

XLVII.—*Descriptions and Figures of Deep-Sea Sponges and their Spicules, from the Atlantic Ocean, dredged up on board H.M.S. 'Porcupine,' chiefly in 1869 (concluded).* By H. J. CARTER, F.R.S. &c.

[Concluded from p. 410.]

*Ophiraphidites tortuosus*, n. sp.

Groups of large, tortuous acerates, more or less uniform in size, congregated in deep depressions on the surface of *Discodermia polydiscus* and *Stelletta pachastrelloides*, without definite arrangement, naked, void of sarcodic structure, and unaccompanied by any other spicules but a few large trifids from *Pachastrella abyssi*; adherent by one end to the surface on which they may be situated, and retained in position chiefly by their intertwining with each other. Form of spicules chiefly acerate, sometimes nearly straight or only slightly curved, bow-like; sometimes acute, and occasionally obtusely pointed or round at the ends, also occasionally with one extremity bifid, 200- by 5-1800ths inch long when nearly straight.

*Hab.* Marine, growing in the depressions above mentioned.

*Loc.* Probably near Cape St. Vincent, as the dried specimens on which they are situated appear to be identical with those in the jar numbered "25, 75, 374 fathoms."

*Obs.* As the spicules of these groups are very remarkable from their snake-like shape, together with the circumstances above mentioned, it is necessary to describe them as far as possible, from their occurring in the dredgings of the 'Porcupine.' I cannot state with certainty whether they represent a distinct sponge or are the transformed spicules of another sponge; but incline to the latter opinion, and to think that they belong to *Pachastrella abyssi*:—first, because the only other spicules that I have found among them are the large trifids of this sponge; secondly, because the arms of this large trifold, as it occurs on the surface, are also occasionally tortuous; and, thirdly, because the arms of these large trifids are frequently bifid at the extremities. On the other hand, the spicules of *Ophiraphidites* chiefly consist of large acerates which, when without the tortuous curving, are precisely like those of *Stelletta pachastrelloides* (Pl. XV. fig. 40, a), where the large acerates in size as far surpass any other of the spicules as the large bifids in *Pachastrella abyssi* surpass in size its acerates; so that, if we adopt the transformation of the latter, it must be from a trifold into a tortuous acerate—if of the former, of a large, normally curved acerate into a tortuous one. Hence the uncertainty in my mind as to which they belong to if they do not

represent a distinct sponge. I might also add that in no sponge have I ever seen these tortuous acerates grouped together as above described below the surface, except in *Hymeraphia vermiculata*, Bk., and its variety *erecta* (Pl. XV. fig. 26, b), where their great inferiority in size and their forming part of a distinct structure, from the midst of which projects large acuates, shows at once that they are not *Ophiraphidites tortuosus*. At the same time, as the laminiform species, viz. *Hymeraphia vermiculata*, Bk., grows on the surface of hard objects, such as pebbles, and other sponges, indiscriminately, and there are tortuous acuates mixed up with the tortuous acerates in *Ophiraphidites*, it may still be a question whether this may not be after all a transformation of the spicules of *H. vermiculata* with which a few of the trifids of *Pachastrella abyssi* have become accidentally mixed.

Be this, however, as it may, after having described *Ophiraphidites tortuosus* as part of the dredgings of the 'Porcupine,' the great point of interest that attaches to them is that such spicules are found fossilized in the Upper Greensand of Haldon Hill, near Exeter, in the Mid-Miocene or Bruxellien "étage" about Brussels, and in the Cretaceous strata of Westphalia, in Germany, respectively. In my illustrations of the fossil sponge-spicules of the Upper Greensand of Haldon Hill, near Exeter, I have figured one ('Annals,' 1871, vol. vii. p. 131, pl. x. fig. 79) under the name of "*Esperites giganteus*," conceiving it then to be, from its sigmoid shape, a gigantic S-shaped bihamate (fibula) of an *Esperia*, whereas now I see that it is a spicule like those of *Ophiraphidites tortuosus*; hence the term "*Esperites giganteus*" should be erased, and that of *Ophiraphidites tortuosus* substituted for it. The specific name "*giganteus*" cannot be retained, because its size corresponds with that of the spicules of the existing *Ophiraphidites*. I next observed it in M. A. Rutot's illustrations of fossil sponge-spicules "de l'étage Bruxellien" about Brussels (Ann. de la Soc. Malacologique de Belgique, t. ix. 1874, pl. 3. figs. 5 & 29), confirmed by its presence in some of the spiculiferous sand itself (kindly sent to me by M. E. Vanden Broeck), wherein it is plentifully present; lastly, in Prof. K. A. Zittel's illustrations of sponge-spicules found about a specimen of *Cæloptychium agaricoides* from the Quadersandstein of Westphalia (Abhandlungen der k. bayer. Akad. der W. ii. Cl. xii. Bd. iii. Abth. Taf. 4. figs. 25 & 26, 1876). Schmidt has also figured them (Grundz. Spongienf. d. atlant. Gebietes, 1870, p. 24, Taf. iii. fig. 3, c), in connexion with *Corallistes Bowerbankii* (*C. typus*, Sdt.), as they certainly are no part of this sponge. To M. Rutot and Prof. Zittel I am greatly indebted for a copy of

their memoirs respectively, which no one engaged in the study of sponges, either recent or fossil, should be without.

#### LITHISTINA, Carter.

There were four species of Lithistina dredged up on board the 'Porcupine' during the cruise of 1870, probably all from the neighbourhood of Cape St. Vincent, viz. *Corallistes Bowerbankii*, *Discodermia polydiscus*, *Macandrewia azorica*, and *Azorica Pfeifferæ*—the two former in dead fragments, and the two latter in a living state. I am unable to say with certainty that *Discodermia polydiscus* came from the same locality as the rest, because the specimens, which are dry, are without number; but presumptive evidence is in favour of it.

*Corallistes Bowerbankii*, Carter, 1876, = *Dactylocalyx Bowerbankii*, Johnson, 1863, = *Corallistes typus*, Schmidt, 1870.

The type specimen of this sponge is in the British Museum, and in general form might be likened to a large, shallow, patulous cup with undulating sides and round edges, supported on a thick short stem. It is 12 inches in diameter, and  $\frac{1}{2}$  an inch thick in the wall; and its structure internally, which consists of the filigreed form of spicule common to the Lithistina, is faced by a dermal layer of three-armed shafts, the arms of which are furcated, intercross with each other and in all parts, are round, smooth, and pointed, *not* filigreed; these, again, are imbedded in the dermal sarcode, which is charged with a single form of flesh-spicule, consisting of a short, thick, subspiral shaft, tuberculo-spined throughout, and not two forms, as erroneously stated in my paper on the Hexactinellidæ and Lithistidæ ('Annals,' 1873, vol. xii. pp. 437 & 441), which mistake was occasioned by my having described from a slide into which the acerate flesh-spicules of *Macandrewia azorica* had got by accident. Colour cream-yellow in the dried state.

I have changed the name of "*Dactylocalyx Bowerbankii*" to that of *Corallistes Bowerbankii* for two reasons, viz.:—first, because *Dactylocalyx* was given by Stutchbury to a Hexactinellid sponge, viz. *D. pumiceus*, so far back as 1841 (half of which is in the British Museum), and therefore is typically connected with this order of sponges; and secondly, because Schmidt has given the name of "*Corallistes*" to many of his Lithistid sponges, which belong to a totally different order—thus avoiding the confusion which must arise by mixing up in name the Hexactinellid with the Lithistid sponges. So far, too, all the Lithistina are sessile or thick, short, stipitate sponges,

and grow on rocks or attached to stones, while this is only partially the case with the Hexactinellida.

