Sabella viridis, M.-Edwards, Règ. An. Illust. pl. 1 *e* (*fide* De Quatref.).

Amongst mud in the insterstices of *Filigrana implexa* from the coralline region.

Genus Dasychone, Sars.

Dasychone Dalyelli, Kölliker; Mgrn. *op. cit.* p. 115.

Occasionally from the coralline ground in the débris of fishing-boats.

Genus Amphicora, Ehrenberg.

Amphicora Fabricia, O. F. Müller; Mgrn. *op. cit.* p. 117.

Abundant under stones on muddy ground between tide-marks and amongst tangle-roots.

Fam. 36. **Serpulidæ.**

Genus Protula, Risso.

Protula tubularia, Mont. (=*protensa*, Johnst.); Johnst. Cat. Brit. Mus. p. 264.

Occasionally in deep water.

Genus Filigrana, Oken.

Filigrana implexa, Berkeley; Mgrn. *op. cit.* p. 119.

Fine masses are common in the coralline region.

Genus Hydroides, Gunner.

Hydroides norvegica, Gunner; Mgrn. *op. cit.* p. 120.

Abundant in deep water, attached to shells, stones, &c.

Genus Serpula, L.

Serpula vermicularis, L.; Mgrn. *op. cit.* p. 120.

Common in deep water.

Genus Pomatocerus, Phil.

Pomatocerus triqueter, L.; Mgrn. *op. cit.* p. 121.

Very common from the littoral to the coralline region.

Genus Spirorbis, Daud.

Spirorbis borealis, Daud.; Mgrn. *op. cit.* p. 122.

Abundant on seaweeds and stones between tide-marks.

Spirorbis lucidus, Mont.; Mgrn. *op. cit.* p. 123.

Common on zoophytes from deep water.

[To be continued.]

XXIX.—*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; with Figures and Descriptions of some remarkable Spicules from the Agulhas Shoal and Colon, Panama.* By H. J. Carter, F.R.S. &c.

[Plates XIII., XIV., & XV.]

I now propose to describe and illustrate for publication a few more of the deep-sea sponges dredged up on board H.M.S. 'Porcupine,' from the bed of the Atlantic Ocean, off the coast of Ireland, or between the north of Scotland and the Faroe Islands—every fragment of which that came into my hands was immediately sketched and preliminarily recorded in my MS. journal, with all the information as regards "soundings &c." that accompanied them, in order that I might possess the means of referring to any particular specimen directly, and, in case of accident, thus endeavour to provide against total loss.

The greater part of these specimens represent sponges which have already been described; and the rest will be considerably reduced by those which I am now about to add. Among the latter, however, will be found such extraordinary forms of the flesh-spicule that, unless I first describe a well-known one for reference, they will probably not be understood.

As regards nomenclature, it is not desirable to give new names if we wish to *speed* knowledge; and hence it is better, if possible, to retain an old one, although inappropriate, rather than oppress the mind at the outset by introducing that to which it is unaccustomed. Much that is valuable is never read because it is accompanied by new names.

Again, if we can find familiar types in our British sponges for reference, when engaged in the study of foreign species, it is better to adopt these than to refer to specimens which are less accessible.

Thus, in the present instance, I shall have recourse to Johnston's *Halichondria incrustans*, whose description, including Col. Montagu's observations (Johnst. Brit. Sponges, 1842, p. 122, pl. xi. fig. 3, and pl. xii. fig. 3), leaves no doubt in my mind that the species grows plentifully about this place (Budleigh-Salterton, Devon); while Johnston's figures of *H. incrustans* and *H. saburata*, together with his specimens now in the Johnstonian Collection of the British Museum, have led me, as well as Dr. Bowerbank (B. S. vol. ii. p. 248) to the conclusion that they all represent one and the same sponge, viz. *Halichondria incrustans*.

The reason that I have not yet published descriptions of more of the sponges that were dredged up on board H.M.S. 'Porcupine,' which were handed over to me for this purpose, is that the system under which I have arranged the collection of sponges in the British Museum is not yet sufficiently matured for publication; and until I have this for reference, there is no other arrangement of the sponges that appears to me to offer any thing so practicable. "Why then," it may be asked, "do you still publish descriptions of these specimens?" My reply is, that "the examination and arrangement of the collection of sponges in the British Museum has already taken up so much time that it seems to me better that I should at once do a little more to the deep-sea ones, and thus partly anticipate my arrangement, than leave them all for description until this is completed."

Returning, then, to *Halichondria incrustans*, it will be remembered by those acquainted with the elements of this sponge that one of the minute or "flesh-spicules" is an anchorate, somewhat like that illustrated in my last communication to the 'Annals' (vol. xiv. p. 105, pl. x. fig. 12); and before proceeding to the description and illustration of the deep-sea sponges, it is desirable that I should notice this spicule in detail in *H. incrustans*, which, perhaps, affords the best typical form of it that can be obtained for this purpose, at the same time that the sponge producing it is common on our shores.

The term "anchorate," first used by Dr. Bowerbank (*Haken*, Schmidt), answers very well generically; but as one end of this spicule is occasionally much more developed than the other, Dr. Bowerbank has found it necessary to add the specific terms "equianchorate" and "inequianchorate," which, respectively, are equally appropriate.

It is the "equianchorate" form, as it exists in *Halichondria incrustans*, that, being the most typical of the two, I am now about to describe *in detail*, in order that the same kind of flesh-spicule, which will hereafter be found to be so extraordinarily

modified in form in the deep-sea sponges, may be understood.

The equianchorate, then, of *Halichondria incrustans* consists of a shaft and three arms or hooks of *equal* size at each end, whence its specific designation (Plate XIII. fig. 1, *a*, *b*, *c*). The shaft is curved bow-like equally (fig. 1, *a*, *d*), and the three arms recurved towards the concavity of the shaft (fig. 1, *b*, *e*, *f*). Two of these arms are lateral (fig. 1, *b*, *f*), and the other anterior or in front (fig. 1, *b e*, *a e*); hence the back of the shaft forms a continuous and uninterrupted curve (fig. 1, *d*). All three of these arms are attached to the shaft by falciform expansions, extending between the shaft and the arms respectively (fig. 1, *a g*, *c h*), which expansions will be termed in the singular number the "falx," and in the plural "falces;" and while the two lateral arms, being opposite to each other, thus present a wing-like appearance (fig. 1, *c h*), the anterior one being single, median, and in front, presents a linear form; but in all the falx is more or less retracted and web-like towards the end of the shaft (fig. 1, *a g*).

As the anterior arm of the anchorate in other sponges frequently presents a petaloid or tongue-shaped form of extreme thinness, while the linear element, when it remains in this form, represents the midrib of a leaf, but as often is retracted into an elliptical or circular body, which, at the base of the petaloid expansion, is joined through the intervention of the falx to the shaft, we shall call this the "tubercle" (fig. 1, *b i*, and fig. 4, *e*).

Thus we have to remember the "shaft," the "lateral" and "anterior arms" respectively, the "falx," and the "tubercle" for this complicated little spicule.

I should also here add that, in the anchorate of *Halichondria incrustans*, there are four lateral convex aliform expansions of the shaft itself, viz. one on each side towards the ends, thus causing the shaft to present a constricted form in the centre when viewed anteriorly or posteriorly (fig. 1, *b* & *c*). These aliform expansions will also be seen, by-and-by, in the anchorate of *Chondrocladia virgata* and other deep-sea sponges.

In my last communication to the 'Annals' (*l. c.*) it will be observed that I have figured three forms of flesh-spicules as common to *Halichondria ægagropila*, Johnston (*Esperia ægagropila*, Carter); and it will also be found that the two additional ones (viz. the "tricurvate" and the "bihamate") are as frequent in their occurrence in many other sponges as the "anchorate" itself, but, being very simple in construction, they do not require a detailed description like the anchorate. In the communication to which I have just alluded it will further be

seen that the anchorate presents the form specifically termed "*in*equianchorate," and thus affords, with that under description, the two principal varieties, viz. the "equi-" and "inequi-" anchorates respectively of this spicule.

Halichondria incrustans differs from *Esperia* (Carter) in possessing *two* forms of skeleton-spicules, viz. an acuate or club-shaped spicule, spined or not, and an acerate (smooth, curved, fusiform, and pointed at each end), sometimes inflated round, hastate, or even minutely spined, at the ends; while *Esperia* only possesses *one* form of skeleton-spicule, viz. smooth, sub-pinlike, fusiform, with the body frequently thicker than the head, which is the reverse of the acuate in *H. incrustans*. The anchorate among the flesh-spicules, too, in *H. incrustans* is equi-ended (equianchorate), while in *Esperia* it is for the most part *in*equi-ended (inequianchorate).

I shall retain the term "*Halichondria*" for the group of sponges whose type is that of *H. incrustans* and its modifications, as it is necessary to adopt one for this purpose, and this, which appears to have been first introduced by Fleming in 1828 (Hist. Brit. Animals, p. 520), has since been most generally used.

With this short introduction, let us proceed to the description of the deep-sea sponges, which respectively will appear under the names:—*Guitarra fimbriata*, n. gen. et sp.; *Melonanchora elliptica*, n. gen. et sp.; *Esperia villosa*, n. gen. et sp.; *Esperia cupressiformis*, n. gen. et sp.; *Chondrocladia virgata*, Wyv. Thomson; *Histoderma appendiculatum*, n. gen. et sp.; *Halichondria abyssi*, n. gen. et sp.; *Halichondria forcipis*, Bk.; *Cliona abyssorum*, n. gen. et sp.; *Desmacella pumilio*, Schmidt; *Reniera fibulata*, Sdt.; and *Dictyocylindrus anchorata*, n. gen. et sp.,—to which will be added descriptions and figures of three remarkable spicules obtained from arenaceous deposits, respectively dredged up on the Agulhas Shoal, Cape of Good Hope, by Dr. G. C. Wallich, in 1857, and obtained just now by Mr. F. Kitton from Colon, Panama; to the former of which the name *Gummina Wallichii*, and to the two latter respectively *Forcepia colonensis* and *Corticium Kittonii*, will be given.

