of this group, it must now be known under the name of *Crepidophyllum subcæspitosum*. The remaining forms originally included under the title of *H. subcæspitosum* are really referable to *Heliophyllum*, of which they constitute a separate species (*H. elegantulum*, Nich. & Thomson). The other form of *Crepidophyllum* is the large compound coral which was originally described by Mr. Billings under the name of *Diphyphyllum Archiaci*, but which turns out on microscopic examination to be unquestionably a species of *Crepidophyllum*.

VII.—*On Two New and remarkable Species of* Cliona. By W. J. Sollas, M.A., F.G.S., &c.

[Plates I. & II.]

1. *Cliona mucronata* (mihi).

(Examined in the dried state.)

Sponge occupying a number of chambers excavated in the solid calcareous base of a species of *Isis*.

Chambers of various forms, oval, spherical, or irregular, joined together in a single series or in more complex groups by constricted apertures or by narrow stolon-like tubes, each of which is usually furnished with a spicular diaphragm.

Spicules of three kinds :—1, a straight acuate (Pl. II. figs. 1–3), having a cylindrical shaft, which terminates at one end in a more or less spherical head and at the other is rounded off bluntly and then produced axially into a short sharp spine or mucrone; average length 0·004 inch, breadth across the head and rounded end 0·0006, and across the neck 0·0004, mucrone about 0·0002 inch long. 2, a slender pin-like acuate (Pl. II. figs. 6, 7), straight or curved, with a more or less spherical head and a sharp point; length 0·0073 inch, breadth across the head 0·0004, across the shaft 0·0002. 3, a minute or flesh-spicule (Pl. II. fig. 9), body spirali-sinuously curved once or oftener, or straight, irregularly spined; length 0·0006 inch.

Diaphragms irregularly disciform (Pl. I. figs. 2, 3, 6), conical (figs. 5, 9), or tubular (figs. 4, 10) and open at both ends; when conical, perforated by the truncation of the apex (fig. 5) or imperforate (fig. 9); circumferential edge of disk-like forms, or the base in the case of the other two forms, attached to the walls of the containing tube or constricted aperture, across which the diaphragm extends transversely. Composed chiefly of the goad-like or first kind of spicules, which are packed closely together side by side, normal to the walls they form (fig. 14)—their globular heads forming the exterior (fig. 15), and their mucronate ends the interior surface of the diaphragms. The interstices between the spicules filled with a tough brownish-coloured kerataceous cement. A number of both the goad-like and the slender pin-like spicules lie on the outer surface of the diaphragms, some taking a circumferential and others a longitudinal direction; in the case of the disk-like and imperforate conical forms, these radiating superficial spicules form a wisp-like cap (fig. 9) over the apex or the centre as the case may be, over which also their points meet and cross one another, while their heads are turned towards the circumferential edge. A few of the minute flesh-spicules occur along with the others; and thus the spiculation of the diaphragms is as complete as that of the sponge.

The diaphragms have a constant thickness, viz. that of the length of the goad-like spicules; but they vary in diameter according to the size of the aperture they fill.

Habitat. In the calcareous skeleton of *Isis*, sp. (Deciduous specimen.)

Locality. (?)

Remarks. In examining the débris from a specimen of *Isis*, sp., which I had broken to pieces for another purpose, I came across one of the singular mucronate spicules which form the staple spicule of this sponge; and taking it to belong to some unknown member of the Suberitidæ, I set to work to discover the organism from which it had been derived. I then found certain curious patelliform bodies (the diaphragms already described), which on examination proved to be mainly composed of this kind of spicule; but since these bodies were wholly unlike any sort of sponge with which I was acquainted, I concluded that they were wanting in some of their parts, and continued my search in the hope of discovering one more perfect than the rest; then I met with them, *in situ*, in the chambers of our *Cliona*, to which they evidently belonged. Now arose a question as to their real relations to this sponge. And here only two alternatives presented themselves to my mind: either they were in some way connected with its propagation, embryos or "seed bodies;" or else they performed the office of septa or diaphragms. But the only known method of propagation amongst the Clionidæ is by means of ova, which they produce plentifully, giving rise to ellipsoidal gastrulæ provided with all the forms of spicule proper to the adult sponge. Thus the possession of a full complement of spicules is a character common to the bodies under consideration and to the embryos of the *Cliona*. On the other hand, however, in the embryos of *Cliona* no wisp-like cap has been observed; and no known embryo of *Cliona* or of any other sponge exhibits the regular and close arrangement of spicules which is to be seen in the walls of our structures; the spiculation of the young *Cliona* is in the highest degree confused, presenting no trace of order or arrangement. These facts are sufficiently important; but when in addition we find the diaphragms, as we may as well call them at once to avoid periphrasis, exhibiting such a great diversity of form and size, and this always in exact correspondence to the size and shape of the orifices or tubes they occupy, and when, moreover, we find them invariably attached to the sides of these tubes or orifices by one circumferential edge, we must, I think, exclude from the question all notion of attributing an embryonic nature to them.