The four species of *Lithistina* above mentioned come respectively from the neighbouring seas of the West Indies, Madeira, the Azores, and the coast of Portugal. The type specimen of *Discodermia polydiscus* in the British Museum came from the island of St. Vincent, in the West Indies, that of *Corallistes Bowerbankii* from Madeira, that of *Macandrewia azorica* from the Azores, and that of *Azorica Pfeifferæ* from Madeira; while, as above stated, all four species have been dredged up on board the 'Porcupine' near Cape St. Vincent. Bocage's specimen of *Discodermia polydiscus* came from the coast of Portugal; and Schmidt's *Corallistes clavatella* = *Macandrewia azorica*, and his *C. typus* = *Corallistes Bowerbankii*, respectively from the Gulf of Florida.

Several dead fragments of *Corallistes Bowerbankii* were dredged up in 374 fathoms near Cape St. Vincent, during the cruise of 1870 (Roy. Soc. Proceed. no. 125). On the jar are the numbers "25, 75, 374 fathoms." I assume that "75" means from 75 to 374 fathoms; otherwise I do not know what it means; the number of the station is of course "25." They are about 4 inches in diameter; and the thickest piece is  $\frac{3}{4}$  of an inch between the two surfaces. Although much worn, they are still angular and undulating in shape, as if they had once formed the walls of a shallow goblet like that of the type specimen in the British Museum; but some fragments being much thicker than any part of this specimen, they probably belonged to a "goblet" of much larger dimensions. Having been dead for a long time, they are of course sarcodeless, and now more or less filled with deep-sea organisms (*Globigerina*, &c.), besides being overgrown in many parts with a variety of other sponges gathered during the time they have been drifting about the bottom of the sea. There is little or no difference in form between their flat surfaces; and this is the case with the type specimen mentioned, which was taken alive and therefore still possesses its dermal sarcode intact, so that there is not much for identification left; but in some parts of the fragments where the mud has been washed out or had never entered, the large and characteristic dermal spicule, with its furcate arms, is still present in considerable abundance, although not exactly *in situ*; for it appears among the other spicular structure of the mass just below the surface; the minute or flesh-spicule, however, is altogether gone, having floated off or out, probably when the sarcode passed into dissolution. Still, the large dermal spicule is sufficient, from its peculiar form and the *horizontality* of its arms, together with its long shaft, to preclude

the possibility of its being confounded with any other of the kind either in the *Geodina*, *Stelletina*, or *Pachastrellina*. Thus the existence of *Corallistes Bowerbankii* near Cape St. Vincent is established.

From the position of the large furcate spicules being *in* rather than on the surface of the specimens, it might be inferred that these, in particular, were on their way to that transformation which the surface layer of all growing sponges must undergo if it passes into and becomes incorporated with the tissue of the interior, while the characteristic layer of these dermal spicules imbedded in the sarcode charged with the flesh-spicule in the living sponge would then altogether disappear. Thus a little further in than the surface no trace of the furcate spicule would be seen; for by this time they would all have become transformed into the staple form of the interior structure—unless the old dermal layer is absorbed, the internal structure pushed forward, and a new dermal layer formed, or the old dermal layer is expanded and its deficiencies made up by the addition of new dermal layer—neither of which appears to be so likely as the first assumption. Be this as it may, the characteristic dermal spicule of *Corallistes Bowerbankii* is present here.

On crushing some portions of these specimens taken from parts which had been washed clean of mud &c., the fragments of the larger filigreed spicules, under the microscope, forcibly recalled to mind those which I had found in the Upper Greensand of Haldon Hill near Exeter ('Annals,' 1871, "On Fossil Sponge-spicules, &c." vol. vii. pl. viii.).

For good illustrations of the dermal and flesh-spicules of this species, see Dr. Bowerbank's figures (Proc. Zool. Soc. 1869, pl. vi. figs. 5-8, "Monograph on the Siliceo-Fibrous Sponges").

*Discodermia polydiscus*, Bocage, 1869, = *Dactylocalyx polydiscus*, Bowerbank, 1869.

The type specimen of this species is in the British Museum; and its general form is shallow, cup-like, with comparatively thick walls and an equally short, stout, stipitate base. It is an inch in diameter, and  $\frac{3}{4}$  of an inch high; and its structure internally consists of the filigreed spicule common to the *Lithistina* (but of a peculiar form, which will be mentioned directly), faced by a dermal layer of thin, smooth, subcircular disks with more or less curvilinear or toothed margin, furnished respectively with a short, round, pointed shaft, which projects internally, and imbedded in a dermal sarcode densely charged with a minute, curved, acerate, microspined flesh-spicule.

The peculiarity of the staple spicule of the interior is that it presents four smooth, round arms, which, radiating irregularly from a central point, soon divide into two branches respectively that terminate botryoidally or in the form of a bunch of grapes, which unites or interlocks with that of the neighbouring branch; and thus the internal structure is formed, except at the surface, where the branches immediately under the dermal layer of disks &c. terminate respectively in flat filigreed or dendriform expansions which do *not* intermingle with those of opposite branches. In the dermal disks there is a circular space opposite the end of the shaft with a *trifid* line, which represents the trifid central canal; and this in the body of the spicule of the interior is often seen in its *quadruple form*, from the addition of the shaft, which makes the fourth arm. Colour yellowish grey or white. Here, again, I prefer the term "*Discodermia*" of Bocage to that of "*Dactylocalyx*," Bowerbank, for the reasons above mentioned.

Several fragments of this sponge were dredged up on board the 'Porcupine,' probably near Cape St. Vincent; but they are all dry and without number. Unlike the foregoing, they are all more or less rounded and elliptical, varying in size, under 1 inch long by  $\frac{2}{3}$  of an inch in their short diameter. One fragment is a little longer and somewhat lobed; but they give no idea whatever of what the general form of the entire sponge might have been. Like the fragments of the foregoing species, too, they are sarcodeless, and partly filled with deep-sea mud and its accompanying minute organisms, but not overgrown with other sponges, perhaps from their having been less stationary and more exposed to friction than the fragments of *Corallistes Bowerbankii*, except in one instance, where the rolled fragment presents a depression in which there is a good specimen of *Ophiraphidites tortuosus*.

The peculiar form of their internal structure, and the presence of the peculiar dermal disks amongst it in considerable numbers, although no trace of the flesh-spicule remains, are quite sufficient to establish the species.

For good illustrations of the dermal and flesh-spicules, together with that of the staple spicule of the interior, see Dr. Bowerbank's figures (Proc. Zool. Soc. 1869, pl. vi. figs. 9-14) and Bocage's "*Éponges silicenses nouvelles de Portugal et de l'île St. Iago, Archipel de Cap-Vert*" (Journal des Sci. Mathémat., Phys. et Naturelles, no. iv. Lisbonne, 1869).

It may seem strange that only dead fragments of this and the foregoing *Corallistes* were dredged up on board the 'Porcupine;' but when it is remembered that these sponges grow

on hard objects such as rocks &c., it can easily be understood how living specimens, as in the following instances, are only obtained by mere accident. (*Euplectella cucumer* was accidentally brought up by a hook and line at the Seychelles by a fisherman there.)

Schmidt's *Corallistes polydiscus* (Atlant. Spongienf. p. 24, Taf. iii. figs. 8 & 9) appears to me, from the form of its surface-spicule, to be a different species, according in this respect with a large vase-like specimen from the Philippine Islands that I have lately been examining, in which, however, there is, in addition to the acerate flesh-spicule, a small solid one of an elliptical form like that characterizing *Pachastrella abyssi*, while the acerate flesh-spicule in all is almost identical with that of *Macandrewia azorica*.

*Macandrewia azorica*, Gray, 1859, = *Dactylocalyx McAndrewii*, Bowerbank, 1869, = *Corallistes clavatella*, Schmidt, 1870.