Guitarra fimbriata, n. gen. et sp. Pl. XIII. figs. 2–5, and Pl. XV. fig. 34.

General form conical (figs. 2 & 3); surface villous, even; villi formed by the projecting ends of the skeleton-spicules, arranged in tufts close together (fig. 3, *d*), and somewhat spirally over the body, lengthened into a tubular fringe around the apex (fig. 3, *a*). Sessile. Colour grey. Vent chiefly

apical (fig. 3, *a*), where it is surrounded by the fringe of long spicules just mentioned, while smaller vents (fig. 3, *c*) are scattered over the surface generally. Pores not seen. Internal structure massive, permeated by the excretory system of canals, which has its chief vent at the apex; charged with skeleton- and flesh-spicules, and surrounded by a cortical layer chiefly composed of the former, whose projecting ends give the villous surface (fig. 3, *d*).

Spicules of two kinds, viz. skeleton- and flesh-spicules. Form of skeleton-spicule, of which there is only one, smooth, acerate, fusiform, finely pointed, and nearly straight; average largest size 27 by ½-1800th of an inch in its greatest diameters (Pl. XV. fig. 34), that of the fringe round the apex much longer, viz. 1-24th inch. Flesh-spicule equianchorate, in which the lateral arms are so blended with the shaft as to convert the whole into a flattened plate, of an hourglass- or guitar-shape, constricted in the centre and round at the ends (Pl. XIII. fig. 4, *a b c*), bordered inside throughout by a fringe directed inwards towards the shaft (fig. 4, *d*), leaving a trapezoidal, clear area opposite the constriction, and a narrow, obovate one at each end (fig. 4, *b c*): anterior arm at each end flat, expanded into a circular or obtuse, thin, elliptical plate, presenting the same kind of fringe round its margin, directed inwards, and leaving, as in the shaft, a transparent ovate area in the centre (fig. 4, *b*); anterior arm equal in width to the end of the shaft &c., to which it is parallel transversely, but longitudinally inclined from it at an acute angle beginning at the end (fig. 4, *a*), where it is united to the shaft by a short falx (fig. 4, *f*), opposite to which is a large, clear, circular tubercle (fig. 4, *e*): average length of largest form 16-6000ths inch; widest part 6-6000ths; constricted part 3-6000ths. Size of entire specimen about 6 by 4-12ths of an inch in its largest diameters. Fringe of spicules round the apex 1-24th inch broad.

Hab. Deep sea.

Loc. Atlantic Ocean, off the N.W. coasts of the British Isles.

Obs. The jar containing this, with a specimen of *Podosponqia Lovenii*, Bocage, one of *Desmacella pumilio*, Schmidt, and a fragment of an Hexactinellid sponge (*Askonema*?) bears *no* label. It is remarkable for the form of the anchorate spicule, which, but for reference to that of *Halichondria incrustans*, above given, is so modified in form that it could hardly be otherwise understood. Although the average largest size of this spicule is figured, it is present of all intermediate sizes down to an embryonic form not more than 2-5000ths inch long, in which the outlines alone of the hourglass-shape can be distin-

guished (fig. 5). Further, it is remarkable for having only *one* form of skeleton-spicule, and that acerate, and only one form of flesh-spicule, which, so far as is known, is unique; also for the length of the skeleton-spicules at the apex of the body, where they present a tubular fringe round an apical vent, like that seen in some of the Calcispongiæ, ex. gr. *Grantia ciliata* &c. I think, from the villous even surface and general composition of this sponge, it might be necessary to place it among the Suberites, in which case it would come into my 5th division, viz. RAYNERIÆ.

Melonanchora elliptica, n. gen. et sp. Pl. XIII. figs. 6–12, and Pl. XV. fig. 35, *a*, *b*.

General form globular, corrugated, studded with projecting tubercles over the upper two thirds, smooth below this, where it partly encloses a small stone (figs. 6 & 7, *b b*). Free. Colour grey. Composed of a stiff, glistening, bladder-like dermis, enclosing a soft fibreless parenchyma. Dermis formed of a wove-like texture, composed of linear spicules, intercrossing each other on the same plane, and held together by tough horny sarcode (fig. 8, *a*), corrugated, and presenting rounded tubercles (figs. 6 & 7, *a a*), whose heads respectively are cribriform (fig. 8). Pores and vents respectively situated in the cribriform tubercles (fig. 8). Internal structure massive, fibreless, permeated by the excretory canal-systems, which have their vents respectively in the tubercles; charged with skeleton- and flesh-spicules, together with ova sufficiently large to be seen with the unassisted eye. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—one, the largest, which is chiefly confined to the parenchyma, smooth, acuate, curved, and abruptly pointed, averaging, in its largest size, 53 by 1-1800th inch in its greatest diameters (Pl. XV. fig. 35, *b*); and the other, which is the smallest, and chiefly confined to the dermal texture, smooth, slightly curved, fusiform, and inflated at the ends, averaging, in its largest size, 35 by 1-1800th of an inch in its greatest diameters (fig. 35, *a*). Flesh-spicule of one form only, viz. equianchorate (Pl. XIII. fig. 9), in which the three arms, growing towards each other (fig. 11), at length unite, and, with the shaft, ultimately form two ellipses, which, cutting each other longitudinally and at right angles (fig. 10), give a melon-shaped appearance to the anchorate (fig. 9), which, but for the gradation of all its stages of development being present, from the simple embryonic *equi*anchorate form (fig. 12, *a b*), like that of *Halichondria incrustans*, to the fully developed melon-shaped one, would hardly have been thought to have come from an ordinary form of the anchorate. Arms, as they approach each other, becoming compressed, widened, and knife-shaped, with the thin edge inwards, and presenting, in their fully developed state, fine parallel striæ close together on the blade, which are perpendicular to its curved outer margin (fig. 9, *b*); also presenting, before the union of the arms is completed, a *notch* on the inner edge (fig. 9, *a*), which is filled up at maturity, at which time the shaft becomes undistinguishable from the arms: average largest size of melon-shaped form 12 by 7-6000ths of an inch in its greatest diameters (fig. 9); that of the embryonic form 6-6000ths inch long (fig. 12). Size of entire specimen about 1¼ inch in diameter in all directions; that of the tubercle about 1 to 2-6000ths inch in diameter.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. This specimen is alone; and the label on the jar only bears "Porcupine, 1869," which refers to the "voyage." It is remarkable for the form of the full-grown anchorate, which here also, but for the presence of all minor grades of development leading up to the matured one, could hardly have been understood. It is further remarkable for the general form and structure of the body, although the presence of a stiff, bladder-like envelope or dermis, similarly composed and filled with a soft, parenchymatous, fibreless mass does not, as we shall see hereafter in *Histoderma appendiculatum*, appear to be so much confined to any particular species as to be a peculiarity of some of the deep-sea sponges. It had grown on, and subsequently partly round, the pebble at its base (Pl. XIII. figs. 6 & 7, *b b*), which, in the otherwise unattached state of the sponge, must at once have served to keep it more or less stationary, with the same side always uppermost. Hence, probably, the restricted position of the pore-areæ.

The alliance of the double form of skeleton-spicules here, as well as their shape respectively, with those of *Halichondria incrustans*, would seem to indicate that this sponge should be placed under the heading "*Halichondriæ*" in my 5th division of sponges, viz. RAYNERIÆ.

Esperia villosa, n. gen. et sp. Pl. XIII. figs. 13-15, and Pl. XV. fig. 36.

General form massive, lobular, erect (fig. 13), growing from a contracted portion of stout, naked fibre (fig. 13, *a*), whose main filaments, being expanded at the ends, appear to have been torn

from some submarine object to which the sponge was thus attached. Sessile. Colour grey. Dermal surface villous, even, consisting of the ends of linear spicules that project in small tufts a little beyond the sarcode, which thus holds them in position (fig. 13, *b*). Pores in the interstices between the tufts (fig. 13, *c*). Vents scattered here and there irregularly. Internal structure parenchymatous and fibrous, surrounded by a spicular crust, which forms the villous surface (fig. 13, *b*), charged with spicules, and permeated by the excretory canal-systems, which respectively end in the vents mentioned. Parenchyma hung on the fibrous structure, which is stout, stiff, reticulate, anastomosing, and chiefly composed of the skeleton-spicules, united together by a small portion of horny sarcode. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. sub-pinlike, stout, smooth, slightly curved, abruptly pointed, head less in diameter than the shaft; average largest size 43 by $\frac{1}{3}$-1800th inch in its greatest diameters (Pl. XV. fig. 36). Flesh-spicules of two forms, viz. bihamate and equianchorate. Bihamate very large, C-shaped, in which the central canal is visible (Pl. XIII. fig. 15, *a*), more or less contorted and sigmoid; average largest size 40 by $2\frac{1}{2}$-6000ths inch in its greatest diameters (fig. 15). Equianchorate very long and narrow (fig. 14, *a*); anterior arm spatuloid, terminated at the fixed end by a short, elliptical tubercle, and attached by an equally short falx to the shaft; the free end, *en profile*, curved forwards and inwards, claw-like (fig. 14, *b*); lateral arms united to the shaft throughout by their falces respectively, and so long as to leave nothing of the shaft visible beyond a constricted portion in the centre (fig. 14, *e*), thus contrasting strongly with the half-grown individual (fig. 14, *c*); average largest size 24 by 3-6000ths inch in its greatest diameters; distance of the free end of the anterior arm from the shaft, when viewed laterally, greater than its width. Size of entire specimen $2\frac{1}{2}$ inches high by $1\frac{1}{4} \times 1$.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. The No. on this jar is "51," whose "station" (for that is what the No. refers to in the "Reports") would give a depth of 440 fathoms. It is in company with *Hymedesmia Johnsoni*, Bowerbank (B. S. vol. i. p. 276), and *Axinella mastophora*, Schmidt. The specimen is very much injured; but enough of it remains to enable me to give the above description and figure in the plate. It is remarkable for the large size of the bihamate (fig. 15) and this particular weaver's-shuttle-like or navicular form of anchorate, which is by far the largest I have yet seen (fig. 14). The bihamate presents the central canal; and the equianchorate differs so much in form between the half- and fully-developed states (fig. 14, *c* & *a b*), that, but for such gradations, they would hardly be recognized as belonging to each other. In the half-grown and embryonic form (fig. 14, *c d*) the shaft is much less covered in the middle, and the arms much wider than in the matured form, where the shaft is hardly seen from the close approach of the lateral arms to each other; while all the arms in the matured form appear to be more curved inwards than in the half-grown specimen, where their *expanded* state chiefly leads to their appearing to be so much wider. But for there being only one kind of skeleton-spicule, and this in singleness and form being evidently allied to *Esperia*, the presence of the anchorate in an equi-ended form would have led me to reject it from the Esperiadæ (Carter), whose most prevalent character is the *in*equianchorate; while the villous condition of the dermis, arising from the projecting ends of the skeleton-spicules, equally differs from the beautiful, subhexagonal, or polygonal, structure presented by the surface of *Esperia ægagropila* and the like, in which the spicules do not project, but are on a level with the dermal sarcode. The naked, stiff, rigid, coarse, reticulate fibre at the base, composed almost entirely of spicules, is very characteristic of *Esperia*, whose parenchyma appears to leave and return to the old spiculo-fibrous structure as required; or, at all events, the latter when once produced is more durable than the parenchyma, which often, in the newly formed state, returns to and partly overspreads an old skeleton. Hence with the Esperiadæ a naked portion of this peculiarly rigid spiculous fibre is as common as it is characteristic.

