A Description of Two New Species of Spongilla from Lake Tanganyika.

By

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With Plates 37 and 38.

CONTENTS.

I. INTRODUCTION.

THE two species of Spongilla described in this paper were collected by Mr. J. E. S. Moore, of the Royal College of Science, during his visit to Lake Tanganyika, in the summer of 1896, and were taken at a depth of 350 fathoms.

Mr. Moore entrusted the material in question to Mr. E. A.

Minchin, Fellow of Merton College, Oxford, who in turn handed it over to me that I might study it. There were, besides four specimens preserved in alcohol and kept in separate bottles, a number of fragments which had been most carefully preserved, some in corrosive sublimate, and the rest in Flemming's fluid, and which were kept apart in separate tubes.

On examination all the material, with the exception of one small piece of that which had been preserved in corrosive sublimate, proved to belong to the same species. The small piece mentioned above must have been cut from a sponge which in its external appearance was almost exactly similar to the one to which the bulk of the material belonged, however different it may be in its skeletal characters, or else Mr. Moore would have noticed the difference. However great the external similarity, a single glance at a section suffices to distinguish them as belonging to two entirely different species.

I have given these species the names Spongilla moorei and Spongilla tanganyikæ respectively. The former species is represented by the bulk of the material, and is named in honour of its discoverer.

Of the latter I had but a small fragment, and have chosen its designation from its locality.

II. Description of Spongilla moorei.

(1) Habits of Growth and External Form.—Spongilla moorei grows on shells of various mollusca, and partially covers them as a crust. The upper surface is raised into lobes or mound-like elevations, which in no case are more than half an inch above the general surface, and which are usually no more than an eighth of an inch above the shallow depressions which separate them. The surface texture of the preserved sponge is somewhat woolly in appearance, though this is probably the result of the broken condition of the dermal membrane, for it has been observed that some of the fragments preserved in Flemming's fluid are smooth, and the spicules of

the skeleton, though supporting the dermal membrane, do not in the natural condition penetrate it.

An osculum is situated at the tip of each of the lobes or mound-like elevations of the surface of the sponge. This opening measures about an eighth of an inch in diameter, and underlying it there is a fairly large gastral cavity. The dermal pores are small, as usual, and are situated on the flanks of the lobes as well as in the intermediate depressions.

(2) The Skeleton.—In treating of the skeleton or the supporting part of the sponge, first, the spicules will be described; secondly, the arrangement of the spicules to form fibres, and of the fibres at large to form the skeleton; and thirdly, the spongin which binds the fibres together.

(A) The Spicules.—In order to facilitate description the spicules will be divided into three classes, the ordinary division into "megascleres" and "microscleres" being intentionally avoided, because it is—to say the least—doubtful whether the small smooth spicules are microscleres or young megascleres.

The three classes of spicules are—

(α) Diactinal monaxons which taper to a sharp point either gradually (amphioxea), or more rapidly (amphitornota), and are without swellings on their shaft. The former are always straight, the latter curved (Pl. 37, fig. 3).

(β) Similar straight amphioxea or curved amphitornota with distinct swellings on the shaft (Pl. 37, fig. 4).

(γ) Irregular systems formed by the fusion of spicules belonging to class *a* (Pl. 37, fig. 2).[1]

(α) The straight amphioxea taper gradually into a sharp-pointed end (Pl. 37, fig. 3, *a* and *b*), while the curved amphitornota, which are far more numerous, taper much more abruptly into a similar point (Pl. 37, fig. 3, *c*—*e*). Both the straight amphioxea and the curved amphitornota are highly variable in thickness, and exhibit all stages of development. The axial thread is of even thickness throughout its whole length in all these spicules.