There then remains, so far as I can see, only the other alternative; and the facts which tell most strongly against the previous supposition are just such as lend most support to this, the complete justification of which is to be found in the constancy with which the diaphragms occur just at the apertures of communication between adjoining chambers and no where else. This is an adaptation which Mr. Carter tells me is not to be found in the case of the embryos of *Cliona*; but there can be no doubt about its existence here. By an observer examining the chambers of our *Cliona* for the first time, it might perhaps be for a moment called in question, since on looking into one of these chambers one may sometimes see, as if simply adhering to its walls, some four or five diaphragms looking just like so many limpets seated on the walls of a hole in a rock, and giving one no hint as to the existence of apertures concealed beneath them; if now, however, we remove these little bodies one by one with a fine needle, we shall disclose beneath each a corresponding opening leading directly into an adjoining chamber. This experiment I have performed several times, and always with the same result. That these organs are peculiar to the constricted apertures can therefore admit of no reasonable doubt; and their diaphragmatic nature seems to follow as a matter of course.

Why such diaphragms should exist, what is their precise function in the economy of the sponge, is another question, and one to which, in the absence of accessible evidence, I do not feel much inclined to hazard an answer; though if one must conjecture, one might suggest that they may act like the fixed ventilating partitions in a mine, shutting off communication in some directions, leaving it open in others, and so determining the path taken by the currents of water coursing through the canal-system of the organism—or, again, that they may perhaps serve to differentiate the sponge into separate individuals. In some instances, however, every aperture in a chamber seems to be provided with an imperforate form of these diaphragms, so as to be completely sealed up from all means of communication with its neighbours. I say "seems," since it is difficult to make this out with certainty, and I have some doubt on the matter. Admitting, however, that I have determined this point correctly, then the whole arrangement suggests that of the seed of the freshwater *Spongilla*; for in such a chamber we have a particle of the sponge more or less spherical in shape, completely surrounded on all sides by an enclosure, which, while chiefly consisting of the calcareous walls of the chamber, yet does, when these are incomplete, possess also a wall of spicules set at right angles to its surface, and thus very much resembles the arrangement of the amphidisks about the seed-like body of *Spongilla*. We might have here, then, a case of physiological adaptation, the existence of the calcareous chamber-walls making possible an economy of spicules, and dispensing with the necessity of a complete spicular enclosure. Thus, when the sponge went into winter quarters, all that would be necessary would be the plugging up of the apertures in its burrows; and on the return of more genial conditions the growth of these plugs into perforated cones and open tubes would provide for the egress of the reviving sponge.

Plausible as this may appear at first sight, it will not, I think, bear a close investigation. In the first place *Cliona* has not yet been proved to produce "seed-like bodies;" and though this evidence is merely negative, it is yet of great weight, if we consider that in no marine sponge whatever have these structures been discovered, and that in *Spongilla* they are probably due to the influence of extreme changes in climatal conditions, to which the marine sponges are not exposed. Again, had the diaphragms of a single chamber formed collectively parts of a single enclosure, one would expect to find the heads of their spicules all turned in one and the same way—that is to say, either outwards or inwards relatively to the chamber. This, however, is by no means the case; no rule is to be discovered in this respect. Take for instance Pl. I. fig. 3, where two of the diaphragms, *a* and *b*, will be seen to have their surface of spicular heads turned towards the interior their respective chambers A and B, while a third, *c*, has it turned just the other way, or outwards towards the exterior. It may be said, however, that this diaphragm belongs more especially to chamber C than to B, and that, accordingly, we must rather consider the fact that its spicular heads point towards the interior of C, than that they point away from the interior of B. An inspection of fig. 6 will at once furnish us with an answer to this argument, so far as it can be called argument; for there we find two diaphragms, the relation of which to their respective chambers is clear enough, *a* evidently belonging to chamber A, and *b* to B, while, at the same time, the position of the surface of spicular heads is reversed in each case, in *a* the points and in *b* the heads of the spicules being turned towards the interior of the respective chambers. In some cases, moreover, I have seen a diaphragm placed obliquely across an aperture where two chambers open into a third, and evidently so arranged as to determine a passage into one rather than into the other.

It seems then, to my mind, that whatever the ultimate function of these bodies may be, their immediate morphological relation to the sponge is that of open or closed partitions between adjoining chambers; and the term "diaphragm" is therefore the most appropriate to them.