Esperia cupressiformis, n. gen. et sp. Pl. XIV. figs. 16–19, and Pl. XV. fig. 37.

General form long, narrow, pyramidal, echinated all round with short, linear processes, diminishing in length, becoming thicker as they are inclined upwards towards the summit, and disappearing altogether towards the base, which is somewhat inflated (Pl. XIV. fig. 16). Matured form club-shaped. Processes at first pointed, and afterwards inflated at the ends respectively, becoming more or less united together by a continuous dermal layer of sarcode (fig. 16, *g*). Free or fixed. Colour whitish grey. (Or, in another form (fig. 19), capitate, head pyriform, compressed (fig. 19, *b*), supported on a slender stem, terminating in an expanded discoid root at the base (fig. 19, *c*.) Hispid over the lower half of the compressed head, and also over the root at the base (fig. 19, *c*). Capitate portion

divided into two lip-like parts, halfway down from the summit, parallel with the compression (fig. 19, *a*).) Dermal surface even, consisting of sarcode densely charged with minute inequianchorates, whose large ends just project above the level of the structure in which they are otherwise imbedded (fig. 16, *f*). Pores not seen, but probably in the dermal sarcode. Vents not seen. Internal structure dense, consisting of bundles of long linear spicules, partly erect and parallel and partly transverse, the former supplying the axial support of the body of the sponge, and the latter that of the echinating processes (fig. 16, *f*). Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. long, smooth, acuate or sub-pin-like, fusiform; average largest size 65 by 1-1800th of an inch in its greatest diameters; head narrower than the shaft (Pl. XV. fig. 37). Flesh-spicules of two forms, viz. inequianchorate and tricurvate. Inequianchorate (Pl. XIV. fig. 17 *a*, *b*) almost without appearance of shaft in the front view, as the lateral arms of the larger end reach down to those of the smaller one (fig. 17, *b*); anterior arm petaloid, much shorter than the lateral ones (fig. 17, *b*), presenting an elliptical tubercle where it is united to the end of the shaft by the falx, which is extended halfway down the petaloid arm; lower end of spicule much aborted; shaft much curved: average largest size $5\frac{1}{2}$ by 3-6000ths of an inch in its greatest diameters. Tricurvate (fig. 18), smooth, in the form of a minute hair-pin or pair of forceps—that is, as it were, consisting of a smooth, linear spicule, bent into a very acute angle, with attenuated arms, here terminated respectively by a bulbous inflation (fig. 18, *a*); round at the bend, and in its average largest size 9-6000ths of an inch long, with a distance of 2-6000ths inch between the extremities (fig. 18). Size of largest entire specimen $3\frac{1}{4}$ inches long by 2-12ths in transverse diameter; that in which the echinating processes are most developed, 4-12ths inch in diameter.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. This sponge appears in jars with the Nos. 52, 54, 57, and 27 on them respectively, also in a little bottle with no number. The three former numbers represent stations at which the depth was 384, 363, and 632 fathoms respectively. No. 27 is "Rockall Bank" (lat. 57°35′N. and long. 13°41′E.)—that is, rocks in the Atlantic, west of the Hebrides and "200 miles from the nearest land," with only 54 fathoms on them. With the latter is a small *Holtenia*, but nothing else in either of the other jars. The capitate variety (fig. 19) is in jar No. 54 by itself. Besides the general form of this sponge—which

becomes club-shaped at maturity, and the echinating processes overrun and united together by the dermal sarcode into broken ridges or rows (fig. 16, *h*), the surface being formed of a layer of myriads of the little inequianchorates and forceps-like tricurvates (fig. 16, *f*), through which the ends of the skeleton-spicules project, especially towards the ends of the echinating processes—the peculiar form of the inequianchorate, which here and there is in groups like the well-known rosettes of *Esperia ægagropila* &c., and the minute little spicule with bulbous ends which so much resembles a pair of forceps, and must be regarded as a tricurvate, all, together with the single and characteristic form of the skeleton-spicule, point out the alliance of this sponge with *Esperia*, while the echinating processes in form and composition are very much like those of *Cladorhiza abyssicola*, which will be found to be another Esperian sponge. The Esperiadæ come into my 5th division, viz. RAYNERIÆ.

Chondrocladia virgata, Wyv. Thomson. Pl. XIV. figs. 20&21, and Pl. XV. fig. 38.

General form a tall, narrow stem, branching scantily and dichotomously, rendered more or less angular by the projection of conical processes arranged alternately round it in a confused spiral manner; each process inflated or jointed in the centre, and surmounted by an attenuated spine-like termination, equal in length to and of the same structure as the conical process. Conical processes and their attenuated spine-like portions diminishing in length towards the ends of the branches, whose stems, thus becoming finally divested of them, present a rounded, naked, *Esperia*-like appearance. Fixed by a spreading root. Colour greenish grey. Surface even, reticulate, composed of dermal sarcode, charged with the flesh-spicules of the species, and pierced by the pointed ends of small linear skeleton-spicules. Pores and vents not seen; probably the former are situated, as usual, in the interstices of the reticular surface of the dermis, and the vents scattered here and there. Internal structure, composed of an axis formed of long skeleton-spicules, arranged parallelly and perpendicularly together, from which radiate transversely bundles of the same kind of spicules to form the "conical processes" &c., imbedded in a parenchymatous sarcode charged with the flesh-spicules of the species, together with the smaller skeleton ones, which project through the surface. Axis and its spicules diminishing in size upwards from the base, where it forms, with the exception of a thin cortical portion, the whole of the stem, intermixed with parenchymatous

structure; permeated by the excretory canal-system, and presenting a distinct spiral arrangement of the spicules. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. smooth, long, linear, slightly curved, fusiform, acuate or sub-pinlike, fine-pointed; average largest size 110 by 2-1800ths inch in its greatest diameters (Pl. XV. fig. 38); head narrower than the shaft. Flesh-spicules of two forms, viz. equianchorate and bihamate:—1st. Equianchorate (Pl. XIV. fig. 20): shaft curved, expanded or alate at each end (fig. 20, *a e*), which end is circular (fig. 20, *c e*), and from which rises the falx (fig. 20, *f*), supporting an umbrella-shaped head of seven arms or claws, of which the falx supplies the eighth (fig. 20, *d*), webbed together for half their length, and recurved obliquely towards the centre of the shaft; average largest size 16 by 5-6000ths inch in its greatest diameters, viz. in its total length and breadth of head respectively. 2nd. Bihamate: C-shaped, smooth, more or less contort and sigmoid, rather small; average largest size 6 by $\frac{1}{2}$-6000th inch in its greatest diameters (fig. 21). Size of entire specimen about 3-12ths inch in diameter at the base, gradually diminishing upwards to a height of 8 to 16 inches (20 to 40 centimetres, Wyv. Thomson, 'Depths of the Sea'). Transverse processes about an inch long, and about 2-12ths inch in diameter at the base.

Hab. Deep sea.

Loc. Atlantic Ocean, between the north coast of Scotland and the Faroe Islands.

Obs. Although there is no number on the jar containing this sponge, the allusion to it in the Report of the 'Porcupine' Expedition for 1869 (Proceed. Roy. Soc. vol. xviii. no. 121, p. 443) shows, by the station ("52") therein mentioned, that it was dredged up here (between the north coast of Scotland and the Faroe Islands) in 384 fathoms. Dr. Wyville Thomson has inserted an excellent figure of it in his 'Depths of the Sea,' p. 188, to which I must refer the reader for an illustration of its general form; but the detail having been left for me to supply, it alone, with illustrations, is herewith given. There were four sponges dredged up on board the 'Porcupine' possessing allied forms of this anchorate, viz.:—that above described; that figured and described by Sars as *Cladorhiza abyssicola* ("Remarkable Forms of Animal Life from the Great Depths of the Norwegian Coast" (Eng.). Published by G. O. Sars. Christiania, 1872, p. 65, pl. vi. figs. 16–34); and another, which I shall hereafter describe and illustrate under the name of *Halichondria abyssi*, as far as the two very small fragments that have been preserved of it will permit.