(β) In addition to being slightly more slender than the

[1] Cf. Schulze and Lendenfeld's nomenclature (10).

spicules already described, the main feature of these spicules is the presence of a number of swellings, which varies from one to five. As a rule they are situated symmetrically with regard to the middle point of the spicule; that is, if there is only one swelling, it is situated at that point, but if there are two they are placed one on each side of that point, and at equal distance from it; and similarly the symmetry is retained when there are three, four, or five swellings. The absence of the symmetrical arrangement as seen in fig. 4, *d*, is very exceptional. The axial thread, in contrast to spicules of class *a*, present a dilatation corresponding to each swelling on the spicule.

(γ) The spicules in this class are of variable and irregular form, since the individual amphioxea or amphitornota which form them may fuse at any point, and at any angle (Pl. 37, fig. 2, *a*—*j*, especially fig. 2, *d*). As a rule, these compound systems are formed from spicules of class *a*, though occasionally a spicule of class β is found to take part in their formation.

With regard to their origin, two suppositions are possible; first, that they are the result of irregular growth, and branching of a single spicule derived entirely from a single scleroblast; secondly, that they arise by fusion of spicules primitively distinct, and formed each by its own scleroblast. Fig. 2, *e*—*j*, might be taken as evidence for the former view, but such forms as that represented in fig. 2, *d*, render such a supposition highly improbable, to say the least. The view that these spicular systems are of compound origin receives strong support from the way in which their axial threads cross one another instead of branching. If these irregularities arose as outgrowths from one spicule formed in one mother cell, it might well be expected that their axial threads should be also formed as outgrowths from that of the main spicule, and would therefore be continuous throughout the system, but this is certainly not the case in many spicules of our Spongilla, as can be seen from the figures. In another sponge, which is probably a monaxonid of the family Axinellidæ, viz. Tricentrium muricatum (Pallas, 1756), Ehlers, 1870 (=Plectronella papillosa, Sollas, 1879) [11], there are branched spicules in which the axial threads are continuous throughout, a fact which may indicate that the spicules themselves owe their form to branching. It seems clear, therefore, that the irregular spicules of Spongilla moorei have in many cases been produced by fusion. Judgment must be suspended for the present with regard to those systems in which no discontinuity can be detected in the axial threads of the component spicule rays; such spicules may be simply branched. The question cannot be decided until the actual origin of the spicules has been studied, and the same may be said for Tricentrium. Since now it has been shown that the triradiates and quadradiates of the Ascons are formed by fusion, there is no inherent improbability in a similar process occurring in other cases [8].

Spicules of a similar character to the compound systems here described have been figured by many authors in various Spongillidæ (Spongilla aspinosa, Potts [9]; Lubomirskia intermedia, Dybowski [4]). All these authors regard them as abnormalities, but in moorei they are so frequent that they must be considered as a normal feature of the species. It is possible that in other Spongillidæ these systems have not received the attention they deserve.

In addition to the spicules described above, there are small masses of silica in Spongilla moorei, comparable with those found in Spongilla aspinosa (Pl. 37, fig. 5).

(B) The Arrangement of the Spicules to form Fibres, &c.—The spicules which form the polyspiculous fibres belong mainly to the first and third classes above described. Spicules of the first class form the greater part of the fibres, while others lie about in the sponge tissue, presenting for the most part an irregular method of arrangement, though many such spicules are placed so as to bridge over the spaces between the fibres in a perfectly definite way. Spicules of the second class, which are far less numerous than those of the first, seldom participate in the formation of the fibres, but, as a rule, lie scattered irregularly between the fibres. The spicular systems of the third class are seldom found in any other position than in the fibres.

As a rule, the spicules are arranged in the fibres with their axes parallel to one another, and in the deeper parts of the sponge the connecting spicules are rather numerous, and more strongly developed than in the more superficial parts. The connecting spicules are usually the most strongly developed spicules in the whole sponge as regards size, differing, however, only in thickness from the smooth curved amphitornota which constitute the fibres (Pl. 37, fig. 3, *d—g*). Speaking generally, the largest spicules of the first class, together with a few of the second and all the third, form the fibres and the connecting links between them; while the smaller spicules belonging to the first, and nearly all those belonging to the second class, are scattered about irregularly in the meshes between the fibres. The smallest spicules of all appear to be absolutely independent of the skeletal meshwork, and this is the strongest argument that can be adduced in favour of the view that they are microscleres, and not young megascleres.