The type specimen of this sponge is in the British Museum, and in general form might be likened to a deep vase with contracted stipitate base and thick wall, becoming deeply undulated as it expands upwards, and terminating in an equally thick round margin, which not only follows the undulating form of the wall itself, but is more or less indented irregularly and curvilinearly throughout. It is 5 inches high by 4 inches in diameter in the widest part of the brim. The inner surface presents a number of circular vents regularly arranged, which, while the dermal sarcode remains on, are single and form the centres respectively of so many sets of superficial, radiating, branched canals converted into gutters by the dermal sarcode, which, when rubbed off or raised, appear in the form of groups of 5-7 or more small holes, that are very characteristic of the species; while the outer side is covered with minute puncta that represent the pores. The internal structure is composed of the filigreed spicule common to the Lithistina, faced by a dermal layer of three-armed shafts, each arm of which is flattened, spread out horizontally, more or less divided and bordered by a curvilinear toothed edge on each side, while the shaft which projects into the interior is smooth, rather short, round, and pointed. These spicules are imbedded in dermal sarcode charged with a minute acerate, smooth (not microspined as in *Discodermia*), curved, fusiform, flesh-spicule in great abundance, which, where the curvilinear edges of opposite arms of the great dermal spicule form between them a circular area, are arranged in the sarcode in a radiating manner, extending from the centre to the circumference, so as to leave in the centre a pore, which can be

expanded by the retraction of the sarcode and elevation of the radiated flesh-spicules into a conical form. This is well represented in Schmidt's figure 7, *b*, Taf. iii. (Atlantisch. Spongienf. 1870).

My reason for retaining Dr. Gray's generic name of "*Macandrewia*," and rejecting Dr. Bowerbank's subsequent one of "*Dactylocalyx*," can, from what has been above stated, be easily understood. Besides, what student of the Invertebrata would not wish to remember the name of the late Mr. MacAndrew?

A single specimen of this sponge was dredged up on board the 'Poreupine,' and, although factured and much more irregular in its growth than the type specimen in the British Museum, was, generally (as the fragments are present and can be put together), of the same form, being about  $4\frac{1}{2}$  inches in diameter across the brim by 3 inches deep, and about  $\frac{1}{4}$  of an inch thick in the walls. It is in the same jar with the dead fragments of *Corallistes Bowerbankii*, on which, as before stated, are the numbers "25, 75, 374 fathoms." Having been taken while *living*, its structure is in all respects like that of the type specimen above mentioned.

There are also two or three other small fragments of this sponge dry and without number, which, having been taken dead and much worn by attrition, only show the characteristic *groups of vents*, which become exposed, as before stated, when the dermal layer has been worn off. Were I to assign any peculiarity to the form of the filigreed spicule of *Macandrewia azorica*, I should say that the tubercles of the branches had a tendency to assume the form of conical, slightly curved prongs, something like those on the antlers of a stag.

Good figures of the spicules of this species may be seen in Dr. Bowerbank's illustrations of it (Proc. Zool. Soc. 1869, pl. iv. fig. 5, pl. v. figs. 1-5), together with fig. 6 in pl. xxiii., which, by accident, has been figured as belonging to the hexactinellid sponge "*Iphiteon callocyathes*, Bk. 1869," = *Myliusia callocyathes*, Gray, 1859. No doubt the spicule of *Macandrewia azorica*, thickly covered by its peculiar flesh-spicule, got by accident into the mounted preparation of *Iphiteon callocyathes*, and thus was drawn as a part of the latter, just as a portion of *Macandrewia azorica* got by accident into my mounted specimen of *Corallistes Bowerbankii* as before stated, and led me into a similar error, viz. that of adding to the latter the flesh-spicule of *Macandrewia azorica*, an error which I have now corrected. This shows how particular we should be in our mountings, or, at all events, in identifying the spicules which they may contain with those only belonging to the sponge we wish to illustrate.



*Azorica Pfeifferæ*, Carter, 1873, ? = *Leiodermatium Lynceus*, Schmidt, 1870.

The type specimen of this sponge is in the British Museum; and its general form is that of an expanded vase whose walls, rising from a thick short stem, soon spread out in an undulating manner into a head 14 inches in diameter, which has the appearance of a large "double flower," on account of the sinuous foliations of the wall, which are so abundant as to fill up the whole of the basal cavity, with the sides and bottom of which they are of course continuous. It is 11 inches in vertical diameter, and the wall seldom more than  $\frac{1}{6}$  of an inch thick, slightly thinning towards the margin, which is round and irregularly fissured or curvilinear. The surface is even, especially on the *outer* side of the wall, where the *pores* are situated in the form of puncta closely approximated, and only interrupted on the *inner* side of the wall, where the *vents* are situated, by the latter, which in the form of single circular holes, each with an elevated margin, are irregularly scattered over this surface at some distance from each other.

The structure internally consists of that fligreed kind of spicule common, as before stated, to the *Lithistina* generally, faced by a dermal layer of siliceous network in which the branching, although larger in some respects than in others, is so irregular that it is impossible to divide it into distinct heads indicative of its being composed of so many distinct dermal spicules like those of the other *Lithistina*; neither are the supports or shafts of these supposed heads a bit more distinguishable on the inner side of the dermal layer, on account of their irregularly branching there also; so that this layer cannot be designated an irregular network. But on the branches of both outer and inner aspects there are short, thick, oval tubercles of a peculiar form, inasmuch as the summit of each respectively presents a short thick branch, which soon divides once or twice into crooked attenuated extremities, while the ends of many of the branches terminate in the same manner; but *the branched oval tubercle appears to me the characteristic feature of the structure*, as I do not observe it to be so marked in any other species, although that of *Farrea densa* ('Annals,' 1873, vol. xii. pl. 17. fig. 6) is something like it. Besides this, the sarcode is charged with an abundance of long, delicate, fusiform acerate spicules, the largest of which are about 1-14th inch in length by 1-3000th in thickness; but these are *only* found towards the *margin* of the frond-like wall, where, coming from opposite sides, they meet, and drying in their sarcode together, there form a more

or less sharp, fringed edge. These spicules rapidly diminish in size with their distance from the margin of the wall; so that very soon they altogether disappear; whether by incorporation with the older and general structure or by absorption I am not able to state. Where they are not present, the margin of the wall presents a *rounded* form. Occasionally the larger ones on the edge are inflated or spined at one or both extremities; but this appears to be an abnormal state, their staple form being acerate. Colour whitish yellow. The "oval" appearance of the summit of the tubercle when seen from above is an optical delusion which is corrected by the lateral view.

There are a few fragments of this sponge in the same jar as the foregoing species (viz. that bearing the numbers "25, 75, 374 fathoms"); and they average 2 inches in diameter by  $\frac{1}{6}$  of an inch in thickness. These, which consist chiefly of *living* portions or portions which were taken *alive* and afterwards preserved in spirit and water, bear all the characters above mentioned, including the presence of the acerate spicules, which are very abundant where the living border of a new layer can be traced growing over the surface of a previously dead or denuded surface of the frond. The fragments appear to have been broken off by the dredge from the head of a living specimen, as the fractured parts are not worn by attrition.

I have given a short account of a very large specimen of this species, viz. *Azorica Pfeifferæ* ('Annals,' 1873, vol. xii. p. 442), which, together with a slightly smaller one of the same kind, was presented to the British Museum by Madame Ida Pfeiffer.

It appears from Schmidt's figures (Atlant. Spongienf. pl. iii. fig. 2 &c.) to be very like his *Leiodermatium Lynceus*; but here the osculez were on the *outer* side, which is the reverse of what they are in *Azorica Pfeifferæ*, and the reverse of what generally obtains in sponges, where the concave or tubular portion receives the vents. Schmidt's diagnosis of *Leiodermatium* (smooth-skin), too, is:—"In der Oberflächenschicht liegen keine isolirten Kieselskörper" (*op. cit.* p. 21). So the presence of the isolated acerate spicules above mentioned, although confined to the sarcode towards the growing margin of *Azorica Pfeifferæ*, is also opposed to this. Hence it becomes doubtful whether Schmidt's *Leiodermatium Lynceus* is *Azorica Pfeifferæ*; but there is no doubt that the latter does not agree with his diagnosis, although the "isolated acerates" are only partially present—that is, about the growing portion. Then, in the *Lithistina*, where there *are* "isolirte Kieselskörper" on the surface, they all disappear from it as the latter becomes incorporated with the internal or older structure, and thus trans-

formed into this structure *pari passu* with the growth or increase in bulk of the sponge.