In *Cladorhiza abyssicola*, Sars, the general form is a branched, shrub-like sponge, rising from a thick, solid, *Esperia*-like stem of spicules (that is, a stem very like in appearance to a glass rope, covered by a cortical layer of sarcode in its natural state), in which the branches are very numerous, often anastomosing by contact, and passing into a massive structure; branches echinated with short filamentous processes, and covered generally with a parenchymatous sarcode charged with the flesh-spicules of the species, viz. a small inequianchorate and a very large bihamate, more or less contort, with everted, fine, whip-like ends. Although the skeleton-spicule is similar to that of *Chondrocladia virgata*, Wyv. Thomson, and the anchorate presents one end like the anchorate of this sponge, with alate appendages on the shaft, fully developed (fig. 22), the whole at the other end is aborted, so as to demand for it the term "*in*-equianchorate" (fig. 22, *c*); while the bihamate, on the other hand, far exceeds in size that of *Chondrocladia*, being 37 by 1-6000th inch in its greatest diameters. I have figured the inequianchorate (Pl. XIV. fig. 22) for comparison, on the same scale, with the equianchorate of *Chondrocladia* (fig. 20) and that of *Halichondria abyssi* (fig. 27), to be described hereafter; but the bihamate is so large that I have not room for the figure of this spicule in this plate. (It seems to me that, in sponges possessing both the anchorate and bihamate flesh-spicules, the larger size of one is always accompanied by a lesser size of the other.) Besides these differences, the opaque cream-yellow colour of *Cladorhiza abyssicola* contrasts strongly with the translucent, greenish-grey one of *Chondrocladia virgata*.

The branched sponge named by Dr. Gray "*Axos Cliftonii*" ("Notes on Arrangement of Sponges," Proc. Zool. Soc. 1867, p. 546), from Nichol Bay, West Australia, must be very like *Chondrocladia virgata*, as the following extract from a note, with rough sketch, kindly handed over to me by Dr. Gray, shows, wherein it is stated to have been "found growing on a piece of rock about a foot square, in 27 branches, 2 feet long." In *Axos Cliftonii* the short, triangular, compressed processes on the stem, whose bases respectively rest longitudinally on the latter, are arranged in an aliform manner spirally round the stem—the skeleton-spicule, of which there is only one form, being acuate, and not fusiform, and the flesh-spicule, of which also there is only one form, being like a *Maltese cross*, with *six* arms, two of which are in a line perpendicular to the plane of the "cross," but so densely charging the parenchymatous sarcode which imbeds the bundles of skeleton-spicules forming the axis, that, altogether, we cannot help seeing in *Axos Clif-*

tonii a great resemblance in every way to *Chondrocladia virgata*.

The single and peculiar form of the skeleton-spicule in *Cladorhiza* and *Chondrocladia*, with the anchorate and bihamate, point to a strong alliance with *Esperia*, Carter, at the same time that their rigid stems, composed of closely united parallel spicules (in *Cladorhiza* anastomosing also) present a strong resemblance to the characteristic fibre-skeleton of *Esperia*.

Histoderma appendiculatum, n. gen. et sp. Pl. XIV. figs. 23–25 and Pl. XV. fig. 39, *a*, *b*.

General form subglobular, smooth, furnished with several narrow tubular prolongations of different lengths, some of which are longer than the diameter of the body (Pl. XIV. fig. 23). Free. Colour light grey. Composed of a stiff glistening bladder-like dermis (fig. 23, *a*), which also forms the walls of the tubuli (fig. 23, *b*), and encloses throughout a soft fibreless parenchyma. Dermis a woven-like texture, consisting of a dense layer of linear spicules intercrossing each other on the same plane, and held together by tough horny sarcode extending into the tubular prolongations, whose cylindrical walls respectively are similarly constructed, and, like the body, retain their form when dry and emptied of their contents. Tubuli terminating abruptly, each followed by a small conical eminence (fig. 23, *c*) which appears to have had the power of opening and closing itself as required. Pores and vents not distinctly seen, but probably situated at the extremities of the tubuli respectively, which, with the exception of one instance (fig. 23, *c*), from which the above description is taken, are all broken off. Internal structure massive, fibreless, charged with the spicules of the species and permeated by the excretory canal-systems, which appear to have had their vents respectively at the ends of the tubuli. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—one, the largest, smooth, slightly curved, acuate, abruptly pointed, average largest size 64 by 1-1800th of an inch in its greatest diameters (Pl. XV. fig. 39, *a*); the smaller one smooth, slightly curved, fusiform, terminating at each extremity in a constricted neck, followed by a remarkably large elliptical pointed inflation, average largest size about 40 by $\frac{1}{2}$-1800th inch, inflated ends wider than the shaft (fig. 39, *b*). Flesh-spicules also of two forms, viz. bihamate and equianchorate. Bihamate (Pl. XIV. fig. 25) smooth, C-shaped, more or less contort and sigmoid; average largest size about 21 by $1\frac{3}{4}$-6000th inch. Equianchorate (fig. 24, *a*, *b*) consisting of a simple shaft with three linear arms at each end, united to the former respectively by a short falx. Size of entire specimen about $\frac{1}{2}$ inch in diameter. Longest tube 1-12th inch in diameter and 9-12ths of an inch in length.

Hab. Deep sea.

Loc. Atlantic Ocean off the west coast of Ireland.

Obs. There are specimens of this sponge in two jars, numbered respectively "2" and "24" (*i. e.* Stations), which would give respectively the depths of 808 and 109 fathoms. In jar No. "2" it is in company with *Tisiphonia agariciformis*, Wy. Thomson, *Pachastrella abyssi*, Schmidt, *Tethya cranium*, *Hymedesmia Johnsoni*, Bk., *Halichondria ventilabrum*, *Geodia*, and deciduous fragments of a *Corallistes*; while in jar No. "24" it is in company only with *Hyalonema longissimum*, Sars (*op. cit.*), and *Tisiphonia agariciformis*.

There is a great resemblance in form and structure between this sponge and *Melonanchora elliptica*, inasmuch as both have the same silvery resilient dermal covering filled internally with soft, pulpy, fibreless parenchyma; but while in the latter the dermal structure is only extended to the base of the short tubercles with cribriform heads respectively, in the former, or *Histoderma*, it is extended into the walls of the tubes throughout, terminating abruptly, and followed by the cone of spicules above mentioned, of which unfortunately there is only one example left, the rest of the tubes having been broken off towards their ends.

With, therefore, no fibrous structure internally, it is evident that the bladder-like dermis is the skeleton or organ of support in these sponges.

In some specimens the tubes are shorter than in others; while in others there is nothing but a slight elevation of the surface surrounding a flat or sunken pore-area, but not formed of cribriform sarcode like that of the tubercles in *Melonanchora*.

When dried the specimens present an asbestine appearance from the densely packed spicules of the dermis, which, together with the stiff, horny sarcode that holds them together, forms a textile fabric that retains its form whether wet or dry.

[To be continued.]

and of the fore and hind legs darker, with small white tips; the middle of the throat, the chest, and underside of the body ashy; the hairs on the underside of the middle of the tail with long silver ends. Length of head and body 21 inches: tail about the same length; but it is probably lengthened, as it is very slender and has a stick inside it.

Hab. North Borneo. B.M.

The white spot, from which Temminck named the species, is very small and indistinct in the British-Museum specimen; but I suppose it is the same as his species, which comes from Borneo, and which he describes as having a "pure white longitudinal band extending from the forehead to the origin of the muffle, covering the ridge of the nose."

It is to be observed that all the plain *Paradoxuri* have a more or less distinct indication of a streak down the nose. The other parts of Temminck's description agree with what a brighter and more adult specimen of this animal would be. This species is at once known from the other *Paguma* by its black whiskers, whereas in almost all the other species they are white. The whiskers differ in strength in the species, being strongest in *P. leucomystax* and most slender and weakest in *P. zeylanica*. It is to be observed that though this is so characteristic, it is not mentioned in Temminck's description.

The British Museum received in 1870 the specimen of *Paradoxurus* from the Andaman Islands presented to the Zoological Society by Mr. Arthur Grote in May 1865, and said to be *Paradoxurus Tytleri* of Blyth (see P. Z. S. 1865, p. 466). As I do not know where this very distinct species is described, I send the following short note of it, as it is perfectly distinct from all the other species in the British Museum.

2. *Paguma Tytleri.*

Paradoxurus Tytleri, Blyth: P. Z. S. 1865, p. 466.

Fur rather long, not dense, pale greyish brown, with long white tips; the sides of the neck, the throat and upper parts of the body, and the insides of the limbs ashy white; the face, the sides of the lower jaw, and the fore and especially the hind feet darkish brown; the cheeks under the eye, the forehead, and a narrow line down the centre of the nose paler, with paler tips to the hairs; whiskers white, scarcely as strong as in *P. leucomystax*.

Hab. Andaman Islands. B.M.

XXXI.—*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*; with Figures and Descriptions of some remarkable Spicules from the Agulhas Shoal and Colon, Panama.* By H. J. Carter, F.R.S. &c.

[Concluded from p. 221.]

Halichondria abyssi, n. sp. Pl. XIV. figs. 26–28, and Pl. XV. fig. 40, *a*, *b*, *c*.