The arrangement of the skeleton at large is reticulate. The most prominent feature of the general conformation of the fibres is the way they pass from the surface of fixation of the sponge to the dermal membrane which they support. Along their course from one surface to the other they present a wavy appearance, often dividing and again reuniting, approaching the dermal membrane nearly always at right angles, and in many cases expanding into a kind of brush-like structure which supports that membrane (Pl. 38, fig. 6). In some of the largest lobes of the sponge the fibres nearest the centre pursue a straight course, while those furthest from that position curve outwards, so as to form supports to the dermal membrane which covers the flanks of these mound-like elevations. Owing to this arrangement a longitudinal radial section of one of these lobes presents an almost fan-like appearance as regards the skeletal fibres.

(c) The Spongin.—All the skeletal fibres of this sponge are enclosed in a distinct sheath of spongin, which is greatly thickened at the points where the connecting spicules occur, these being either partially or completely surrounded by it (Pl. 38, figs. 6 and 7). Not only are the fibres and the connecting spicules enclosed in a sheath of spongin, but the surface of the sponge is covered by a thin layer or cuticle of the same substance, which dips down between the cells of the dermal membrane, and communicates with that which envelops the fibres (Pl. 38, fig. 6).

(3) The Canal System.—Owing to the fact that the material which had been preserved for histological study of the sponge had been shaken considerably in moving from place to place, a great number of cells had apparently become loose, and were found lying in the spaces of the canal system. In consequence it was impossible to make a complete and thorough study of that system, though individual cells were in many places nicely preserved; nor is Spongilla, for other reasons, a favourable object for the study of the canals in the Monaxonida.

The canal system in Spongilla moorei belongs to the type usually described as the third. The dermal pores, which are situated on the flanks of the mound-like elevations of the surface and in the intermediate depressions, are small, and open into the subdermal cavity, which is lined by flattened epithelium, and considerably reduced by the passing through of the skeletal fibres, which are enclosed in a sheath of spongin, which is covered by cells of the epithelial layer.

The inhalant canals which pass from the subdermal cavity into the chambers are narrow and difficult to make out. In some cases these canals are short, owing to the flagellated chambers being situated close to the floor of the subdermal cavity. Those canals which pass into the chambers which are situated more deeply in the sponge are long and narrow, following a winding course, and keeping nearly always between the chambers and the fibres of the skeleton. On their way down into the deeper parts of the sponge they give off branches which open into the chambers by way of prosopyles, which are so small that it is almost impossible to make them out. The apopyle was easily distinguishable as a wide opening, communicating directly with the wide exhalant canals, and occupying nearly a fourth of the surface of the otherwise almost spherical flagellated chamber, which is lined by collar-cells with nuclei situated at their bases. The canals of the exhalant system are much wider than those of the inhalant, and, as a rule, occupy a central position between the fibres. As they pass down into the deeper parts of the sponge they converge and unite together, forming wider canals, which are few in number, and which open into the somewhat spacious gastral cavity, which communicates with the exterior by way of an osculum situated at the summit of each of the mound-like elevations of the surface.

(4) The Gemmule.—The gemmules, which are few in number and scattered about singly, are spherical in shape and small in size, measuring only ·35 mm. in diameter. They possess a thin coat, which is not surrounded by spicules specially characteristic of the gemmule, but by the ordinary skeleton spicules. Their cellular contents present the same characters as do those of the common species of Spongilla, and each individual cell is full of the two kinds of granules which are quite characteristic of the cells of Spongillid gemmules. It is just possible that had the material been preserved later in the year the gemmules would have been more numerous, though there would appear to be no absolute necessity for the production of gemmules, since the sponge lives at a depth of 300 fathoms, and cannot possibly be either dried or frozen.