The reason for my designating this sponge "*Pfeifferæ*" is evident from what I have above stated; and we may now extend its distribution from Madeira to the coast of Portugal.

#### CALCAREA.

*Grantia ciliata*, Fleming, ? var. *spinispiculum*.  
(Pl. XII. figs. 6, 7, & 8.)

The specimen of this calcareous sponge dredged up on board the 'Porcupine' on the North-Sea side of Shetland in 64-75 fathoms has grown on one of the cones of *Dictyocylindrus virgultosus*, Bk., together with a young specimen of *Tethya cranium* (Pl. XII. fig. 6). It is  $\frac{1}{4}$  inch long by  $\frac{3}{16}$  inch broad. The body is fusiform; and the beard, which is  $\frac{1}{16}$  inch wide, is composed of an erect row of large, acerate, linear spicules arranged parallel to each other, intermixed with small triradiates, and ending in a defined free edge, which is neither patulous nor fringed, but even; while the body itself is composed of the usual mass of triradiates, among which are plentifully scattered long, fusiform, stout acerates, which are grouped together in projecting tufts all over the surface, thus presenting a granulated aspect, in which tufts, especially towards the lower part of the sponge, are fine acerate spicules recurvedly barbed or spined in a serrated manner, chiefly on one side of the outer third of the free end (fig. 7). This form of spicule, which averages, in its largest size,  $\frac{1}{6000}$  inch long, and of which about a third is barbed, is a peculiarity that has necessitated my giving a short description of the whole sponge, not only because such a form of spicule is present *here*, but because I have met with a similar form before, in connexion with a specimen of *Grantia ciliata* obtained from a piece of sea-weed thrown up on the beach of this place (Budleigh-Salterton, south coast of Devon).

In July 1870, while looking at some spicules of *Grantia ciliata* which had been mounted about two years previously, I observed that there were two or three linear ones with one end inflated and spined on one side, something like the end of the spined anchoring-spicules of *Euplectella aspergillum*, together with other recurved spines like barbs, extended more or less in the same line for a certain distance up the shaft; while, knowing that calcareous spicules mounted in balsam sooner or later pass into dissolution, leaving behind them only a few aqueous-looking globules, I immediately measured and

sketched these spicules, so that the record of them is not lost and is herewith given (Pl. XII. fig. 8). Now, I am in the habit of mounting a portion of a calcareous sponge in a *dry cell*, where it may be considered to be almost imperishable without accident. These spicules were respectively about 50- and 90-6000ths inch long and 1-6000th inch broad, while the barbs numbered about sixteen, and the terminal inflation in one presented *no* spines. To what variety of *Grantia ciliata*, if to any in particular, they appertained I cannot state, as I can only say that up to the time they were mounted I knew of no other kinds of calcareous sponges on this beach, and therefore they could be only the kinds mentioned; but I have in vain sought for such spicules since, although I have examined many specimens of *Grantia ciliata*, taken from the same kind of seaweed, similarly thrown up on the beach here, as the specimen came from to which these spined spicules must have belonged.

The next instance (for they are not common) that I have observed of this kind of anchoring-spicule occurring in a calcareous sponge is that figured by Hæckel in 'Die Kalkschwämme,' 1872 (Atlas, pl. 50. fig. 1), under the name of *Syculmis synapta* (previously named by Schmidt in MS. *Sycurus synapta*). This sponge, which is about  $\frac{1}{2}$  inch long in the body and about  $\frac{1}{12}$  inch thick (*op. cit.* vol. ii. p. 289), is provided with anchoring-spicules of a peculiar kind, inasmuch as the free extremity is furnished with three spines or claws, more or less directed to one side, and without terminal inflation, while there are no barbs or spines on the other part of the spicule, which is long and linear. The specimen came from the Museum at Copenhagen, and originally from the coast of Brazil (*op. cit.* vol. ii. p. 288).

Thus we may infer that some at least of the tubular calcareous sponges, in addition to having a structure very much like that of *Euplectella* in miniature, are also provided with similar anchoring-spicules. I have sought for them in many species since discovering them in the slide above mentioned, without having found any thing of the kind, until coming to the one above mentioned, which was dredged up on board the 'Porcupine.' I need hardly add that they should be sought for in the posterior part of the sponge, or that attached to the object on which it may have grown.

There was but one other specimen of a calcareous sponge dredged up on board the 'Porcupine;' and this is in a jar numbered 51, = 440 fathoms, between the north of Scotland and the Färöe Islands. It is in company with *Polymastia brevis*, Bk., but so mutilated that nothing more can be made out of

it than that it was about the size of that above mentioned, but had *no beard*, and an *untufted* even surface without any trace of barbed spicules, but with the usual triradiates and the large acerates above mentioned, which, when entire, must have given it somewhat of the character of *Ute capillosa*, Sdt. (Spongienf. Adriat. 1862, Taf. 1. fig. 6).

Since the above was written and illustrated, I have seen Franz Eilhard Schulze's paper on the structure and development of *Sycandra raphanus*, Häckel (*Zeitschrift f. wissenschaft. Zoologie*, xxv. Bd., 3. Supp., Dec. 1875), in which four figures are given like the spined spicules above mentioned in the Budleigh-Salterton specimens commonly called "*Grantia ciliata*" (Taf. xix. fig. 1, *a-d*), also said to be "rare" and occurring in the tufts at "the distal ends of the radiating tubes."

## ADDENDUM.

Having made a Table of all the sponges dredged up on board H.M.S. 'Porcupine' in 1869-70 that were handed over to me, with the stations and depths respectively from which they had been obtained, I have been able to draw up the following summary so far as the information accompanying them permits, viz.\*:—

1st. *In the Deep Sea between the North of Scotland, the Orkneys, the Shetland and the Färöe Islands.*

Aplysina nævus, n. sp.	Dictyocylindrus simplex, n. sp.
Spongia officinalis <i>auett.</i>	— anchoratus, n. sp. ( <i>Ann. &amp; Mag. Nat. Hist.</i> 1874, vol. xiv. p. 251, pl. xv. fig. 43, <i>a, b, c.</i> )
Dysidea fragilis, <i>Johnst.</i>	Halichondria foliata, <i>Bk.</i>
Spongelia pallescens, <i>Sdt.</i>	— panicea, <i>Johnst.</i>
Dictyocylindrus virgulosus, <i>Bk.</i>	— cancellata, var. nov.
— abyssorum, n. sp.	Isodictya varians, <i>Bk.</i>
Plumohalichondria microcionides, n. sp.	Thalysias, <i>Duchas. de Fonb. et Michelotti.</i>
Microciona jecusculum, <i>Bk.</i>	Reniera crassa, n. sp.
— longispiculum, n. sp.	— fibulata, <i>Sdt.</i>
Phakellia ventilabrum, <i>Bk.</i>	Halichondria incrustans, <i>Johnst.</i> (var.)
— infundibuliformis, <i>C., = Halichondria infundibuliformis, Johnst.</i>	— forcipis, <i>Bk.</i> ( <i>Op. et loc. cit.</i> p. 246, pl. xiv. figs. 29-32 &c.)
Hymenaphia vermiculata, <i>Bk.</i>	
— erecta, n. sp. (? variety).	
Cornulum textile, n. gen.	

\* As these sponges are arranged consecutively in accordance with my classification, as far as is at present possible, no notice is to be taken of the same name being repeated here and there, as this refers to the author's appellation, and not to the location of the sponge in my Classification.