General form unknown. Sessile, spreading horizontally. Colour grey or brown. Internal structure massive, consisting of an areolar skeleton formed of polygonally arranged bundles of spicules covered with sarcode (Pl. XIV. fig. 26). Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of three forms, viz.:—the longest, smooth, curved, fusiform acerate, fine-pointed, average largest size 45 by $\frac{2}{3}$-1800th inch in its greatest diameters (Pl. XV. fig. 40, *a*); shorter spicule, stout, smooth, acuate, curved, rather abruptly pointed, averaging in its largest size 35 by 1-1800th inch in its greatest diameters (fig. 40, *b*); smallest form smooth, curved, fusiform, inflated equally at each extremity, average largest size 22 by $\frac{1}{2}$-1800th inch in its greatest diameters (fig. 40, *c*). Flesh-spicules of two forms, viz. equianchorate and tricurvate. Equianchorate (Pl. XIV. fig. 27, *a*, *b*): shaft round, much curved, almost bent, expanded but not alate at the ends, where the expansion extends into a claw- or clam-shaped umbrella-like head, composed of six linear recurved arms webbed together nearly to the extremities; average largest size 16 by 3-6000ths inch in its greatest diameters, viz. length of shaft and width of head respectively. Tricurvate (fig. 28) stout, 18 by 1-6000th inch in its greatest diameters. Size of entire fragments each about $\frac{1}{2}$ inch in diameter and 1-12th inch thick.

Hab. Deep sea, on deciduous shells.

Loc. Atlantic Ocean. Between the north coast of Scotland and the Faroe Islands.

Obs. The jars containing these two fragments respectively bear the No. "65," which station gives a depth of 345 fathoms. That in the smaller jar is of the least consequence, being a mere unconnected formless fragment of a brown colour; while the other (which is figured) has grown over the concavity of a small ostraceous bivalve shell (fig. 26, *b*), and is of a lighter colour, but at once reveals the structure and habitat of the sponge, although, from being only a fragment

with none of the surface left, it fails to afford its general form. The unconnected brown fragment is in company with specimens of *Tisiphonia agariciformis* only; while that on the shell has with it *Tisiphonia, Hymedesmia Johnstoni*, Bk., *Hymedesmia verticillata*, Bk., and *Desmacella pumilio*, Sdt., also a branched Suberite with pin-like spicule only, *Tethya cranium*, and *Halichondria ventilabrum*.

In the brown fragment there is *no tricurvate* (fig. 28); but it is abundant in the fragment growing over the shell. I also observe that, in the figure of *Hymedesmia Johnstoni* given by Dr. Bowerbank (B. S. vol. i. pl. 18. fig. 293) from a Madeira specimen, there is *no* tricurvate, while the tricurvate is a prominent object in a specimen of the same sponge from Madeira in the British Museum. Still as it was the habit of *Halichondria abyssi* to take in grains of sand and foreign spicules into its structure, I am still doubtful, as the tricurvate is not in both specimens, whether it also may not have belonged to a different sponge.

Thus we have here another or third sponge whose anchorates have the clam-shaped or umbrella-like ends similar to those of *Cladorhiza* and *Chondrocladia*, while there are three forms of skeleton-spicules instead of one, hence resembling, but for the absence of spines, some of the varieties of *Halichondria incrustans*; so that, unless these clam-shaped ends are to be considered the chief grouping characters, the presence of the three forms of skeleton-spicule, together with the massive areolar structure, the sessile incrusting habit, and the "crumb-of-bread"-like structural appearance of this sponge, must ally it more to *H. incrustans* than to *Cladorhiza* or *Chondrocladia*, where the general form is branched stem-like, and there is only one form of spicule, like that of *Esperia*.

Lastly, I would observe that there is in both specimens a minute equianchorate spicule (fig. 27, *c*), about 4-6000ths inch long, in great abundance, which, although with straight shaft and anchor-like head, seems to me to be no more than the embryonic form of the great equianchorate flesh-spicule with bent shaft and deeply dentate clam-shaped heads.

Halichondria forcipis, Bk. Pl. XIV. figs. 29–32, and Pl. XV. fig. 41, *a*, *b*.

General form massive, lobed, sessile, stiff, areolar, like "crumb of bread." Sessile. Colour light grey (Pl. XIV. fig. 29). Surface irregularly areolar, owing to the form of the subjacent skeleton-structure; covered with a dermal sarcode, which, adhering to the projecting points of the former, presents a cribriform structure over the rounded cavities beneath (fig. 29, *a*). Pores making up the cribriform area just mentioned (fig. 29, *a*). Vents scattered. Internal structure becoming cavernous towards the base (fig. 30), charged with the spicules of the species, and permeated by the excretory canals, of which the dilated cavernous structure is chiefly composed. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—1st, the largest, smooth, stout, slightly curved, acuate, rather abruptly pointed, average largest size 40 by $1\frac{1}{3}$-1800th inch in its greatest diameters (Pl. XV. fig. 41, *b*); 2nd, smooth, nearly straight, slightly fusiform, constricted and slightly inflated at the extremities, average largest size 20 by $\frac{1}{3}$-1800th in its greatest dimensions (fig. 41, *a*). Flesh-spicules of two forms, viz. tricurvate and equianchorate. Tricurvate long, bent upon itself so as to assume the form of a pair of forceps (Pl. XIV. fig. 32, *a*) (whence its designation): arms separate at the point of bending (which is round), but in contact a little further on, and then spreading out again for a short distance towards their terminations, which are *unequal*, one arm being a little longer than the other; arms incipiently spined throughout, spines recurved or inclined *towards* the bend on each arm, becoming almost obsolete at the bend itself; extremities much attenuated and finely pointed; average largest size 30 by $\frac{1}{2}$-1800th of an inch in its greatest diameters. Equianchorate (fig. 31, *a*, *b*) stout, consisting of a curved shaft and three linear arms at each end; the tubercle evident, and the falces respectively extending to about half the length of the arm; average largest size 13 by 4-6000ths of an inch in its greatest diameters, viz. the length of the shaft and width of the head respectively. Size of entire specimen $1\frac{3}{4}$ long, $1\frac{1}{2}$ wide, and $\frac{1}{2}$ inch high or thick, vertically.

Hab. Deep sea.

Loc. Atlantic Ocean. Between the north of Scotland and the Faroe Islands.

Obs. This specimen is alone in a jar with the No. "54" on it, which gives a depth of 363 fathoms. It has already been described among the British sponges by Dr. Bowerbank under the name above given (vol. ii. p. 244), but *not* illustrated. The "bidentate spicules" mentioned by Dr. Bowerbank appear to me to be merely early forms of the equianchorate, and the "minute bihamates" embryonic forms of the tricurvate or large forcipiform spicules, which, in the deep-sea specimen are not more than 2-1800ths inch long, very faintly displayed, very abundant, and with arms in *all* of *unequal* length, the short one being not more than one third of the

length of the other (Pl. XIV. fig. 32, *b*) ; so that this, being a constant occurrence and making its appearance in the embryonic form, must be considered a normal condition of the spicule. Dr. Bowerbank's specimen was dredged up "at Shetland."

In *Esperia cupressiformis* there is a very minute form of the same kind of tricurvate (Pl. XIV. fig. 18), but with a bulbous inflation at the extremity of each arm and other differences which will be learnt by reference to its description. I have also just found a minute sponge on the "rocks" here (Budleigh-Salterton), not more than 2 lines long, containing a similar spicule, but without bulbous ends, hairpin-like. It is *very* minute, not being more than 2-6000ths inch long, but in company with the same kind of equianchorate and double form of skeleton-spicule as those in *Halichondria forcipis*, though not the same species.

All, however, are eclipsed by the beautiful form which I have figured of a much stouter forcipiform spicule that came from an arenaceous deposit in the neighbourhood of Colon or Aspinwall, Panama, five specimens of which, having been mounted, were sent to me by Mr. F. Kitton of Norwich. Here the arms in all are *equal* in length and the extremities abruptly pointed, indeed, may be termed conical; this, together with the great development of the spines, points out a different species from that of *Halichondria forcipis*, for which I propose the name of *Forcepia colonensis* (Pl. XV. fig. 47). Size of specimens 19 by $\frac{3}{4}$-1800th inch in its greatest diameters; width of bend 2-1800ths inch, distance of ends 3-1800ths inch. In Schmidt's *Suberites arciger*, from the coast of Greenland (Atlantisch. Spongienfaun. p. 47, Taf. v. fig. 6), we appear to have another example of this form of spicule, in which the body is smooth and the ends, which are strongly though scantily spined, so far separated from each other that the spicule forms two sides of an almost equilateral triangle, the distance between the free ends being about 53-6000ths inch. This, too, Schmidt calls a tricurvate (*Bogen*).

The forceps-form of the tricurvate spicule in *Halichondria forcipis* is therefore not confined to this sponge, or kind of sponge, since it appears, as before stated, in *Esperia cupressiformis*, in the Budleigh-Salterton specimen, in *Suberites arciger* (if I am right in identifying the tricurvate in Schmidt's sponge with it), as well as free in this arenaceous deposit about Colon. At the same time it should be remembered that this spicule is subject to great variety in form, since I have lately found it here (in a new species of *Esperia*) straight (that is,

without any bend), and even longer than the skeleton-spicule of the species; while throughout it was enclosed by a delicate nucleated mother-cell, shaped like a bolster.

The mounted specimen of *Suberites arciger* which Schmidt sent to the British Museum, besides the tricurvate, presents the true pin-like skeleton-spicule of a Suberite.

In *Halichondria forcipis* both the skeleton-spicules and equianchorates are very much allied, in general form, to those of *Halichondria incrustans*; but in place of the bihamate of the latter we have the forcipiform tricurvate in the former, while the "crumb-of-bread"-like appearance of the structure, in the general form, is very much like that of *Halichondria incrustans*, which used to be designated "*H. panicea*."

Cliona abyssorum, n. sp. Pl. XIV. fig. 33, and Pl. XV. fig. 45, *a*, *b*, *c*.