III. The Affinities of Spongilla moorei.

The presence of the gemmule is the most important character tending to fix the position of Spongilla moorei among the Spongillidæ. Gemmules have been described in marine sponges, and this fact diminishes the importance of the existence of gemmules in a newly discovered sponge as a character supposed to be distinctive of the Spongillidæ (Topsent [12]). It appears that there is no special feature in the structure of the skeleton of Spongilla moorei that would cause it to be separated from the Chalinidæ had it been a marine sponge. It most decidedly possesses more spongin than the Spongillidæ are usually supposed to have. As a matter of fact, it is difficult to make out what structural reasons there are for retaining the family Spongillidæ. It is not at all improbable that when they are more carefully studied they will be distributed among the several genera of the Homorrhaphidæ. But as our knowledge has not yet attained a stage which will enable us to do this, it is deemed advisable for the present to place this new species among the Spongillidæ, and to retain that assemblage of sponges as a family, however artificial it may be.

The characters of the gemmule of Spongilla moorei place this species among the sub-family Spongillinæ, and not among the Meyininæ or the Lubomirskinæ. They lack the amphidiscs which surround the gemmule of the Meyeninæ, while, on the other hand, the Lubomirskinæ is a sub-family which has been created for the purpose of including certain fresh-water sponges in which, up to the present, the gemmule has not been discovered.

Spongilla moorei appears to be more closely related to Spongilla aspinosa (Potts) than to any other species of the Spongillinæ. Both species agree in possessing spicules which are smooth, straight or curved, and for the most part rather abruptly pointed. Malformed spicules, as they are described by Potts [**9**], are found in both, but they appear to be more numerous and more complicated in Spongilla moorei than in Spongilla aspinosa. Further, both species produce gemmules which are small in size, spherical in shape, and supplied with a thin crust which is not protected by spicules characteristic of the gemmule, but by the ordinary skeleton spicules. Though the gemmules are few in Spongilla aspinosa, they are more numerous than in Spongilla moorei, a feature which may be explained either by the lesser importance and consequent scarcity of the gemmule in the latter species, or simply by the season at which the material was collected.

Spongilla aspinosa differs from Spongilla moorei in that it possesses small flesh spicules, which lie on the dermal membrane and among the smooth, slender skeleton spicules.

These small spicules are not found in Spongilla moorei, unless they are represented by those drawn in Pl. 37, fig. 3, *j—l*, and fig. 4, *j—n*, which is probably the case. However, it must be admitted, as has been done by Potts, that in both cases these small spicules may be young megascleres, and not microscleres. The only distinction obtaining between megascleres and microscleres, viz. that the former are bound up in the general skeleton of the sponge while the latter lie scattered about freely, is a functional rather than a morphological character, and seems to break down in the Spongillidæ, whose Homorrhaphid ancestors were probably without microscleres. The consequence of this is the impossibility of deciding definitely the true character of certain spicules. It seems, however, a safe conclusion that these small spicules are the same in Spongilla moorei as in Spongilla aspinosa, though in the former they are not found in the dermal membrane, their place being taken by the cuticular layer of spongin which covers the surface.

The form of growth of these two species appears to differ. Spongilla aspinosa is provided with long, slender, cylindrical branches which occasionally subdivide. These branches grow from a thick basal membrane. Spongilla aspinosa, however, at times forms merely a sheet which envelops the support on which it grows, while Spongilla moorei in all the specimens examined presented this appearance.

The spongin has not been described in Spongilla aspinosa, and therefore neither comparison nor contrast is possible.

The colour of Spongilla aspinosa is said to be green, a fact which is the result of the position in which it grows, for Spongilla lacustris and Ephydatia mülleri and fluviatilis may be either green or pale, according as they grow in direct sunlight or in the shade. Owing to the depth at which Spongilla moorei lives, the green colour of Spongilla aspinosa would appear to be wanting.