- Halichondria abyssi*, n. sp. (*L. c.* p. 245, pl. xiv. figs. 26-28 &c.)  
*Melonanchora elliptica*, n. gen. (*L. c.* p. 212, pl. xiii. figs. 6-12, &c.)\*  
*Cribrella hospitalis*, *Sdt.*  
*Eesperia cupressiformis*, n. gen. (*L. c.* p. 215, pl. xiv. figs. 16-19, &c.)†  
*Chondrocladia virgata*, *Wy. Th.* (*L. c.* p. 217, pl. xiv. figs. 20 & 21 &c.)  
*Cladorhiza abyssicola*, *Sars.* (*L. c.* p. 219, pl. xiv. fig. 22.)  
 ———, var. *corticocancellata*, nov.  
*Eesperia placoides*, n. sp.  
 ——— *villosa*, n. sp. (*L. c.* p. 213, pl. xiii. figs. 13-15 &c.)  
*Halichondria Hyndmani*, *Bk.*  
 ——— *carinosa*, *Johnst.*  
*Hymedesmia Johnsoni*, *Bk.*  
*Hymeraphia verticillata*, *Bk.*  
*Suberites massa*, *Sdt.*  
*Cometella pyrula*, n. sp.  
*Podospongia Lovenii*, *Boc.*  
*Latrunculia cratera*, *Boc.*  
*Desmacella pumilio*, *Sdt.* (*L. c.* p. 250, pl. xv. fig. 42, a, b, c.)  
*Donatia lynceurium*, *Gray*, = *Tethya lynceurium*, *Lam.*  
*Trichostemma hemisphaericum*, *Sars.*  
*Thecophora semisuberites*, *Sdt.*  
 ——— *ibla*, *Wy. Th.*  
*Rinalda uberrima*, *Sdt.*  
*Polymastia ornata*, *Bk.*  
 ——— *brevis*, *Bk.*  
 ——— *robusta*, *Bk.*  
 ——— *mamillaris*, *Bk.*  
 ——— *stipitata*, n. gen.  
*Geodia nodastrella*, n. sp.  
*Wyville-Thomsonia Wallichii*, *Wright*, = *Tisiphonia agariciformis*, *Wy. Th.*  
*Stelletta pachastrelloides*, n. sp.  
*Tethya cranium*, *Lam.*  
 ——— *zetlandica*, *Cart.*, ? var.  
 ——— *abyssorum*, ? var.  
 ——— *infrequens*, ? var.  
*Pachastrella abyssi*, *Sdt.*  
 ——— *geodioides*, n. gen.  
*Rossella velata*, *Wy. Th.* (*Annals*, 1875, vol. xv. p. 120.)  
*Holtenia Carpenteri*, *Wy. Th.* †  
*Grantia ciliata*, ? var.

## 2nd. Deep Sea in the "Chops" of the English Channel.

- Corticium abyssi*, n. sp. (*Annals*, 1873, vol. xii. p. 18, pl. i. figs. 1-9 & 15.)  
 ——— *parasiticum*, n. sp.  
*Isodictya varians*, *Bk.*  
*Reniera fibulata*, *Sdt.* (*Op. cit.* 1874, vol. xiv. p. 250, pl. xv. fig. 44, a, b.)  
*Eesperia cupressiformis*, n. g. (*L. c.*)  
 ———, var. *hamatifera*, nov.  
*Hymedesmia Johnsoni*, *Bk.*  
*Cliona abyssorum*, n. gen. (*L. c.* p. 249, pl. xiv. fig. 33 &c.)  
*Desmacella pumilio*, *Sdt.* (*L. c.*)  
*Tisiphonia agariciformis*, *Wy. Th.*  
*Aphrocallistes Bocagei*, *Wright.* (*Op. cit.* 1873, vol. xii. p. 446.)  
*Farrea ocea*, *Bk.* (*L. c.* p. 445.)  
*Holtenia Carpenteri*, *Wy. Th.*  
*Corallistes*, spicules of a.

\* Stray, fully developed anchorates of this sponge (that is, with the three arms united like a four-ribbed ellipse) are very common in the Atlantic sea-bed. Dr. Wallich sent me a drawing of one dredged up on board the 'Bulldog' in 1860.

† For "No. 27, &c.," p. 216 (*Annals*, 1874, vol. xiv.), sixth line from bottom, read "42=862 fathoms, Chops of English Channel."

‡ *Holtenia Carpenteri* has been described and illustrated by Sir Wy. Thomson in the 'Philosophical Transactions' for 1869 (vol. 159, pt. ii. p. 701 &c.), who before leaving in the 'Challenger' had had similar illustrations lithographed of *Hyalonema lusitanicum* and *Tisiphonia agariciformis*; so no description of either of these sponges will be found in my report.

## 3rd. A "few miles north of Cape St. Vincent," 1870.

*Halisarca cruenta*, n. sp.  
*Hircinia* (*Polythereses*, *Duch. de Foub. et Michelotti*).  
*Microciona jecusculum*, *Bk.*  
 — planum, n. sp.  
*Phakellia ventilabrum*, *Bk.*  
 — infundibuliformis, = *Hal. infundibuliformis*, *Johnst.*  
*Halichondria panicea*, *Johnst.*  
*Isodictya spinispiculum*, n. sp.  
*Thalysias tricurvata*, n. sp.  
*Thalysias* (*Duch. de Foub. et Michelotti*).  
*Reniera fibulata*, *Sdt.* (*L. c.*)  
*Histoderma appendiculatum*, n. gen.  
 ? = *Cœlosphæra tubifex*, *Wy. Th.*  
 (*Op. cit.* 1874, vol. xiv. p. 220, pl. xv. fig. 39, a, b.)\*  
*Halichondria forcipis*, *Bk.*, var. *bulbosa*, nov.  
 — *phlyctenoides*, n. sp.  
 — *carnosa*, *Johnst.*

*Polymastia stipitata*, n. gen.  
*Geodia megastrella*, n. sp.  
 — —, var. *lævispina*.  
*Tisiphonia agariciformis*, *Wy. Th.*  
*Tethya cranium*, *Lam.*  
 — —, var. *zetlandica*, *Cart.*  
*Pachastrella abyssii*, *Sdt.*  
 — *amygdaloides*, n. sp.  
 — *geodioides*, n. gen.  
 — *intexta*, n. sp.  
*Corallistes Bowerbankii*, = *Dactylocalyx Bowerbankii*, *Johnson*.  
*Discodermia polydiscus*, *Boc.* = *Dactylocalyx polydiscus*, *Bk.*  
*Macandrewia azorica*, *Gray.*  
*Azorica Pfeifferæ*, *Cart.*  
*Askonema setubalense*, *Kent.*  
*Rossella velata*, *Wy. Th.* ('Depths of the Sea,' p. 419).  
*Polytrema miniaceum*, *De Blainville.*

## Jars with no Number.

*Corticium parasiticum*, n. sp.  
*Halichondria panicea*, *Johnst.*  
 — *incrustans*, *Johnst.*, var. nov.  
*Esperia cupressiformis*, n. sp. (*Op. et loc. cit.*)  
 — —, var. *hamatifera*, nov.  
*Chondrocladia virgata*, *Wy. Th.*  
 (*Op. et loc. cit.*)  
*Guitarra fimbriata*, n. gen. (*Op. cit.*  
 1874, vol. xiv. p. 210, pl. xiii. figs. 2-5 &c.)†  
*Podospongia Lovenii*, *Boc.*  
*Desmacella punilio*, *Sdt.* (*L. c.*)  
*Donatia lyncurium*, *Gray.*

*Cometella simplex*, n. sp.  
*Polymastia ornata*, *Bk.*  
*Geodia nodastrella*, n. sp.  
*Tisiphonia agariciformis*, *Wy. Th.*  
*Aphrocallistes Bocagei*, *Wright.*  
 (*L. c.*)  
*Farrea occa*, *Bk.* (*L. c.*)  
*Askonema setubalense*, *Kent.*  
*Holtenia Carpenteri*, *Wy. Th.*  
*Hyalonema lusitanicum*, *Boc.* Probably from station 46, about 55 miles N.W. of the Butt of Lewis.