Sponge retiform, permeating the branches of *Lophohelia prolifera*, and appearing here and there in small heads through corresponding holes in this coral. Pores and vents respectively in these heads. Internal structure areolar, charged with the spicules of the species, and permeated by the excretory system, which is more areolar than tubular. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz.:—1st, the largest, smooth, pin-like, fusiform, curved, fine-pointed, chiefly confined to the "heads," average largest size 57 by $\frac{2}{3}$-1800th inch in its greatest diameters, head oval and as wide as the shaft (Pl. XV. fig. 45, *a*); 2nd, the small skeleton-spicule, smooth, curved, fusiform, acerate, fine-pointed, chiefly confined to the body, average largest size 25 by $\frac{2}{3}$-1800th inch in its greatest diameters (fig. 45, *b*). Flesh-spicule of one form only (fig. 45, *c*), smooth, spiral, sinuous, straight, abruptly terminated at each end, and presenting four bends on each side in its course, densely charging the sarcode throughout; average largest size 20 by 1-6000th inch in its greatest diameters. Size of entire specimen undefinable from its fungus-like permeating growth.

Hab. Deep sea, permeating the branches of *Lophohelia prolifera*.

Loc. Atlantic Ocean, "chops" of English Channel.

Obs. The specimen of *Lophohelia prolifera* in which this sponge was found is partly enveloped in *Corticium abyssi*, which having already been figured and described in the 'Annals' of 1873 (vol. xii. p. 17, pl. i. figs. 1 & 2), I must refer the reader to that for all particulars concerning this part of its history, merely observing that it was dredged up from a

depth of 500 fathoms at the entrance of the English Channel.

The sponge itself, being very minute, while its concealment, according to the habit of the so-called "boring sponges," being, with the exception of the small apertures through which the heads respectively are protruded, completely within the branches of the coral, it is impossible without breaking up the *Lophohelia* to ascertain its exact form, though this may be anticipated from our acquaintance with that of *Cliona coralinoides*, so common on the British coasts ('Annals,' vol. viii. 1871, p. 14, pl. ii. figs. 33–37), since all these "boring sponges" have the same kind of half-reticulated, half-lobulated form in the interior of the bodies which they inhabit.

This species, however, is especially beautiful on account of the dense mass of large, spiral, sinuous spicules (fig. 33) with which the sarcode is charged, presenting, when torn to pieces under the microscope, the appearance of tresses of curled hair. It is figured by Dr. Bowerbank in his B. S. (vol. i. p. 239, pl. iii. fig. 71) as it "occurs in the interstitial membranes of *Geodia carinata*, Bk. MS."!

Cliona abyssorum being, according to my arrangement, a Suberite, will come under my fifth group of sponges, viz. RAYNERIÆ.

Desmacella pumilio, Schmidt (Atlantisch. Spongienfaun. p. 53, Taf. 5. fig. 14, and mounted specimen in British Museum). Pl. XV. fig. 42, *a*, *b*, *c*.

Amorphous fragments of this sponge occur about the specimen of *Corticium abyssi* which envelops the *Lophohelia* just mentioned (Annals, *l. c.*). Its skeleton-spicule is pin-like (fig. 42, *a*); and flesh-spicules a bihamate (fig. 42, *c*) and a very much flattened tricurvate (fig. 42, *b*), which latter, however, does not appear in Schmidt's illustrations of this sponge. But as yet I do not know what value to attach to these flesh-spicules in many instances as special characteristics. At the Cape of Good Hope (Natal) the same kind of small equianchorate navicular form is present in several sponges, many of which are even more than generically different.

In *my* arrangement *Desmacella pumilio* would come among the Suberites in my 5th division, viz. RAYNERIÆ.

Reniera fibulata, Schmidt (Spong. adriatisch. Meeres, p. 73, Taf. vii. fig. 9). Pl. XV. fig. 44, *a*, *b*.

Fragments of this sponge occur about this specimen (in the same amorphous condition as the preceding one), possessing a smooth, curved, pointed, fusiform, acerate skeleton-spicule (fig. 44, *a*), and a bihamate flesh-spicule (fig. 44, *b*). But I do not see any difference, in this respect, between Schmidt's *Reniera fibulata* (*l. c.*) and his *R. bullata* from the coast of Portugal (British Museum, mounted specimen; and Atlantisch. Spongienf. p. 40). In the mounted specimen at the British Museum, too, of *R. accommodata* from Cette in the south of France (Spong. Küste Algier. p. 30) there are with the same form of skeleton-spicule tricurvates as well as bihamates. But this is a world-wide sponge, presenting several slight varieties in its spicular complement, yet, I think, only one general form, to which I hope to return for more lengthy consideration on a future occasion, as the subject is thus well worthy of a separate treatise.

Reniera fibulata and its like will come into a Group as yet unnamed in my fifth division of sponges, viz. RAYNERIÆ.

Dictyocylindrus anchorata, n. sp. Plate XV. fig. 43, *a*, *b*, *c*.

This is another sponge which, in small amorphous masses, occurs about the *Corticium* just mentioned, and presents three kinds of spicules, viz. a skeleton, an echinating, and a flesh-spicule. Skeleton-spicule stout, smooth, curved, gradually pointed; but the curve sudden and *between the centre and the large end*, which is very characteristic of the sponges bearing this form of spicule; average largest size 60 by 2-1800ths inch in its greatest diameters (fig. 43, *a*). Echinating spicule nearly straight, acuate, or club-shaped and short-spined throughout; average largest size 34 by ½-1800th of an inch in its greatest diameters (fig. 43, *b*). By the term "echinating" is meant a spicule that has its head fixed in the fibre which sustains the skeleton-spicules, while the rest of its body is free. Flesh-spicule a minute anchorate, of the navicular or weaver's-shuttle-like form, much bent upon itself; average largest size 1½-1800th of an inch long (fig. 43, *c*).

This sponge would of course come among my fourth division of sponges, viz. ARMATÆ.

Hence about the specimen of *Corticium abyssi* which envelops the *Lophohelia* (see fig. of spec. Annals, *l. c.*) there are seven kinds of sponges, viz.:—*Farrea occa* and *Aphrocallistes Bocagei*, which grew on the branches of the dead coral; *Cliona abyssorum*, the boring sponge, which inhabited their interior; *Corticium abyssi*, which enveloped the whole; and *Desmacella pumilio*, *Reniera fibulata*, and *Dictyocylindrus*

anchorata, which, in amorphous fragments, exist inside the tubes of the *Farrea* and on the surface of the *Corticium* respectively.

Lastly, we come to two beautiful forms of sponge-spicules which were found *free* in an arenaceous deposit of the Agulhas Shoal at the Cape of Good Hope, and in the neighbourhood of Colon, Panama, respectively:—the former dredged up by Dr. G. C. Wallich himself in 1857; and the latter from Colon, together with the forcipiform spicule above mentioned, just mounted and forwarded to me by Mr. F. Kitton, of Norwich.

For the sponge bearing the spicule from the Agulhas Shoal I propose the name of "*Gummina Wallichii*," and for that from Colon "*Corticium Kittonii*."

To some it may seem strange to give a name to a sponge from a single form of spicule; but when it is considered that there is no kind of sponges but the Gummineæ of Schmidt in which such-like spicules are to be found, and that the spicules themselves respectively are sufficiently remarkable to characterize any sponge, the difficulty will probably disappear. Let us now proceed to their description, beginning with

Gummina Wallichii, n. sp. Pl. XV. fig. 46, *a*, *b*, *c*.

Spicule acerate, curved, fusiform, covered with twelve (?) rows of prominent tubercles, alternately placed in longitudinal lines extending from one end of the spicule to the other (fig. 46, *b*). Tubercle (fig. 46, *c*) consisting of a short cylindrical process somewhat expanded at the base, constricted in the centre, and again slightly expanded at the summit, which is round (fig. 46, *c*). Central canal (fig. 46, *a*) bent angularly in the centre, from which it proceeds towards each extremity in a slightly undulating form, straightening towards the end. Size of specimen 58 by $4\frac{1}{2}$-1800ths inch in its greatest diameters.

Obs. Of the arenaceous deposit in which this exquisitely beautiful spicule was found, Dr. G. C. Wallich, who kindly sent it to me in February 1871, states, "I have a considerable quantity of a green sand-like deposit which I dredged up in 80 to 100 fathoms water on the Agulhas Shoal so long ago as 1857."

It is interesting to find that the arenaceous deposit from which Mr. Kitton obtained his spicules was of a like nature, inasmuch as, after boiling a portion of it in nitric acid, he states that the casts of the internal cavities of Foraminifera, minute corals, and boring sponges, which were also present, came out of a "dark green colour like the greensand fossils."

It is further interesting to find a figure of this spicule in Dr. Bowerbank's 'British Spongiadæ' (vol. i. p. 270, pl. xi. fig. 244), which is stated to have been "repeatedly found in the matter obtained by washing the roots of *Oculina rosea* and other corals from the South Sea by my friends Messrs. Mathew Marshall, Legg and Ingall; but the sponge from whence it is most probably derived has never yet been determined," &c. With this Dr. Bowerbank gives two other figures of similar kinds of spicules, and considers that they "indicate the existence of a peculiar tribe of sponges with which we are at present entirely unacquainted." That "tribe," as I have above stated, is probably Schmidt's Gummineæ.

Corticium Kittonii, n. sp. Pl. XV. fig. 48, *a*, *b*, *c*.

Spicule stout, consisting of a short shaft from one end of which 2, 3, or 4 arms spread upwards and outwards *en fleur-de-lis* (fig. 48, *a*, *b*, *c*). Arms about twice the length of the shaft, and all parts, with the exception of that about the junction of the arms with the shaft, thickly covered by stout vertical short spines. Size of specimens—total length 19-1800ths inch; shaft 11 by 2-1800ths inch in its greatest diameters.

Obs. The arenaceous deposit from which these beautiful spicules were obtained came from the neighbourhood of Colon, Panama, and was sent to Mr. Kitton, of Norwich, chiefly for its richness in Diatomaceæ. They are so exquisitely mounted, and so perfect, that nothing further in this respect could be desired; while they are so characteristically like those of *Corticium abyssi* which I have described and figured in the 'Annals' (vol. xii. July 1873, p. 19, pl. i. figs. 3–5), that I do not think I can be wrong in giving the name above mentioned to the sponge from which these were originally derived.

