; 5, focussed on the centre of the spicule; 6, focussed low;
 7–10, different microhexactines;
 11, 12, a group of microhexactines in a spicule-preparation:
  11, focussed higher, 12, focussed lower.
13–20.— Micramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.
21–25.— Micramphidiscs; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
 21–23, the same micramphidisc;
  21, focussed high: 22, focussed 0.7 μ lower; 23, focussed 1.4 μ lower;
 24, 25, two different micramphidiscs.
26–30.— Pinules; magnified 300; phot. Zeiss, apochr. 8, compens. oc. 12.
31.— A microhexactine (of which only two opposite rays are in focus); magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4.
32–37.— Rays of microhexactines; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
 32, the basal quarter of a ray, focussed low;
 33, the basal half of the same ray, focussed higher; 34, focussed still higher;
 35, the distal third of the same ray focussed highest;
 36, the tip of another ray;
 37, another ray.

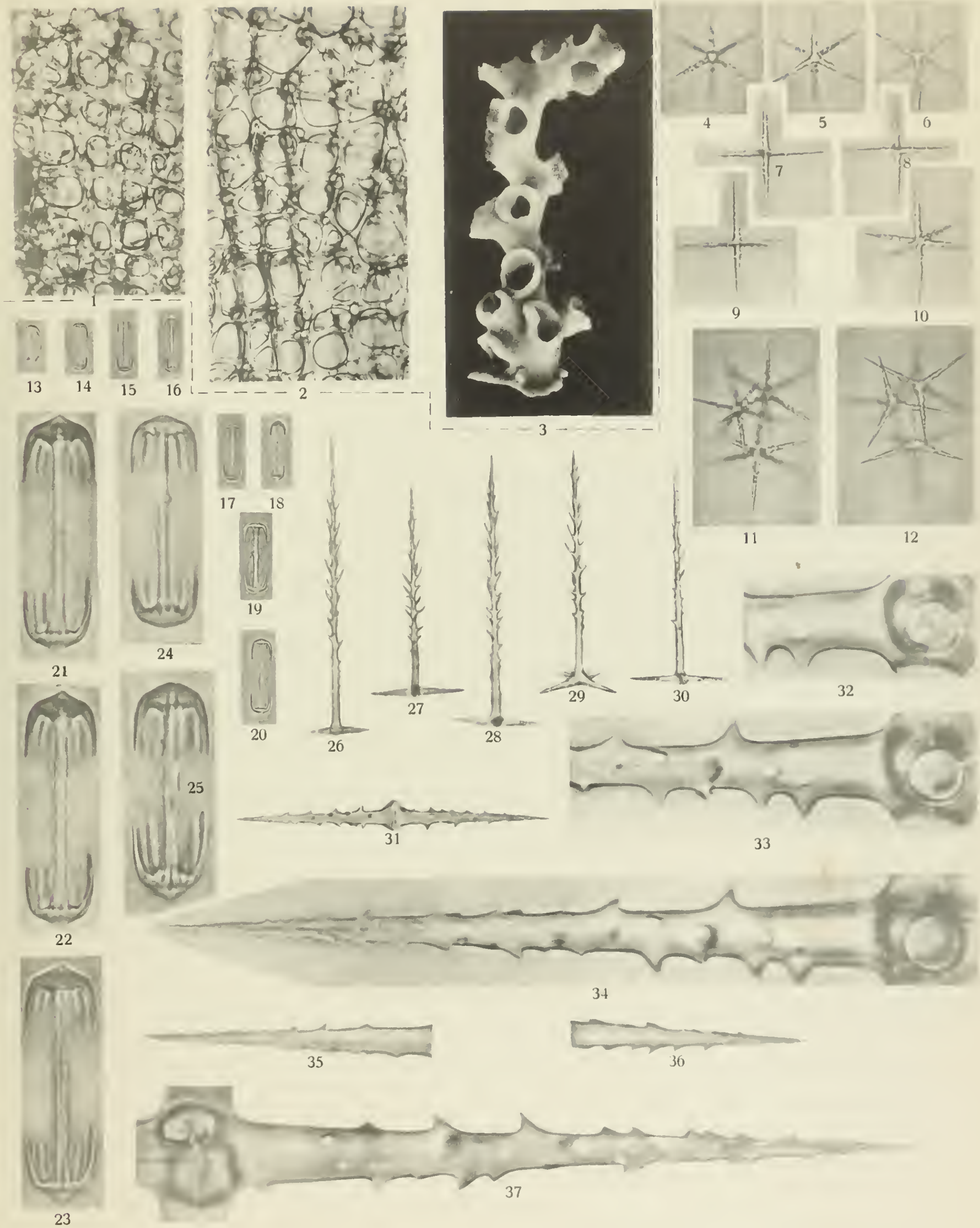


Fig. 1—3 Euretid from Station 4641.
Fig. 4—37 Hyalonema (Prionema) crassum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 107.

PLATE 107.

Hyalonema (Prionema) crassum LENDENFELD.

Figures 1–20.

1, 2.— A large serrated macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12:
1, focussed high, on the uppermost teeth; 2, focussed lower, on the centre of the shaft.

3, 4.— A terminal anchor of a large serrated macramphidisc; magnified 500, phot. Zeiss, H. I. apochr. 2, compens. oc. 4:
3, focussed high; 4, focussed a little lower.

5.— A medium-sized serrated macramphidisc; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.

6–15.— Paratangential superficial amphioxes; magnified 50; phot. Zeiss, apochr. 16, compens. oc. 2:
6–10, slender ones from the dermal membrane;
11–15, stouter ones from the gastral membrane.