## DRIED SPECIMENS OF SPONGES.

Among the dried specimens without number are *Hyalonema lusitanicum*, *Holtenia Carpenteri*, and *Rossella velata*, with a fragment of the base of *Euplectella aspergillum* directly attached to a piece of old coral detritus, and fragments of *Aphro-*

\* For "2 and 24, &c.," p. 221 ('Annals,' 1874, vol. xiv.), eleventh line from top, read "24 & 24 = 292 fathoms, near Cape St. Vincent;" and for "2," in thirteenth line from top, read "24 and 2 in pencil."

† In a sponge from the neighbourhood of the Falkland Islands, sent me by Mr. T. Higgin, of Huyton, Liverpool, the anchorate of *Guitarra* is present in plurality as a foreign object.

*callistes Bocagei*; also large fragments of *Corallistes Bowerbankii*, *Discodermia polydiscus*, and *Macandrewia azorica*; *Pachastrella abyssii*, *Stelletta pachastrelloides*, and *Geodia megestrella*, the latter entire.

MEMORANDA OF OTHER ORGANISMS FOUND AMONG  
THE SPONGES.

*Polytrema miniaceum*.

On an old fragment of a branch of dead coral about an inch long and  $\frac{3}{17}$  inch thick, partly covered with Polyzoa, and pierced with holes of a *Cliona*, which was living in its interior, are five specimens of *Polytrema miniaceum* with their heads, as usual, broken off, leaving nothing but their lower halves. This fragment was dredged up at station 24, = 292 fathoms, a few miles north of Cape St. Vincent. With the exception of these specimens, I have not met with even a trace of *Polytrema* among the sponges dredged up on board the 'Porcupine' north of this locality.

*Xanthidium abyssorum*, n. sp.

General form a spherical cell, covered with erect, conical, transparent, hollow cirri, ending in two or three short filaments, straight and expanded, or recurved and curled. Cell more or less filled with yellowish, granular, soft material. Composition chitinous. Size of cell about 4-1800ths inch in diameter; length of cirrus above 1-1800th inch.

*Hab.* Marine.

*Loc.* Chops of English Channel, in 862 fathoms.

*Obs.* This form of *Xanthidium* is found attached to *Corticium parasiticum* where the latter covers the old stems of *Esperia cupressus*, var. *hamatifera*. Nitric acid applied on the slide causes the ends of the cirri to contract, but does not dissolve the cell, which on drying and mounting loses its sphericity, but not its diameter. The cirri, however, become so transparent in the balsam that it is difficult to see them. I possess a fossil specimen in flint, of precisely the same form, only hardly half the diameter in the cell, which is angulo-spherical by contraction, and the cirri a little longer. Precisely the same kind of cirri, too, are present in some winter-eggs or statoblasts of the Bombay *Lophopus* which I have mounted; and the reasons may be seen ('Annals,' 1859, vol. iii. p. 342), in my comparison of the winter-eggs of the freshwater Bryozoa with the seed-like body of *Spongilla*, why I therein stated that the results of my observations were "more in



favour of the *Xanthidia* being the petrified orbicular statoblasts of the Polyzoa than the petrified sporangia of Desmidiæ."

*Xanthidium bicirratum*, n. sp. (Pl. XV. fig. 44.)

General form a spheroidal or slightly elliptical cell, provided with two opposite erect cirri, each of which, after a short distance, divides into two longer filaments that, recurving in opposite directions apparently in the same plane, finally cross those of the opposite side. Cell empty or filled with a few yellowish fragments of soft material. Composition chitinous. Size of cell about 2-6000ths inch in diameter; length of cirrus before dividing about 1-6000th inch, length of filaments after dividing 5-6000ths inch.

*Hab.* Marine.

*Loc.* Common between the north of Scotland and the Färöe Islands.

*Obs.* Although, in this instance, the cell is not more than a fifth of the size of that of *X. abyssorum*, its general appearance, together with its contents, inclines me to view it as a *Xanthidium*—that is, the shell, at least, of the egg of a Polyzoon. Nitric acid applied on the slide does not cause any appreciable alteration in the shape, nor does drying or mounting in balsam, probably on account of the chitinous wall being thicker than in *X. abyssorum*.

*Coccoliths and Rhabdoliths.*

The oval and cyclical *Coccoliths* with their respective *Coccospheres* have also been generally present in great abundance; also *Rhabdoliths*, but no *Rhabdospheres*. The oval *Coccolith* appears to abound between the north of Scotland and the Färöe Islands; the cyclical one southwards, and the *Rhabdoliths* from the "chops of the English Channel" to Cape St. Vincent, where all three forms are found together—at least, judging from what I have observed about the sponges from these three different localities.

I might here add that, in the sand about the sponges in the British Museum, dredged up by Sir J. Ross in 300 fathoms,  $74\frac{1}{2}^{\circ}$ , and in 206 fathoms,  $77\frac{1}{2}^{\circ}$  south latitude, respectively, I found no *Coccoliths* and very few *Globigerinæ*, but many *Radiolaria*.

BLACK GRAINS.

Among the *Globigeriniferous* sand may often be observed "black grains," frequently shapeless and more or less angular,

but often representing casts, with their peculiar markings, of the chambers of *Globigerina* and other minute Foraminifera. If a little of this sand be carefully washed, dried, and placed under the microscope, it will be easily seen that they have all the same origin; for, beginning of a yellowish colour, passing into brown, and finally black, they may respectively be observed within the chambers of *Globigerina*, half in and half out, as they approach that state in which, being altogether without even a fragment of the white calcareous test, and in the form of casts, they either retain this recognizable form or lose it altogether and become more or less angular.

## EXPLANATION OF THE PLATES.

## PLATE XII.

- Fig. 1.* Pebble on which there is a Terebratule and six kinds of sponges. *a a*, pebble; *b*, Terebratule,—the Terebratule bearing *c*, *Aplysina nœvus*, *d*, *Spongia officinalis*, *e*, *Dysidia fragilis*; the pebble bearing:—*f f f*, fronds of two specimens of *Phakellia ventilabrum*, Bk.; *g g*, *Spongia Lörenii*, Boc.; *h*, *Microciona longispiculum*. All natural size.
- Fig. 2.* *Aplysina nœvus*, grown over a branch of coral, natural size. *a*, fragment, magnified, to show:—*b*, dermal incrustation covered with pore-depressions or puncta; and *c*, basal end of filaments expanded into layer of attachment.
- Fig. 3.* *Dictyocylindrus abyssorum*, natural size. *a*, portion of branch, magnified, to show hirsute character; *b*, small acute, spined; *c*, anchorate; *d*, tricurvate (bow): *b, c, d* on scale of 1-24th to 1-1800th of an inch. *e*, end of tricurvate, more magnified, to show that it is spined; *f*, anchorate, more magnified. For skeleton-spicules see Pl. XV. fig. 25, *a, b*.
- Fig. 4.* *Hymenophia vermiculata*, Bk., var. *erecta*, natural size. *a*, fixed end of large skeleton-spicule; and *b*, tortuous subskeleton-spicules with which it is surrounded: scale 1-24th to 1-1800th inch. *c*, *H. vermiculata*, Bk., covering a small pebble: natural size. For skeleton- and subskeleton-spicules, see Pl. XV. fig. 26, *a, b*.
- Fig. 5.* *Dictyocylindrus virgulosus*, Bk., bearing a young *Tethya cranium* and a variety of *Grantia ciliata*. *a*, *Tethya*; *b*, *Grantia ciliata*; *c*, small acute spined spicule of *D. virgulosus*; *d*, acerate subskeleton-spicule, smooth: scale of *c, d*, 1-24th to 1-1800th inch.
- Fig. 6.* *Grantia ciliata*, Flem., var. *spinispiculum*, C., on *Dictyocylindrus virgulosus*, natural size.
- Fig. 7.* The same, barbed spicule among the acerates towards the base: *a*, fixed end; *b*, free or barbed end. Scale 1-24th to 1-6000th inch.
- Fig. 8.* *Grantia ciliata*, Flem., variety (from Budleigh-Salterton, south coast of Devonshire). Two barbed spicules with inflated extremities, respectively; one spined like the anchoring-spicule of *Euplectella aspergillum*. Scale 1-12th to 1-6000th inch.
- Fig. 9.* *Cornulum textile*, natural size. *a*, textile sheath; *b*, fibrous struc-

ture of the interior, projecting and frayed out; *e*, anchorate; *d*, tricurvate: *c*, *d*, on the scale of 1-24th to 1-6000th inch. *e*, anchorate, more magnified. For the skeleton-spicule see Pl. XV. fig. 28.