To the likeness in nature of the arenaceous deposit from which these spicules were obtained to that of the Agulhas Shoal dredged up by Dr. Wallich, and of both to the "greensand" of the Chalk Formation, I have above alluded.

Nor should I omit to add here, respecting the probable existence of the Gummineæ themselves in the "greensand deposit," that the fossil spicules termed "*Monilites*" (Annals, vol. vii. 1871, p. 132, pl. ix. figs. 44–47, now that I am better acquainted with the existing species) seem to me to have belonged to sponges of this kind; while I have lately found acerate and short-shafted, three-armed, *beaded* forms of this spicule in some powder from the interior of a flint from

Warborough, Berkshire, forwarded to me by the Rev. R. St. Pattrick, in company with a full spicular complement of the fossil *Geodia* termed (*l. c.*) *Geodites haldonensis*, in great abundance, which appears to have been the specimen in particular enclosed in this flint.

Thus the *Gummina* would seem to have grown about the *Geodia* before the latter became imbedded for fossilization; while it is curious that among the deposits of heterogeneous sponge-spicules in the Upper Greensand of Haldon Hill, I should have happened to select the very spicules for the representative of *Geodites haldonensis* that are, with the exception of those of the supposed *Gummina*, exclusively present in the powder of the Warborough flint.

Thus it would *à priori* appear that, by going to the interior of flints, we may be able to find out the exact spicular complement of each species whose spicules are heterogeneously mixed up in the spiculiferous deposits of the Greensand.

But, on the other hand, the presence of seven existing species together, as found in the deep-sea specimen to which I have above alluded, shows how we may be defeated in this inquiry.

EXPLANATION OF THE PLATES.

Plate XIII.

All the spicules in Plates XIII. and XIV. are flesh-spicules, and, to show their sizes relatively, all, with the exception of fig. 32, *a*, Plate XIV., have been drawn on the scale of 1-12th to 1-6000th inch. Fig. 32, *a* is drawn on the scale of 1-12th to 1-1800th inch.

Fig. 1. *Halichondria incrustans*, Bk, equianchorate, three views: *a*, lateral, *b*, anterior, and *c*, posterior views, respectively; *d d d*, shaft; *e e e e*, anterior arm; *f f f f*, lateral arms; *g g*, falx of anterior arm; *h h h h*, falces of lateral arms; *i i*, tubercle, here linear.

In this instance the shaft is alate on each side, above and below, as seen in *b* and *c*.

N.B. The anchorate of *Halichondria incrustans* is figured and described in detail especially to enable the reader to comprehend the following forms of this spicule, which are so modified, that they would be almost unintelligible without a key of this kind.

Fig. 2. *Guitarra fimbriata*, n. gen. et sp., natural size.

Fig. 3. The same, magnified two diameters: *a*, apical vent, surrounded by a fringe of long spicules; *b*, root; *c*, smaller vents on the surface; *d*, portion of surface *en profil*, more magnified to show the structure of its villous surface.

Fig. 4. The same, three views of the anchorate: *a*, lateral view, *b*, anterior, and *c*, posterior view (all fringed on their inner aspect); *d*, fringe; *e*, tubercle; *f*, falx.

Fig. 5. The same, embryonic form of this anchorate.

Fig. 6. *Melonanchora elliptica*, n. gen. et sp., natural size, lateral view: *a a*, tubercular pore-areæ; *b*, small stone in the base.

Fig. 7. The same, basal view, natural size: *a*, tubercular pore-areæ; *b*, stone in the base.

Fig. 8. The same, tubercular pore-area, much magnified to show its cribriform sarcode, crossed by bundles of the dermal spicules, *a*.

Fig. 9. The same, anchorate, nearly fully developed, lateral view. When fully developed the notch in the centre of the inner margin of the arms (*a*) is entirely obliterated, and the arms thus rendered uninterruptedly continuous. All the arms present fine parallel striæ (*b*) perpendicular to the margin.

Fig. 10. The same, end view, showing the four melonoid divisions crossing each other at right angles.

Fig. 11. The same, earlier stage of development of anchorate when the arms are approaching each other but not united. The dotted lines indicate the direction in which they extend to meet each other so as, with the shaft, to form a melonoid form like figs. 9 & 10.

Fig. 12. The same, embryonic form: *a*, lateral; *b*, anterior view.

Fig. 13. *Esperia villosa*, n. sp.: *a*, naked fibre spreading below into a root-like form of attachment; *b*, magnified view of dermal sarcode, to show how the projecting tufts of spicules form the villous surface, with the pores intervening; *c*, the same, with the spicules broken off and their ends only showing.

Fig. 14. The same, fully developed anchorate, navicular, or weaver's-shuttle-like form: *a*, anterior view; *b*, lateral view; *c*, half-developed form, to show the difference in width of the arms &c.; *d*, embryonic form; *e*, apparent constriction in shaft formed from approximation of lateral arms in fully developed form.

Fig. 15. The same, bihamate spicule: *a*, central canal.

Plate XIV.

Fig. 16. *Esperia cupressiformis*, n. sp., magnified two diameters: *a*, root; *b*, stem; *c*, branches; *d*, upper extremity; *e*, branch, more magnified; *f*, end of same, still more magnified, to show termination of skeleton-spicules covered by sarcode densely charged with the flesh-spicules figs. 17 and 18, the ends of the former of which project; *g*, *Esperia cupressiformis* (variety of), the end magnified, to show *h*, branches of the same, webbed together by dermal sarcode.

Fig. 17. The same, flesh-spicule of inequianchorate: *a*, lateral view; *b*, anterior view.

Fig. 18. The same, forcipiform flesh-spicule: *a*, enlarged view of bulbous extremity.

Fig. 19. *Esperia cupressiformis*, variety of, natural size: *a*, lateral view of head, showing its compressed form and lip-like semi-division, in a line parallel to the compression, also its surface half-covered with projecting bundles of skeleton-spicules; *b*, the same, front view of flat side; *c*, stem and root.

Fig. 20. *Chondrocladia virgata*, Wy. Thomson: *a*, lateral view of equianchorate; *b*, anterior view of same; *c*, posterior view of one extremity as seen from behind, to show the form of tooth and head, with the union of the latter through the falx to the alate end of the shaft; *d*, head; *e e e e*, alate appendages of the

shaft; *f*, falx or eighth arm of head joining the latter to the shaft.

Fig. 21. The same, bihamate flesh-spicule.

Fig. 22. *Cladorhiza abyssicola*, Sars, inequianchorate of, to compare with the foregoing: *a*, lateral view; *b*, dorsal view; *c c*, aborted ends; *d*, alate appendages of shaft; *e*, falx.

The other flesh-spicule, viz. the bihamate, being of enormous size, is too large to be here introduced.

Fig. 23. *Histoderma appendiculatum*, n. sp., natural size: *a*, body; *b*, tubular appendages; *c*, conical projection at the end.

Fig. 24. The same, equianchorate: *a*, lateral view; *b*, anterior view.

Fig. 25. The same, bihamate flesh-spicule.

Fig. 26. *Halichondria abyssi*, n. sp., natural size, on a deciduous ostracean shell: *a*, sponge; *b*, shell.

Fig. 27. The same, equianchorate: *a*, anterior view; *b*, lateral view; *c*, embryonic form.

N.B. Here there are no alate appendages, but the end of the shaft widens into the umbrella-like head.

Fig. 28. The same, tricurvate flesh-spicule, seen in one of the two specimens only.

Fig. 29. *Halichondria forcipis*, Bk., upper surface, natural size: *a*, fragment of dermal surface, to show pore-areæ = cribriform sarcode in the interstices of the skeleton-structure.

Fig. 30. The same, lower surface, natural size: showing large cancellous structure, and detritus imbedded in the sarcode: *a*, deciduous ostracean bivalve shell.

Fig. 31. The same, equianchorate: *a*, lateral view; *b*, anterior view.

Fig. 32. The same, forcipiform spicule incipiently spined: *a*, full-grown form; *b*, embryonic form.

Fig. 33. *Cliona abyssorum*, n. sp., spiro-sinuous flesh-spicule.

Plate XV.

All the spicules in this Plate are drawn on the scale of 1-12th to 1-1800th of an inch, with the exception of figs. 42, *a*, 43, *a*, *b*, 44, *a*, and 45, *a*, *b*, *c*, which are all on the scale of 1-24th to 1-1800th inch, and fig. 47, on the scale of 1-12th to 1-6000th inch, to show their relative sizes.

Fig. 34. *Guitarra fimbriata*, skeleton-spicule of one form only.

Fig. 35. *Melonanchora elliptica*, skeleton-spicules of two forms: *a*, small; *b*, larger form.

Fig. 36. *Esperia villosa*, skeleton-spicule of one form only.

Fig. 37. *Esperia cupressiformis*, skeleton-spicule of one form only.

Fig. 38. *Chondrocladia virgata*, Wy. Thomson, skeleton-spicule of one form only.

Fig. 39. *Histoderma appendiculatum*, skeleton-spicules of two forms: *a*, large; *b*, smaller form.

Fig. 40. *Halichondria abyssi*, skeleton-spicules of three forms: *a*, long acerate; *b*, shorter and stout acuate; *c*, smallest, with inflated ends.

Fig. 41. *Halichondria forcipis*, Bk., skeleton-spicule of two forms: *a*, small; *b*, large.

Fig. 42. *Desmacella pumilio*, Schmidt: *a*, skeleton-spicule of one form only; *b* and *c*, flesh-spicules, tricurvate and bihamate respectively.

Fig. 43. *Dictyocylindrus anchorata*, n. sp.: *a*, skeleton-spicule of one kind only; *b*, echinating spicule, spinous; *c*, equianchorate flesh-spicule, navicular, much bent upon itself.

Fig. 44. *Reniera fibulata*, Schmidt: *a*, skelcton-spicule of one kind only; *b*, flesh-spicule, bihamate.