The composition of the diaphragms may be best determined by placing one on a glass slide, adding a few drops of nitric acid, and boiling over a spirit-lamp till the acid has nearly all evaporated; a few more drops must then be added, and the operation repeated as many times as may be necessary for the solution of the kerataceous cement which binds the spicules together. When this has been accomplished, the acid must be driven off completely by continued heating, and the spicules mounted on the same slide as has served for their preparation: no attempt must be made to wash them with distilled water, or to transfer them to another slide; either of these operations is sure to result in the loss of some or all of the small flesh-spicules with which the diaphragms are but sparingly supplied.

By examining the edge of one of the diaphragms as an opaque object, under an objective magnifying about 100 diameters, the arrangement of its spicules can readily be made out; and no arrangement could be simpler (Pl. I. fig. 14). The more or less cylindrical spicules lie side by side, their mucronate extremities forming the inner and their globular heads the outer face of the diaphragm, so that the latter looks like a pavement of glass marbles (Pl. I. fig. 15), all of the same size, and packed as closely as possible, and in consequence exhibiting a quincuncial pattern; the inner face has very much the same appearance, with the single difference that from each marble of its pavement a small spike stands out erect. Across the open end of those diaphragms that are perforated, a thin film of dried protoplasm or structureless membrane extends (Pl. I. fig. 10, *f*), with a small central or excentric lumen (fig. 10, *l*). In the membranous film a few spicules are usually present.

There can be no doubt as to the attachment of the diaphragms; for on removing one from its chamber it often leaves behind it a row of adherent spicules.

On examining the interior of the chambers of the *Cliona* one finds its body-spicules lying full length against the walls, without any tendency to a regular arrangement; one also finds fragments of structureless membrane adhering loosely to the walls, or lying freely in the interior of the chambers, and in these each of the different spicules of the species are contained. Small rounded granular bodies (Pl. I. fig. 12, *c*, and fig. 18) also occur rather plentifully in these bits of membrane; and since they sometimes contain vacuoles (fig. 18, *b*), we may regard them as desiccated cells.

The walls themselves are pitted all over with hemispherical excavations (fig. 8) having rounded edges, and usually about 0·001 inch in diameter. These, which are usual, I suppose to be the first results of the solution by which the *Cliona* excavates its abode.

Little circular openings (Pl. I. fig. 16) are also visible on the sides of the chambers, and become much more clearly exposed after washing the chambers with a little dilute acid; they lead into tubular processes of variable length, generally simple, sometimes bifurcating, and apparently terminating blindly.

On the outside of the *Isis* containing the *Cliona* may be seen a number of rounded holes (Pl. I. fig. 17), by which the chambers with which they communicate freely open to the exterior. These holes are not very abundant; indeed I have been surprised not to find more of them. They occur in groups, and appear to be of two kinds—one larger (fig. 17, *o*), serving probably for the oscules of the sponge, and the other smaller, for its pores (fig. 17, *p*). Generally in the *Clionidæ* they present a crown of pin-like spicules pointed outwardly.

On dissolving a fragment of the infested *Isis* in acid we liberate the spicules it contains, and then find not only the forms we have already described, but a number of others of quite a different character, particularly the abundant sword-like forms, of which instances are exhibited in Pl. II. figs. 10, 11. At first I thought these were proper to our species *C. mucronata*; and since they appeared to be more numerous in its chambers than the mucronate forms, I set them down as its body-spicule, and regarded the mucronate spicules as more or less peculiar to the diaphragms; but after meeting with sponges of other genera, such as *Stelletta*, in the chambers of our *Cliona*, I began to suspect that the sword-like spicules might belong to a different species—a supposition which became confirmed on finding diaphragms in which the sword-like spicules were the chief constituents, to the entire exclusion of mucronate ones. This led me to examine each chamber of the *Cliona*-burrows separately by reflected light; and I then found that those chambers which were provided with diaphragms of mucronate spicules exhibited the same spicules scattered over their walls, and, similarly, that chambers in which ensiform spicules were present were closed by diaphragms into the composition of which ensiform spicules chiefly entered. The spiculation of each chamber was pure; those that contained mucronate spicules never contained ensiform ones, and *vice versâ*. To make quite sure of this, I then proceeded as follows:—Under a magnification of about 50 diameters I picked out a cell, the openings to which were guarded by diaphragms of one kind or the other, say of mucronate spicules; the edge of this cell was then marked by a fine-pointed pencil for the purpose of identification. Next I drew out two pieces of glass tubing to very fine capillary terminations, and filled one with water and the other with dilute hydrochloric acid; working now under a watchmaker's glass, I inserted the capillary end of the tube containing acid into the marked chamber, and expelled a drop of the acid into it. By the resulting solution of its walls its spicules were detached and set free, so that it only remained to introduce the capillary end of the other tube into the chamber, and by forcing out the water in a fine jet to wash its contents into an excavated glass slide, where they could be examined by transmitted light. This operation I performed many times, and so convinced myself of the complete correspondence between the spicules composing the diaphragms and those lying on the walls of the same chamber. Similarly the fragments of dried sarcode present in some of the chambers always contain the same kinds of spicule as the associated diaphragms.