16.— View of the largest specimen; natural size; phot. Zeiss, anastig. 480/412 mm.

17–20.— Parts of an anchor-tooth of a large serrated macramphidisc; magnified 2000; u. v. phot. Zeiss, q. monochr. 1.7, q. oc. 10:
17, the tip of the tooth, focussed high;
18, the distal part of the same tooth, focussed lower; 19, focussed still lower;
20, the middle-part of the same tooth, focussed lowest.

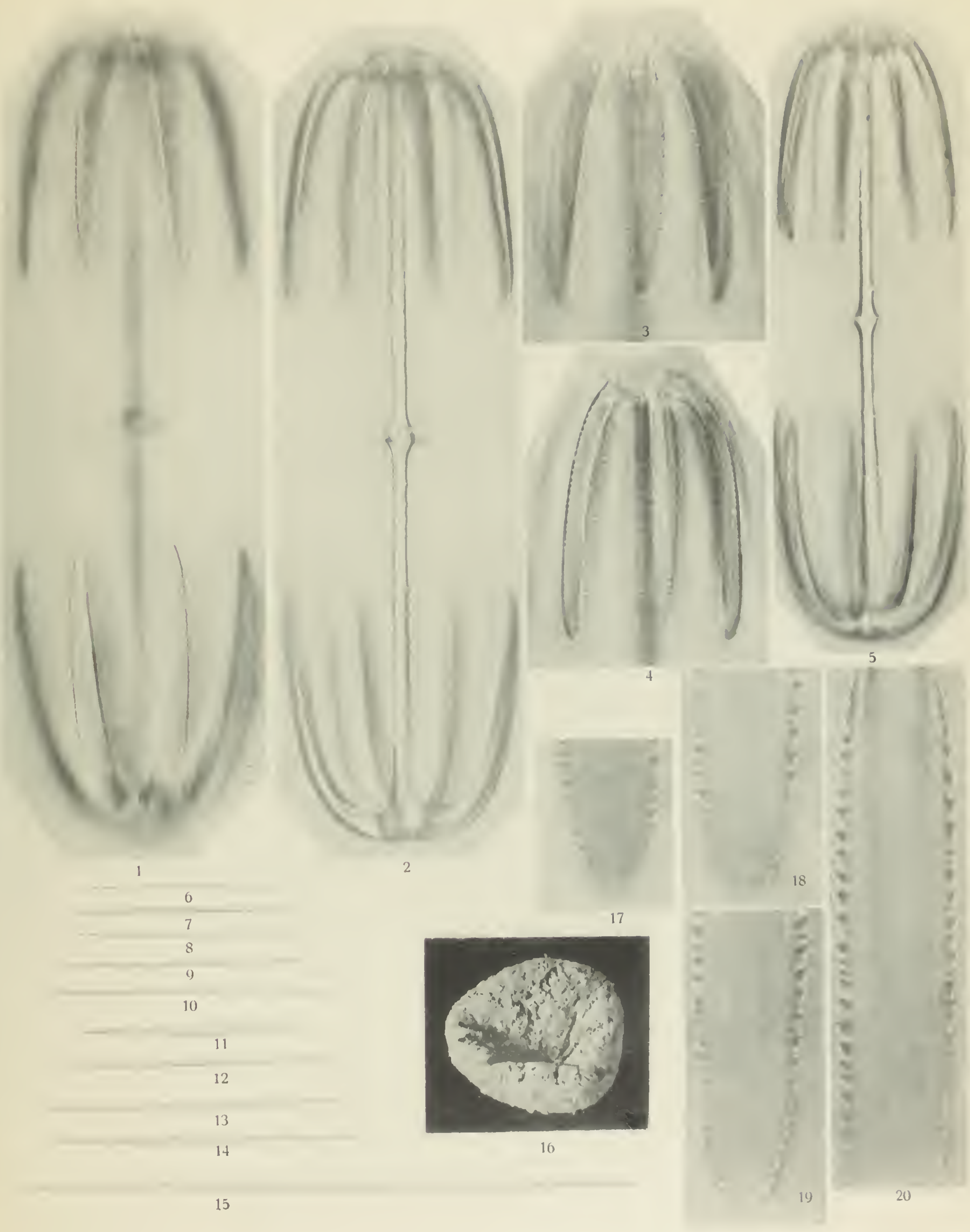


Fig. 1–20 Hyalonema (Prionema) crassum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 108.

PLATE 108.

Hyalonema (Prionema) crassum Lendenfeld.

Figures 1–17.

1–9.— Superficial pentactines; magnified 30; phot. Zeiss, planar 20 mm.:
  1, 3–5, 8, 9, hypodermal pentactines;
  2, 6, 7, hypogastral pentactines.
10–13.— Hexactine megascleres; magnified 30; phot. Zeiss, planar 20 mm.
14, 15.— Two smooth macramphidiscs; magnified 500; phot. Zeiss, apochr. 8, compens. oc. 12.
16, 17.— Parts of smooth macramphidiscs; magnified 500; phot. Zeiss, H. I. apochr. 2, compens. oc. 4:
  16, an anchor, focussed high, on the tips of the uppermost teeth;
  17, a little more than half of a macramphidisc, focussed on the centre of the shaft.

Fig. 1—17 Hyalonema (Prionema) crassum n. sp.

Lendenfeld photographed.

Phototype by Charles Bellmann, Prague.

PLATE 109.

PLATE 109.

The projection measuring apparatus.

Front-view. The mirror is behind the frosted glass-plate and therefore invisible.

The spicules seen projected on the frosted glass-plate are macramphidiscs and microhexactines of *Hyalonema* (*Hyalonema*) *agassizi* Lendenfeld.

The projection-measuring-apparatus.