IV. Description of Spongilla tanganyikæ.

Owing to the fact that there was but a small piece of this sponge among the material presented to me for investigation, is impossible to make any statement with regard to its external form and habits of growth. However, it may be conjectured that in both respects it must have resembled Spongilla moorei, since Mr. Moore failed to detect it as a distinct form. Though the two species are probably similar to one another in their habits of growth and external characters, they are strikingly dissimilar in the characters of their individual spicules, though the general arrangement of the spicules in the fibres and of the fibres at large is strikingly alike.

The description of this species must, of necessity, be brief. The same plan will be followed as far as possible as in the case of the description given of Spongilla moorei.

(1) The skeleton will be described under the following heading:

(A) Spicules.
(B) Arrangement of spicules, &c.
(C) Spongin.

(A) Spicules.—It may be safely stated that there are megascleres and microscleres in this sponge. The megascleres consist of amphistrongyla and amphitornota, which are for the most part thickly covered with small spines. In addition to these there are a few smooth or sparsely spined amphioxea (Pl. 38, fig. 10, *a*, *f*, *g*, *h*—*l*, and *o*—*q*). A few irregularly shaped spicules, which appear to be the result of fusion, are present (Pl. 38, fig. 10, *m*). The microscleres are much slenderer than the megascleres, though they almost equal them in length. They are always smooth and slightly curved (Pl. 38, fig. 10, *n*).

(B) The General Arrangement.—The arrangement of the spicules does not differ materially from that already described in Spongilla moorei. The spiny amphistrongyla and amphitornota, together with a few smooth or sparsely spined amphioxea, are arranged with their axes parallel to one another to form the skeletal fibres. These divide and again reunite, producing an arrangement which is usually described as being reticulate. The fibres are connected together in many places by spicules which bridge over the intermediate spaces. These spicules are the largest in the whole sponge, as a rule, as was found to be the case in Spongilla moorei. In addition to these there are many spicules, both spiny and smooth, which appear to lie about more or less freely in the tissues. The slender microscleres are nowhere connected with the fibres, but lie absolutely free in the tissues.

(c) The Spongin.—The spongin is not so highly developed in Spongilla tanganyikæ as in Spongilla moorei. The former, therefore, in this respect resembles more closely the ordinary species of the Spongillidæ than the latter appears to do. The spongin does not appear to extend to the surface, and the layer which covers the fibres is correspondingly thin. The greater development of spongin occurs at the points where the fibres branch or reunite, and at the places where the connecting spicules penetrate the fibres.

2. The Gemmule.—Though there was but a small piece of this sponge it happened to contain several gemmules. These are devoid of special spicules, but are surrounded by the ordinary skeletal spicules and the microscleres. They possess a thin coat as in Spongilla moorei, and are spherical and of small size. As regards their cellular contents they present the ordinary characters of the Spongillid gemmule.

V. The Affinities of Spongilla tanganyikæ.

This subject must be considered from two aspects. In the first place, the characters of the gemmule must be taken into consideration, since the grouping of the Spongillidæ into the three sub-families, Spongillinæ, Meyeninæ, and Lubomirskinæ, and the division of the sub-families into genera, usually adopted, depends on these characters. In the second place, the spicules are of great importance as presenting a close resemblance to the spicules of Lubomirskia intermedia var. *a* (Dybowski, cf. pl. iv, fig. 3, *b*, [4]), which belongs to the sub-family Lubomirskinæ.