Finally, having made sure that I had present in my specimen of *Isis* two species of *Cliona*, the chambers of which appeared to be inextricably entangled with each other, I was able by a little careful searching to trace out the distribution of each; and I then found that the chambers of one species never opened into the chambers of the other, but that communicating chambers were always occupied by one and the same species. This is indicated in Pl. I. fig. 1, where the cells left unclosed are those of *C. mucronata*, while the ones shaded with dark lines belong to the next species, *C. ensifera*. Here and there apparently isolated chambers of one or the other species occur, as those of *C. ensifera* at *a*; these, however, are not really isolated, but communicate with chambers of the same kind either above or below the plane of the drawing. We have now thus brought to light what appears to me a very remarkable fact, and one that might easily lead to great confusion in species; for no one examining the burrows in my specimen of *Isis* would have supposed them to contain two different kinds of sponges. In the outline and arrangement of the chambers themselves no difference is to be detected; and but for a little care the different kinds of spicules within them would certainly have been described as belonging to one and the same species. The necessity for great caution in deciding what spicules to eliminate and what to retain in determining the true complement of spicules proper to a sponge has already been illustrated by the researches of Carter, who has had frequently to disentangle the spicules of commingled species one by one as it were, and so, by immense care, has arrived at correct results where failure would otherwise have been certain.

2. *Cliona ensifera* (mihi).

Sponge burrowing in chambers of the same kind as in the preceding species. Spicules of three kinds:—1, an acuate spicule (Pl. II. figs. 10, 11), having a straight or curved shaft, which is cylindrical in form for a certain distance from the globular pin-like head, and then expanding becomes fusiform for the rest of its length, and finally terminates in a more or less abrupt point: length 0·0095 inch; breadth across the head and broadest part of the shaft 0·0006, and across the neck 0·0002 inch. 2, a slender acuate (Pl. II. figs. 12, 13), straight or curved; inflated head variable in shape, spherical and ellipsoidal; dimensions variable, averaging 0·0075 inch in length and 0·0004 in breadth. 3, a minute or flesh-spicule (Pl. II. fig. 15), with a straight or curved shaft produced into a number of unequal conical spines; length 0·0006 inch. Diaphragms in shape and position very similar to those of *C. mucronata*, though slightly more irregular in outline, composed of ensiform spicules which lie side by side normal to the walls. Owing to the fact, however, that these spicules are as often curved as straight, they frequently depart from a normal position and are arranged obliquely, forming curved radii about the axis or centre of the diaphragm. The heads of the spicules form the outer surface of the diaphragm as in *C.*

mucronata; but sometimes they project for greater or less distances from the surface, so as to render it irregular. Besides the single layer of spicules, which forms a wall as thick as they are long, there are sometimes present additional ensiform spicules, which, lying in the same direction as the others, are stuck into the diaphragm like pins into a pin-cushion, and so increase its thickness to once and a half the length of a single spicule. The additional spicules are only held together by the insertion of their points; no keratacеous cement is present between the projecting ends of their shafts, which consequently form a white layer—in striking contrast to the yellow colour of the rest of the diaphragm, in which keratacеous matter occurs (Pl. I. fig. 11).

On the surface of the diaphragms all the kinds of spicules which characterize the sponge are scattered irregularly. The combination of two diaphragms to form a single one is of frequent occurrence in this species; and from it results the form shown with two centres in Pl. I. fig. 13, where about each centre the smooth shafts of the spicules form the curved radii of a circular area distinguished by the absence of spicular heads, which, however, are abundant enough outside the circumference of the circular area.

Remarks. The spicules represented by Pl. II. figs. 1, 6, 9 are sufficient to define the species *C. mucronata*, in which they occur; and similarly *C. ensifera* is quite sufficiently defined by the spicules of figs. 10, 12, and 15. But to possess a complete knowledge of a species it is necessary to know more about it than its mere distinctive characters; one must know also the variations to which it is subject: a knowledge of the extreme as well as of the average characters of a species is of the highest importance if we would seek to construct accurate tables of phylogeny. Hence it has seemed to me well to add here figures and descriptions of the unusual forms of spicules which both the foregoing species exhibit—not that all of these will be available for immediate use, but that they may become so eventually, while some, on the other hand, will possess a present and special significance for us. The forms represented by Pl. II. figs. 18–21 are somewhat common variations amongst pin-head spicules: fig. 18 shows a form of doubly inflated head in which the second inflation is of a different size to the first; in fig. 21 the two inflations have become more nearly equal in size, but still remain in immediate contact with each other; in fig. 19 a still further change has taken place in the separation of the heads by an intervening portion of the cylindrical shaft. In fig. 20 the second inflation is merely lateral and confined to one side of the shaft.