- Fig. 10. *Halichondria foliata*, Bk., fragment, natural size. *a*, anchorate; *b*, tricurvate: scale 1-24th to 1-6000th inch. For the skeleton-spicules see Pl. XV. fig. 29, *a*, *b*.
- Fig. 11. *Plumohalichondria microcionides* (rolled fragment), natural size. *a*, clavate acute, spined, 1-48th to 1-6000th inch; *b*, anchorate, more magnified: scale 1-24th to 1-6000th inch. For skeleton-spicules see Pl. XV. fig. 30, *a*, *b*.

### PLATE XIII.

- Fig. 12. *Esperia placoides*, natural size. *a a a*, scales; *b b*, grooves between the scales; *c c*, vents; *d*, stem; *e*, diagram of two scales, viewed laterally, to show their structure and the groove between them; *f*, free surface, hirsute; *g*, base, rooted to the interior by bundles of skeleton-spicules; *h*, vertical portion; *i*, groove: scale 1-24th to 1-48th inch. *k*, diagram of a portion of the surface of a "groove," magnified, to show *l*, the pore-areæ occupying the interstices of the reticulated smooth rugæ, *l' l' l'*; *m*, vent, magnified, to show form; *n*, anchorate; *o*, bihamate or fibula; *p*, bundle of tricurvates; *q*, single tricurvate: *m-q* on same scale, viz. 1-24th to 1-6000th inch. For the skeleton-spicule see Pl. XV. fig. 32.
- Fig. 13. *Esperia borassus*, on a fragment of *Pachastrella abyssi*, Sdt., natural size. *a a a*, pachastrella and spicules; *b*, *E. borassus*; *c*, anchorate; *d*, bihamate: on the same scale, viz. 1-24th to 1-6000th inch. For the skeleton-spicule see Pl. XV. fig. 33.
- Fig. 14. *Esperia cupressiformis*, var. *hamatifera*, free extremity, natural size. *a*, large anchorate; *b*, small anchorate; *c*, bihamate: on the same scale, viz. 1-24th to 1-6000th inch. For the skeleton-spicule see Pl. XV. fig. 34.
- Fig. 15. *Cladorhiza abyssicola*, Sars, branch of, natural size. *a*, characteristic bihamate.
- Fig. 16. *Cladorhiza abyssicola*, var. *corticocancellata*, end of branch of, natural size. *a*, characteristic bihamate.
- Fig. 17. *Halichondria phlyctenodes*, on a fragment of *Corallistes Bowerbankii*, natural size. *a a a*, *Corallistes*; *b*, *H. phlyctenodes*; *c c*, appendiculate tubular vents; *d*, end of one that has been cut off; *e*, tubular vent, magnified two diameters; *f*, anchorate; *g*, bihamate: on the same scale, viz. 1-24th to 1-6000th inch. For the skeleton-spicule see Pl. XV. fig. 35.
- Fig. 18. *Cribrella hospitalis*, Sdt., natural size. *a*, sponge; *b*, pore-areæ, circular and cribriform; *c*, stem; *d*, anchorate: on the scale of 1-24th to 1-6000th inch. For the skeleton-spicules see Pl. XV. fig. 36, *a*, *b*.
- Fig. 19. *Halichondria forcipis*, Bk., var. *bulbosa*, a fragment in a fragment of a bivalve shell, natural size. *a*, shell; *b*, sponge; *c*, anchorate; *d*, bihamate; *e*, tricurvate, in the form of a pair of open compasses: on the same scale, viz. 1-24th to 1-6000th inch. *f*, one arm of the tricurvate, more magnified to show the bulb at the extremity. For the skeleton-spicules see Pl. XV. fig. 37, *a*, *b*.

## PLATE XIV.

- Fig. 20.** *Cometella pyrula*, n. sp., on a pebble. *a a*, two pebbles linked together by the stem of another specimen, from which the head has been broken off; *b*, *C. pyrula*; *c*, stem without head: natural size. *d*, section of the same, magnified two diameters, to show internal structure, composed of nucleus with radiating bundles of spicules, ovarian zone, layer of compressed excretory cavities, subdermal zone, and dermal layer, diagrammatic. *e*, summit, still more magnified, to show that the terminal vent, *f*, thereon is surrounded by a bundle of long acerate spicules like *i*, and the surface *g*, covered with polygonal spaces, whose lincation culminates in pointed elevations; *h*, elevation, greatly magnified, to show that it is a pore situated in the centre of a whirl of the spicules, "*k*," about which the anchorate spicules, "*l*," are congregated and alone to be found; *i*, skeleton-spicule; *k*, spined acuate or subskeleton-spicule; *l*, anchorate; *m*, the same, more magnified: *k*, *l*, *i* are drawn to the same scale, viz. 1-48th to 1-6000th inch. For the skeleton-spicule see also Pl. XV. fig. 38.
- Fig. 21.** *Hymenophia verticillata*, Bk., on a pebble, magnified two diameters. *a*, pebble; *b*, *H. verticillata*; *c*, monticules, from which respectively a large skeleton-spicule projects as at "*m*"; *d*, fixed end of large skeleton-spicule, often bulbous; *e*, acerate centro-inflated spicule, fissurate at the ends; *f*, central inflation; *g g*, fissurate ends; *h*, the same, magnified, to show the three arms; *i*, staple spicule of the body and dermis verticillately spined; *k*, the same, moniliform; *l*, the same at an early stage of development, to show that the bead-like form is persistent; *n*, diagram of monticule, to show its elementary composition and the arrangement of the spicules composing it; *o*, dermal layer charged with verticillate and moniliform spicules; *o o*, group of centrally inflated spicules surrounding the great acuate spicule *p*. For the skeleton-spicules see Pl. XV. fig. 39, *a*, *b*, *d*, *e*, *i*, and *k* are on the same scale, viz. 1-48th to 1-6000th inch.
- Fig. 22.** *Pachastrella amygdaloides*, on a piece of rock, natural size. *a*, rock; *b*, sponge; *c*, vent-area; *d*, the same specimen, lateral view, natural size. *e*, rock; *f*, sponge; *g g*, forms of large radiate skeleton-spicule; *h*, form of acerate spicule; *i*, subskeleton-spicule, microspined; *k*, flesh-spicule, microspined; *ll*, stellate with linear arms or rays: with the exception of *h* and *i*, all are on the same scale, viz. 1-24th to 1-6000th inch.
- Fig. 23.** *Pachastrella goodioides*, natural size: *a*, diagram on the scale of 1-48th to 1-1800th inch, to show heterogeneous composition of body and surface; *bbb*, large radiate skeleton-spicules; *ccc*, subskeleton radiate spicules; *dd*, acerate spicules; *ee*, siliceous balls of a *Goodia*; *f*, test of a *Gh bigerina*; *g g*, grains of quartz; *h*, dots representing globo-tuberculated stellates, more magnified in *m*. Spicules separate:—*i*, large radiate skeleton-spicule, with three arms, on same scale; *kkk*, subskeleton radiate spicules of various forms; *l*, acerate spicule, scale 1-24th to 1-6000th inch; *m*, globostellate or flesh-spicule under its two forms, viz. *n*, with stelliform interior, *o*, with solid interior, scale 1-12th to 1-6000th inch; *p*, more magnified view of tubercle.
- N.B. As the skeleton acerate spicule is of the same form in

both the last species, only one figure has been given; but it should be remembered that while it varies in length in both species, especially in the latter, it is generally three times the length in *P. anygdaloides* that it is in *P. geodioides*.