(A) The Gemmule.—The gemmule of Spongilla tanganyikæ lacks the amphidiscs which surround the gemmule of the Meyeninæ. It therefore appears that this species cannot belong to that sub-family. But it equally lacks the small spicules which are usually found in close relation with the gemmule of the Spongillinæ. Potts, however, places Spongilla aspinosa among the Spongillinæ, in spite of the fact that its gemmules lack characteristic spicules. If this arrangement be followed, the absence of such spicules from Spongilla moorei and Spongilla tanganyikæ should not be considered as a barrier against including these species among the Spongillinæ. But the inclusion does away with the importance of the presence of special gemmule spicules as a sub-family character.

The thin coat of the gemmule resembles that found in Spongilla moorei, Spongilla aspinosa, and others of the Spongillinæ, and has no similarity to the thick coat of the gemmule of the Meyeninæ. The characters of the gemmule, therefore, as far as they go, point to this new African species discovered by Mr. Moore being one of the Spongillinæ.

(B) The Spicules.—It is generally stated that the skeletal spicules of the several species of the Spongillidæ have no characters of higher than specific value. It is difficult to make out from the literature of the family how far such a statement is justified. However, the spicules of Spongilla tanganyikæ possess such characters that it is almost impossible to believe that they have not a wider application. This sponge, considered from the point of view of the skeleton, seems to present a certain amount of affinity with a few species of the Spongillinæ on the one hand, and of the Lubomirskinæ on the other.

The megascleres of the greater number of species arrayed under the sub-family Spongillinæ are sharp-pointed,—that is, they are either amphioxea or amphitornota. There are, however, a few species which possess spicules with rounded ends, that is, amphistrongyla. The species in question are Spongilla nitens (Carter [3]), Spongilla böhmii (Hilgendorf [5], and Spongilla loricata (Weltner [13]), to which may be added Spongilla tanganyikæ, now described for the first time. Spongilla tanganyikæ, therefore, seems to be more closely related to these species, so far as the characters of the skeleton are concerned, than to any other species of the Spongillinæ. Of the three species named above, it appears to present closer affinity with Spongilla böhmii than with either of the other two, for in Spongilla nitens and in Spongilla loricata the amphistrongyla are smooth, while in both Spongilla böhmii and Spongilla tanganyikæ they are spiny. In the former the spines are more thickly set at the end, which is a special feature of the megascleres of some species of the Lubomirskinæ, and which may point to a certain amount of affinity in that direction, while in the latter they are evenly distributed over the whole spicule. In Spongilla böhmii the megascleres are curved as in Spongilla nitens, Spongilla loricata, and most of the Lubomirskinæ, while in Spongilla tanganyikæ they are straight. However, there is among the Lubomirskinæ a variety of Lubomirskia intermedia, described by Dybowski as var. *a*, in which the spicules are spiny and almost straight. The spines are evenly distributed, and the ends of the spicules in many cases present the amphistrongylote character. Another feature of Lubomirskia intermedia agreeing with Spongilla tanganyikæ is that the microscleres are smooth, and almost equal the megascleres in length. In Lubomirskia bacilifera and Lubomirskia papyracea the spicules are Amphistrongylote, though in the former the spines are arranged at the ends of the spicules, in contrast with those of Spongilla tanganyikæ, but to a certain extent agreeing with those of Spongilla böhmii, while in the latter the spines are evenly distributed over the shaft of the spicule, in contrast with those of Spongilla böhmii, but similar to those of Spongilla tanganyikæ.

From these points of comparison it seems that Spongilla tanganyikæ as well as Spongilla böhmii must be closely related to the Lubomirskinæ. Had it not been for the presence of the gemmule in the small piece of Spongilla tanganyikæ at my disposal, I would certainly have placed it among the

Lubomirskinæ. On the other hand, were gemmules to be found in any species of the Lubomirskinæ, it would have to be removed from that sub-family as at present defined. Consequently I venture to suggest that the sub-family Lubomirskinæ should be abolished, and the species contained in it placed under the Spongillinæ, which then could be rearranged into a number of genera according to the characters of the megascleres.

Appendix on some Sponge Spicules found in the Mud of Lake Tanganyika.