In fig. 24 a short conical spine projects from the fusiform part of the shaft—a bud-like process, which, if prolonged, would give our uniaxial spicule a decidedly biaxial appearance. This budding of the spicules is one of the commonest of phenomena amongst the Spongidæ. In *Geodia arabica* I have seen a variety of one of the large anchoring spicules which had developed a fourth fluke, and so become four- instead of three-pronged; and, similarly, in a *Stelletta* I once observed a variety of the trifid bifurcate anchoring spicule in which an additional bifurcate arm had put in an appearance, so that the spicule had become quadrifid: thus, then, our uniaxial spicules may become biaxial, and, likewise, quadriradiate may become quinqueradiate spicules. The excessive variation to which sponge-spicules are subject makes it easy to conceive how the existing types of multiradiate spicules might have all originated from a primitive uniaxial cell. Let such uniaxial spicule-cells bud to a variable extent, some producing one, and others two, three, four buds and so on, and we should possess just the sort of material which, when submitted to the influence of natural selection, would furnish us with the spicules of all our existing types,—to me apparently a much more natural way of looking at things than that followed by Dr. W. Marshall. This speculative observer considers that, in the case of the Hexactinellidæ, a sarcodic meshwork was first produced, which afterwards became silicified, and then broke down into separate sexradiate spicules. We have, however, every reason to believe that sexradiate spicules originate, like all others, in spicule-cells; and Carter has actually seen the separate sexradiates of *Aphrocallistes* in various stages of cementation up to their complete enclosure in a continuous siliceous network. Marshall's view *, therefore, seems to me to reverse the case with a vengeance.

In fig. 23 we appear to have two spicules joined together by their heads, though whether by ankylosis or as a result of budding, one cannot, in the absence of a visible axial canal, definitely say. In fig. 16 we have two shafts diverging at an angle of 60° from the same head; and as but one head is seen here, the case is probably one of mere budding.

In fig. 24 the shaft of an ensiform spicule has lost its point and acquired a rounded termination like that of the mucronate spicules of *C. mucronata*, only without the mucrone; at the

* In reference to Marshall's conception of the structure of *Sclerothamnus*, I may here point out that, when spicules grow together by ankylosis, their axial canals do not become continuous by opening into one another; on the contrary, while two or more spicules may become one, their canals always remain separate and distinct.

same time it has become shorter; and in fig. 25 the diminution in length has gone a step further, while the shaft has become straight and cylindrical, so that, but for the absence of a terminal mucrone, it would almost exactly resemble the typical spicule of *C. mucronata.* In the last-mentioned species we have the spicule of fig. 4 showing a very considerable shortening in the long direction; in fig. 5 the spicule tapers from its wide neck, instead of enlarging from a constricted neck towards its rounded extremity. Fig. 2 appears to be intermediate between figs. 1 and 5.

These mucronate spicules are quite distinct from any form of spicule yet figured or described; and it is therefore exceedingly interesting to find varieties of them in which the mucrone is changing its character, and, by enlargement, tending towards the fusiform outline of *C. ensifera.* The instances in which this change is well marked were not discovered till after the plates were drawn; and so a single example is represented in the woodcut (fig. 1). Here, then, while *C. ensifera* shows spicules tending towards *C. mucronata*, *C. mucronata* on the other hand presents us with a variety of its staple spicule which almost passes into the staple spicule of *C. ensifera.*

Fig. 1.

Variety of mucronate spicule of *C. mucronata.* × 435.

But the difference between the other spicules of these two species, viz. the slender acuates (figs. 6, 12) and the flesh-spicules (figs. 9, 15), is so slight that no one would think of founding species on them alone. The main difference between *C. mucronata* and *C. ensifera* exists only in the form and size of the staple spicules (fig. 2, 11); and this distinction, as we have already indicated, is half or more than half bridged over by varietal modifications. It hence appears to me that in these two forms of *Cliona* we may actually witness, so to say, the transformation of species; for of the claims of each of the species we have described to distinction no one can for a moment doubt, while, at the same time, the forms by which one might pass into the other are also sufficiently obvious.

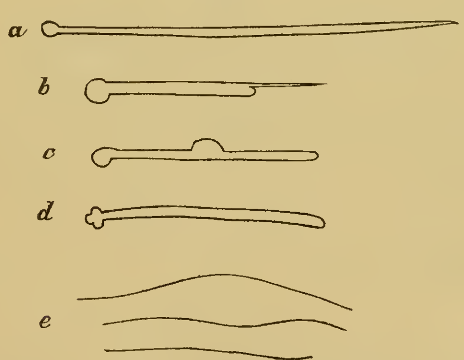
The flesh-spicules of both species are very interesting, as they appear to exist in all stages of growth. Their first appearance, so far as I can make out, is in the form of a simple straight rod about 0·0004 inch in length; this soon becomes sinuous and spined at each end with three or four conical spines; additional spines then appear along its sides, while by unequal lateral growth and by the unequal development of lateral spines the multicurved forms (figs. 15, 18) are brought about. Fig. 19 represents a very unusual form, in which the spines of the spicule have become bifurcate at their ends.