- Fig. 24. *Halichondria abyssii* ('Annals,' 1874, vol. xiv. p. 245, pl. xiv. fig. 2, c), "embryonic form" of flesh-spicule (anchorate), magnified, to show that it is birotulate: *a*, lateral view; *b*, end view.

## PLATE XV.

- Fig. 25. *Dictyocylindrus abyssorum*, skeleton-spicules: *a*, large; *b*, small. Scale 1-24th to 1-1800th inch.
- Fig. 26. *Hymeraphia erecta*, skeleton-spicules: *a*, large; *b*, small. Scale 1-24th to 1-1800th inch.
- Fig. 27. *Dictyocylindrus virgulosus*, Bk., skeleton-spicule. Scale 1-24th to 1-1800th inch.
- Fig. 28. *Cornulum textile*, skeleton-spicules: *a*, large; *b*, small. Scale 1-24th to 1-6000th inch.
- Fig. 29. *Halichondria foliata*, Bk., skeleton-spicules: *a*, large; *b*, small. Scale 1-24th to 1-6000th inch.
- Fig. 30. *Plumohalichondria microcionides*, skeleton-spicules: *a*, large; *b*, small. Scale 1-48th to 1-6000th inch.
- Fig. 31. *Microciona longispiculum*, skeleton- and flesh-spicules: *a*, large; *b*, small; *c*, flesh or echinating spicule. Scale 1-24th to 1-1800th inch.
- Fig. 32. *Esperia placoides*, skeleton-spicule. Scale 1-48th to 1-6000th inch.
- Fig. 33. *Esperia borassus*, skeleton-spicule. Scale 1-48th to 1-6000th inch.
- Fig. 34. *Esperia cupressiformis*, var. *bihatiferis*, skeleton-spicule: *a*, body form; *b*, surface form. Scale 1-12th to 1-1800th inch.
- Fig. 35. *Halichondria phlyctenodes*, skeleton-spicule. Scale 1-48th to 1-6000th inch.
- Fig. 36. *Cribrella hospitalis*, Sdt., skeleton-spicules: *a*, large; *b*, small. Scale 1-24th to 1-6000th inch.
- Fig. 37. *Halichondria foreipis*, Bk., var. *bulbosa*, skeleton-spicules: *a*, large; *b*, small. Scale 1-24th to 1-6000th inch.
- Fig. 38. *Cometella pyrula*, skeleton-spicule. Scale 1-48th to 1-6000th inch.
- Fig. 39. *Hymeraphia verticillata*, Bk., var. *erecta*, skeleton-spicules: *a*, large; *b*, small or centrally inflated. Scale 1-24th to 1-1800th inch.
- Fig. 40. *Stelletta pachastrelloides*. *a*, large acerate skeleton- or "body-spicule;" *b*, three-armed "zone-spicule;" *c*, anchoring-spicule;" *d*, microspined subskeleton-spicule: all on the same scale, viz. 1-48th to 1-1800th inch. *e*, microspined flesh-spicule, more magnified; *f*, large stellate spicule with conical rays spiniferous; *g*, minute bistellate spicule with linear rays: scale of *f* & *g*, 1-12th to 1-6000th inch. *h*, head of anchoring-spicule, more magnified; *i*, microspined subskeleton spicule, more magnified.
- Fig. 41. *Pachastrella intexta*, quinquerradiate skeleton-spicule, scale 1-24th to 1-6000th inch. *a*, bacilliform blunt-spined flesh-spicule; *b*, bistellate minute flesh-spicule with linear rays: scale 1-12th to 1-6000th inch.

- Fig. 42. *Isodictya spinispiculum*, spicule of. Scale 1-24th to 1-6000th inch.
- Fig. 43. *Microciona interta*: *a*, skeleton-spicule; *b*, bihamate; *c*, bihamates in the mass. Scale 1-24th to 1-6000th inch.
- Fig. 44. *Xanthidium bicirratum*. Scale 1-12th to 1-6000th inch.

## PLATE XVI.

- Fig. 45. *Geodia nodastrella*. *a*, "zone-spicule," viewed laterally; *b*, end view of head; *c*, "body" or large skeleton acerate spicule; *d*, "anchoring-spicule" fluked and forked; *e*, body-stellate; *f*, siliceous balls of crust, globular and elliptical forms; *g*, nodostellate of dermis and crust; *h*, dermal acerate: all on the same scale, viz. 1-48th to 1-1800th inch. *i*, body-stellate, more magnified; *k*, nodostellate of dermis and crust, more magnified.
- Fig. 46. *Geodia megastrella* on a fragment of *Corallistes*: *a*, sponge; *b*, aperture or common vent; *c*, pore-areæ; *d*, fragment of *Corallistes Bowerbankii*.
- Fig. 46'. The same, spicules of. *a*, zone-spicule; *b*, less frequent form of head of zone-spicule; *c*, "body" or large skeleton acerate spicule; *d*, anchoring-spicules, fluked and forked; *e*, megastrella, arms microspined; *f*, body-stellate; *g*, siliceous balls of crust, globular and elliptical forms; *h*, dermal stellate; *i*, dermal acerate: all on the same scale, viz. 1-48th to 1-1800th inch. *k*, megastrella, more magnified; *l*, body-stellate, more magnified; *m*, dermal stellate, more magnified.
- Fig. 47. *Geodia megastrella*, var. *lævispina*. *a*, zone-spicule; *b*, body or large skeleton acerate spicule; *c*, anchoring-spicules, fluked and forked respectively; *d*, megastrella; *e*, siliceous balls of crust; *f*, stellate of dermis and crust; *g*, dermal acerate: all on the same scale, viz. 1-48th to 1-1800th inch. *h*, megastrella, more magnified; *i*, spines broken off; *k*, dermal stellate, more magnified.
- Fig. 48. *Tethya cranium*, var. *infrequens*. *a*, projecting forked anchoring-spicule, with arms truncated and terminating in little cup-shaped excavations with serrated margins respectively; *c*, projecting fluked or anchor-like anchoring-spicule: scale 1-48th to 1-6000th inch. *b*, extremity of arm of forked form (*a*), more magnified.
- Fig. 49. *Tethya cranium*, var. *abyssorum*: *a*, two bihamates, magnified to show that they are spinous. Scale 1-6th to 1-6000th inch.
- Fig. 50. *Puchastrella parasitica*. *a*, radiate skeleton-spicule, showing that its arms are thrice forked; *b*, shaft, prolonged above as well as below; *c*, acerate skeleton-spicule; *d*, spinous bacillary flesh-spicule; *f*, minute stellate: all on the same scale, viz. 1-24th to 1-6000th inch. *e*, spinous bacillary flesh-spicule, more magnified.
- Fig. 51. *Microciona minutula*: *a*, large skeleton-spicule; *b*, different forms of its head; *c*, slender acute; *d*, bihamates. Scale 1-24th to 1-6000th inch.
- Fig. 52. *Corticium parasiticum*, spicules of. Scale 1-24th to 1-6000th inch.
- Fig. 53. *Cometella simplex*, natural size.