Along with the sponge material which Mr. Moore entrusted to Mr. Minchin, there was a microscopical slide with some of the mud of Lake Tanganyika mounted on it. There were on the slide, among other things, some sponge spicules which in shape resemble those of the genera Uruguaya (Carter [3]) and Potamolepis (Marshall [7]). They vary from ·14 to ·31 mm. in length, and from ·013 to ·05 in breadth. A great number of intermediate stages between the two extremes are present. Some of the spicules seem to be "micropunctate." They are nearly always curved, though the amount of curvature varies considerably. The smallest spicules are of even thickness throughout, being amphistrongylote. The spicules of intermediate size in some cases present the same form as the small ones, but differ in other cases in that they are slightly swollen at the ends. The largest spicules are in all cases club-shaped. In passing from the smallest spicules to the largest there seems to be a gradual change from amphistrongyla to amphitylota (Pl. 38, fig. 11).

It is difficult even to suggest what these spicules are. From their characters they might well be the spicules of a species belonging to the genus Uruguaya. But as the species of this genus belong to the New World, and those of Potamolepis to the Old, their locality seems to favour the view that they are the spicules of some Potamolepid sponge. The variation in size increases our difficulty, for it is impossible to decide whether the smallest forms are young spicules, or a different class of spicules, belonging either to the same or to an entirely different species. If, however, the largest spicules are looked upon as fully developed forms, and the smallest ones as immature forms, the size of the normal spicule, that is the fully developed form, agrees with those of Potamolepis leubnitziæ rather than with the spicules of any other Potamolepid sponge. Still there is a real difference in that these spicules are distinctly swollen at the ends, while those of Potamolepis leubnitziæ are not. It seems, though closely resembling the spicules of the species mentioned above, that the spicules now discussed may belong to another species. The matter, however, must be left open for the present, as the above feature, when considered alone, is not a sufficient reason for the formation of a new species.

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EXPLANATION OF PLATES 37 and 38,

Illustrating Mr. Richard Evans' paper "On Two New Species of Spongilla from Lake Tanganyika."

The figs. 1—8 on Plates 37 and 38 refer to Spongilla moorei, figs. 9 and 10 on Plate 38 to Spongilla tanganyikæ, and fig. 11 to *Potamolepis from* the mud of Lake Tanganyika.

PLATE 37.

FIG. 1.—(× 1.) Spongilla moorei growing on a molluscan shell.

FIG. 2.—(*a—e* and *e—m* × 300; *a'*, *b'*, *c'*, and *d* × 750.) A number of irregularly shaped spicules showing both the variety and the irregularity of form which they present. The spicules *a'*, *b'*, *c'* represent *a*, *b*, and *c* on a larger scale of magnification, and together with the spicule *d* show the relation which exists between the axial threads in these compound spicules.

FIG. 3.—(× 300.) Amphioxea and amphitornota without swelling. *a*, *b*, and *l*. Straight amphioxea. *c—k*. Curved amphitornota. *j*, *k*, and *l* are possibly microscleres, or they may be young megascleres.

FIG. 4.—(× 300.) Amphioxea and amphitornota with swellings. *a*. Straight amphioxea with four swellings. *b—l*. Curved amphitornota with a variable number of swellings from one to five. *d* shows the swellings asymmetrically arranged. *h—n*. Either microscleres or young megascleres with one swelling.

FIG. 5.—(× 750.) Masses of silica found in Spongilla moorei, varying both in size and shape.

PLATE 38.

Fig. 6.—(× 200.) The skeleton near the surface as seen in section. The spongin is shown forming a thin layer at the surface and covering the fibres in the interior.

Fig. 7.—(× 800.) A portion of two fibres with a large connecting spicule and a much finer one with a swelling. The spongin is greatly thickened at the points where the connecting spicules enter the main fibres.

Fig. 8.—(× 45.) The skeleton as seen in a section passing from the base to the upper surface. A portion of the shell on which the sponge was growing is seen at the bottom of the figure.