Cliona subulata.

Associated with the *Isis* which furnished the preceding spicules, is a patch of *Melobesia*, in which also *Cliona*-burrows occur; but these, curiously enough, are occupied by a third species, the spicules of which are represented in Pl. II. figs. 26–28, and appear to belong to a new species, for which I propose the name of *C. subulata.* I should state that burrows of the two preceding species occur in the *Melobesia* along with this.

Note.—While writing this paper I had occasion to refer to a specimen of *Cliona* occupying burrows excavated in a solid piece of limestone rock, which I had brought away with me from Dawlish. I had always taken my specimen to be *C. celata*, and referred to it in order to determine whether it possessed diaphragms of any kind like those of *C. mucronata.* As to this my results were negative; but an examination of its spicules showed that it differed from *C. celata* in the form of its flesh-spicules, while its skeleton-spicules are essentially the

Fig. 2.



Spicules of *C. linearis*: *a*, skeleton-spicule; *b*, variety of *a*, with rounded end and produced spine; *c* and *d*, varieties of *a*, with rounded ends (*a*–*d* × 140); *e*, flesh-spicules (× 435).

same as those of *C. celata*, *Raphyrus Griffithsii*, and *Halichondria ficus*. The flesh-spicule, instead of remaining relatively short and becoming spined, attains, as if by the sacrifice of its spines, a great length (0·0033 inch) relative to its breadth, which is too small for measurement, and remains smooth.

This must be regarded as a variety of *C. celata*; and I propose for it the name of *C. linearis*.

Cliona linearis, var. of *C. celata*.

Skeleton-spicule as in *C. celata* (fig. 2, *a*). Flesh-spicule a long filiform acerate (fig. 2, *e*), straight or tricurved; length 0·0033 inch, breadth so narrow as scarcely to exhibit a double outline under a magnification of 500 diameters.

EXPLANATION OF THE PLATES.

Plate I.

Fig. 1. A fragment of *Isis*, sp., with *Cliona*-burrows: *m*, *m*, chambers of *C. mucronata*; *e*, *e'*, of *C. ensifera* (natural size).

Figs. 2–7. Outlines of chambers (A, B, C) of *C. mucronata*, showing various forms of diaphragms ($a, b, c, d, d_1, d_2, d_3$): *d'*, diaphragm seen in plan, concealing an aperture beneath it; *w*, walls of a chamber. × 30.

Fig. 8. Hemispherical pittings on the walls of the *Cliona*-burrows. × 60.

Fig. 9. Imperforate conical form of diaphragm (*C mucronata*), seen from its convex or exterior surface. × 30.

Fig. 10. Tubular diaphragms (*C mucronata*): *f*, film of dried sarcode containing spicules; *l*, lumen. × 30.

Figs. 11–13. Diaphragms of *C. ensifera*: *f*, film of attached membrane; *c*, cells contained in the membrane. × 30.

Fig. 14. View of the edge of a diaphragm of *C. mucronata*. × 140.

Fig. 15. Superficial view of the inner surface of a diaphragm of *C. mucronata* mounted in Canada balsam. × 140.

Fig. 16. Openings in the walls of chambers of *Cliona* leading into tubular processes. × 30.

Fig. 17. Openings on the exterior of the *Cliona*-containing *Isis*, leading into the chambers of *C. mucronatu* within: *p*, openings for pores; *o*, for oscules? × 30.

Fig. 18. Cells from the membranous films found in the chambers of *C. ensifera*: *b*, vacuole. × 435.

Plate II.

[All the figures on this Plate are magnified 435 diameters.]

Figs. 1–9. *Cliona mucronata*.

Figs. 1–3, mucronate spicules; figs. 4 and 5, varieties of the preceding; figs. 6 and 7, slender acuate spicules; fig. 8, variety of figs. 6 and 7, having two shafts, a short cylindrical one with rounded ends and a slender pointed one, both proceeding from the same head; fig. 9, various forms of flesh-spicules.

Figs. 10–25. *Cliona ensifera*.

Figs. 10, 11, and 22, normal ensiform spicules exhibiting different degrees of curvature.

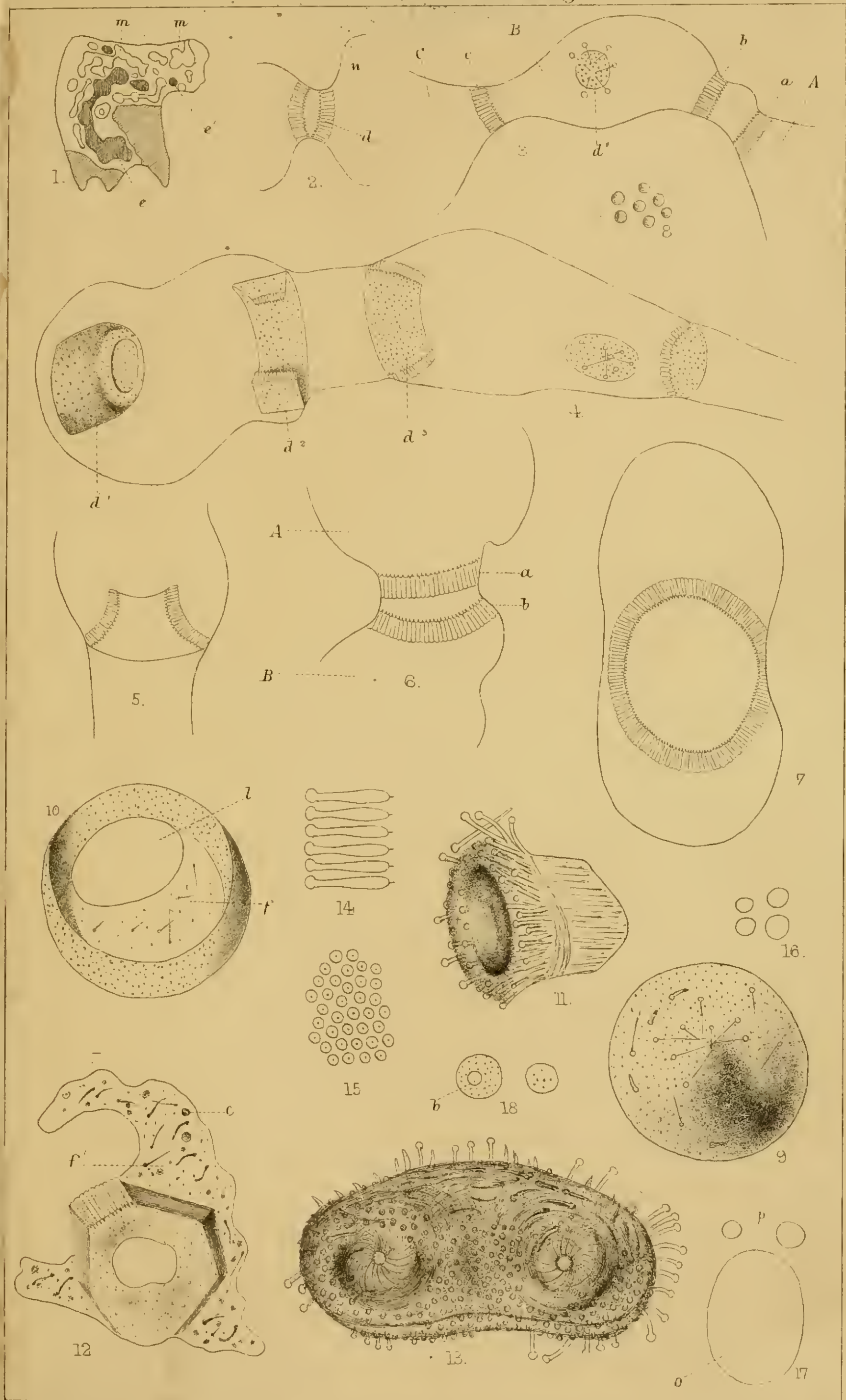
Figs. 12, and 13, slender acuate spicules; fig. 14, a variety of figs. 12 and 13.
Fig. 15, flesh-spicules in various stages of growth, *a*, *b*, *c*, *d*, and *e*.
Figs. 16–25. Varieties of the ensiform spicule.
Fig. 16. Variety with two shafts diverging at an angle of about 60°, and proceeding from a common head.
Fig. 17. Variety in which the shaft has become straight and cylindrical and rounded at the end, so as to resemble mucronate forms of *C. mucronata.*
Figs. 18–21. Various forms of inflated terminations of the ensiform spicules.
Fig. 22. Extremely curved variety of ensiform spicule.
Fig. 23. Two ensiform spicules joined together, with an angle of divergence of about 150°.
Fig. 24. Variety with a conical spine.
Fig. 25. Variety similar to fig. 17.
Figs. 26–28. *Cliona subulata.*
Figs. 26 and 27. Skeleton-spicules of *Cliona subulata.*
Fig. 28. Flesh-spicule of same.

VIII.—*Description of a new Species of* Spatangidæ. By Edgar A. Smith, F.Z.S., Zoological Department, British Museum.