Fig. 9.—(× 200). A portion of the skeleton of Spongilla tanganyikæ seen in section near the surface, showing the main fibres formed almost entirely of spiny spicules, while both spiny and smooth ones are found scattered about irregularly.

Fig. 10.—(× 400.) Spicules of Spongilla tanganyikæ. *a—f.* Straight spiny amphistrongyla. *g* and *j*. Straight, spiny amphitornota. *h*, *k*, and *l*. Straight, sparsely spined amphioxea. *o*, *p*, and *q*. Straight, smooth amphioxea. *m*. Irregularly shaped, spiny spicule. *n*. Microsclere.

Fig. 11.—Potamolepis spicules from the mud of Lake Tanganyika. *a* and *b*. Two large spicules with a curved shaft and swollen ends, i. e. curved amphitylota. *c*, *d*, and *e*. Three intermediate spicules with curved shaft and rounded ends, but not swollen, i. e. curved amphistrongyla. *f* and *g*. Two small spicules similar to *c*, *d*, and *e*, i. e. amphistrongyla.

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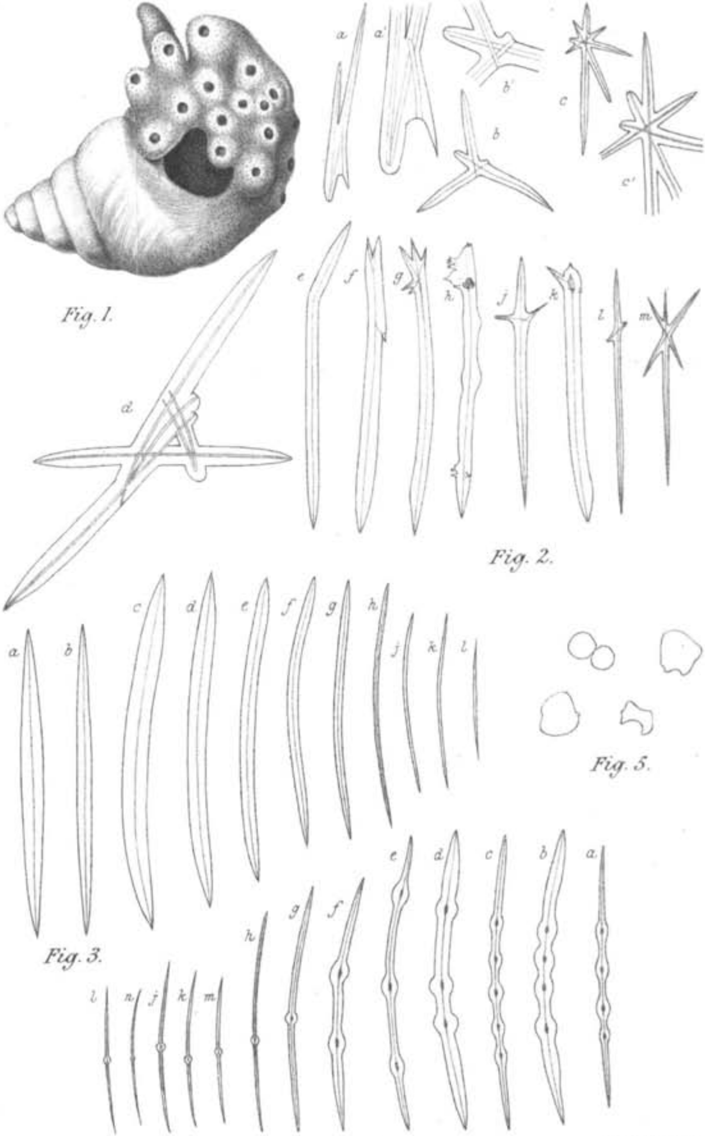

R.E. del.

F. Huth, Lith^r Edin^r