The record of the existence of another species of the genus *Linthia* is very interesting, since up to the present time it comprised but a single recent form. Unfortunately I cannot give the locality whence the specimen was obtained with any degree of certainty; however, there is some evidence which tends to show that it was brought either from the Pacific Islands or from the west coast of South America, since it was found in a collection of shells which consisted almost exclusively of species which are well-known inhabitants of those regions.

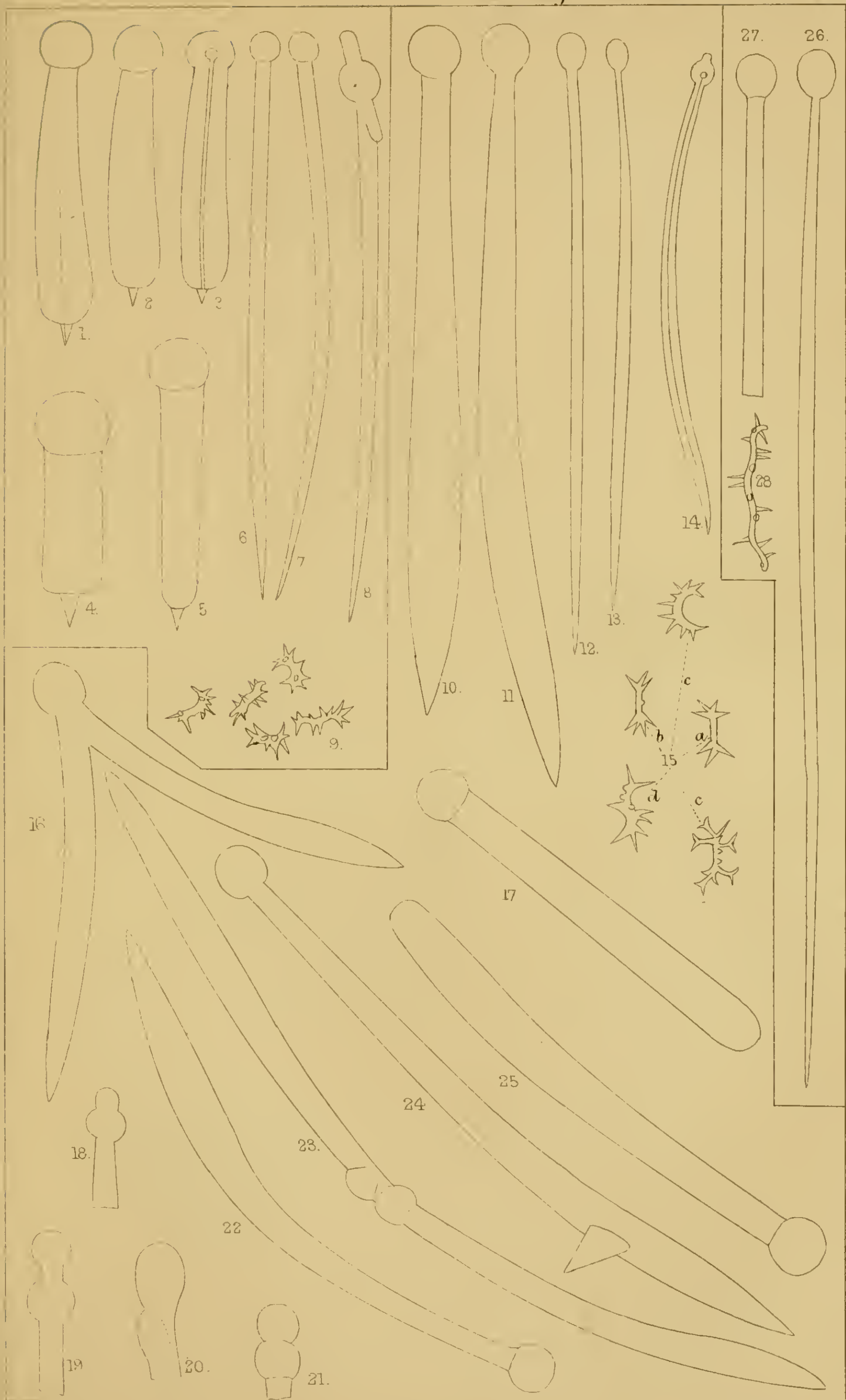
Linthia rostrata.

Test, seen from above, cordiform, narrowed posteriorly, viewed laterally much beaked behind through the prominence of the hinder interambulacral region above the anus, and a deep well-marked excavation beneath the beak; lower surface a little convex; viewed endways the sides appear rather flat, converge to an obtuse apex, and gradually round off below, joining the somewhat convex base. Genital openings four, central, very small, equal, subequidistant; posterior pair scarcely wider apart than the anterior ones. Ambulacra very unequal, anterior lateral pair almost double as long as the posterior ones, moderately deeply sunken, inclined considerably towards the anterior end, yet arcuated in the opposite



W. G. S. del.

Mintern Bros. lith.



W G S del.

Mintern Bros lith