Fig. 45. *Cliona abyssorum*, skeleton-spicules of two forms: *a*, large, pin-like; *b*, smaller, acerate; *c*, flesh-spicule, spiro-sinuous. See more magnified view of the latter in fig. 33, Pl. XIV.

Fig. 46. *Gummina Wallichii*: *a*, central canal; *b*, rows of tubercles; *c*, more magnified view of tubercle.

N.B. In the upper half, for convenience, the tubercles are omitted.

Fig. 47. *Forcepia colonensis*. Scale 1-12th to 1-6000th inch.

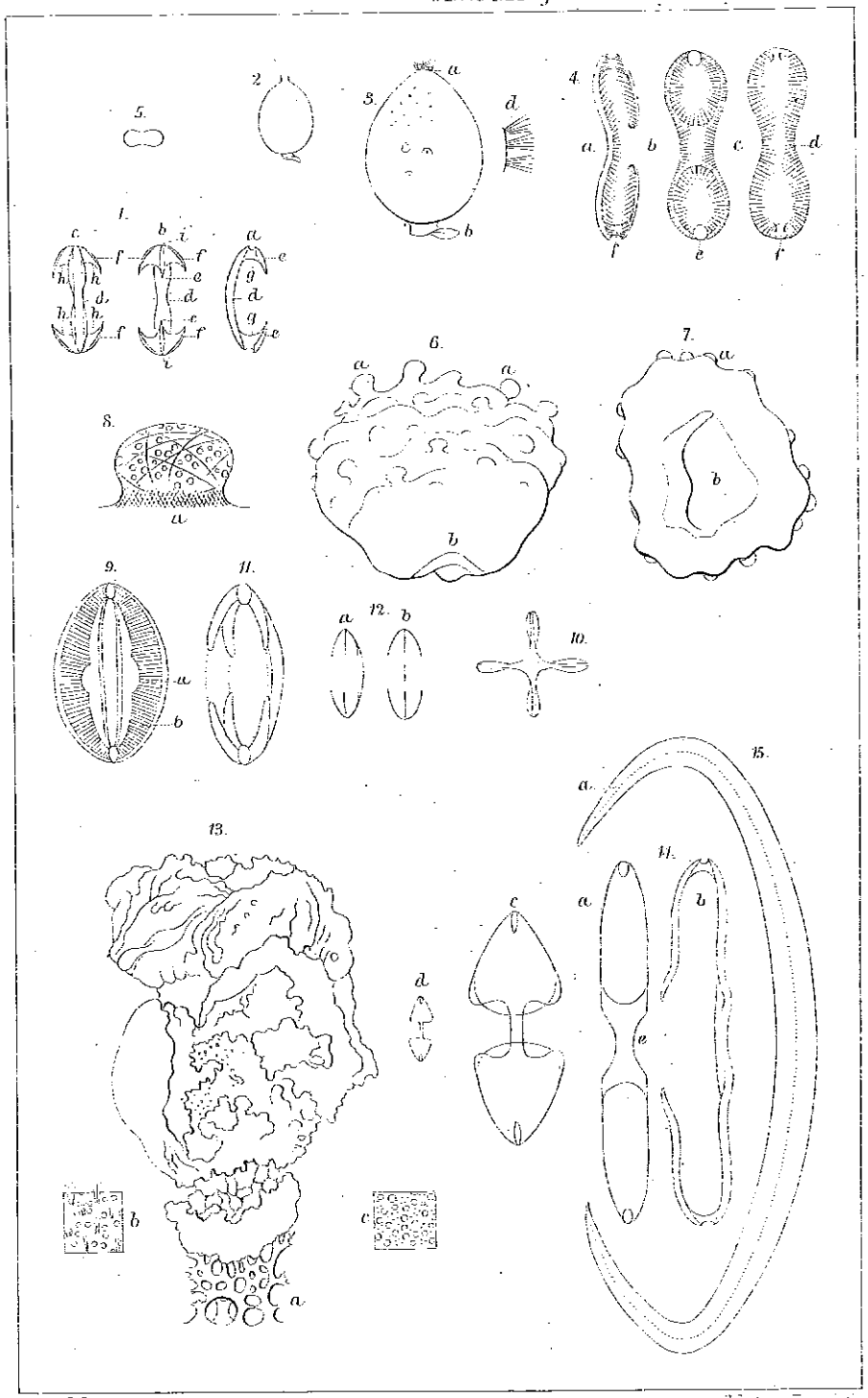
N.B. On one side the spines are partly omitted for convenience. This figure is intended for comparison with fig. 32, *a*, Pl. XIV.; but it should be remembered that it is drawn to a much larger scale, not being half so long as fig. 32 in reality, although stouter and more markedly spined.

Fig. 48. *Corticium Kittonii*: *a*, three-branched form; *b*, four-branched (here the spines are again omitted for convenience); *c*, two-branched form.

XXXII.—*Description of a new Species of Lizard of the Genus* Celestus. By A. W. E. O'Shaughnessy, Assistant in the Natural-History Departments of the British Museum.

Celestus bilobatus, sp. n.

Body slender, elongate, rounded; limbs short, the anterior not reaching to the eye, the posterior not quite to the middle of the side. Ear very small, almost closed. Head obtuse; muzzle rounded, shorter than the interorbital width of the head. Supranasals two pairs; internasal large, broad; frontal broad, oblong; small interparietal, smaller fronto-parietals, large parietals, and small occipital. A small scale or two scales wedged in between parietals and supraorbitals. Five supraorbitals, the fifth triangular, entirely on the flattened upper surface of the head and abutting on the internasal. Two narrow plates, one elongate, coming forward from the line of the supraoculars, are wedged in between the fifth supraorbital and internasal and the several postnasal or lateral plates, of which there are two postnasals proper, one over the other, and two consecutive loreals. Rostral very short and very wide. Supralabials eight. Teeth conspicuously bilobate. Scales in forty-one longitudinal series, twelve-to-fourteen-keeled, without prominent central keel; eighty-six scales in the median ventral series; the preanal scales much larger, in three rows, about twelve. All the scales rounded. Tail much longer than body and head.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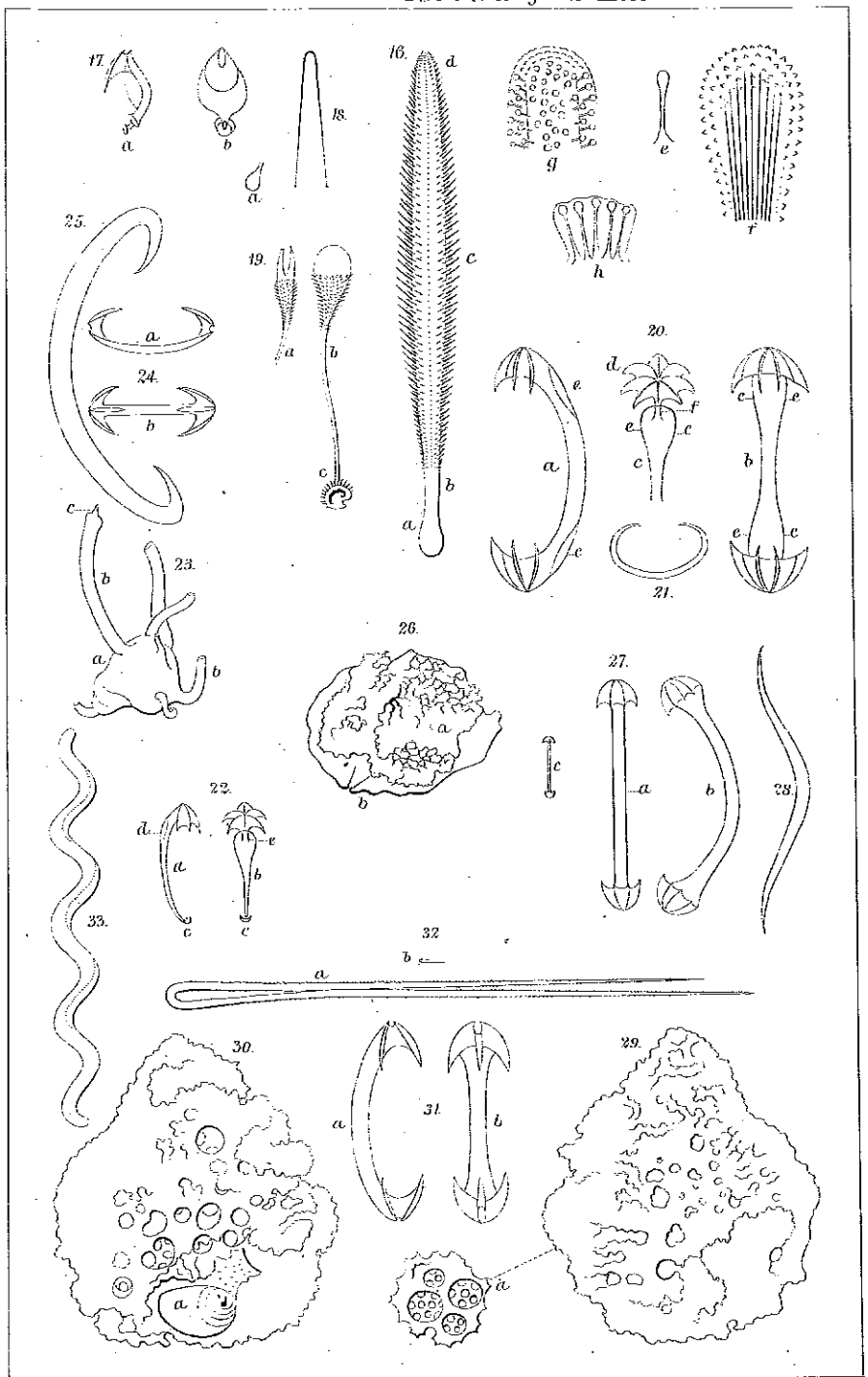

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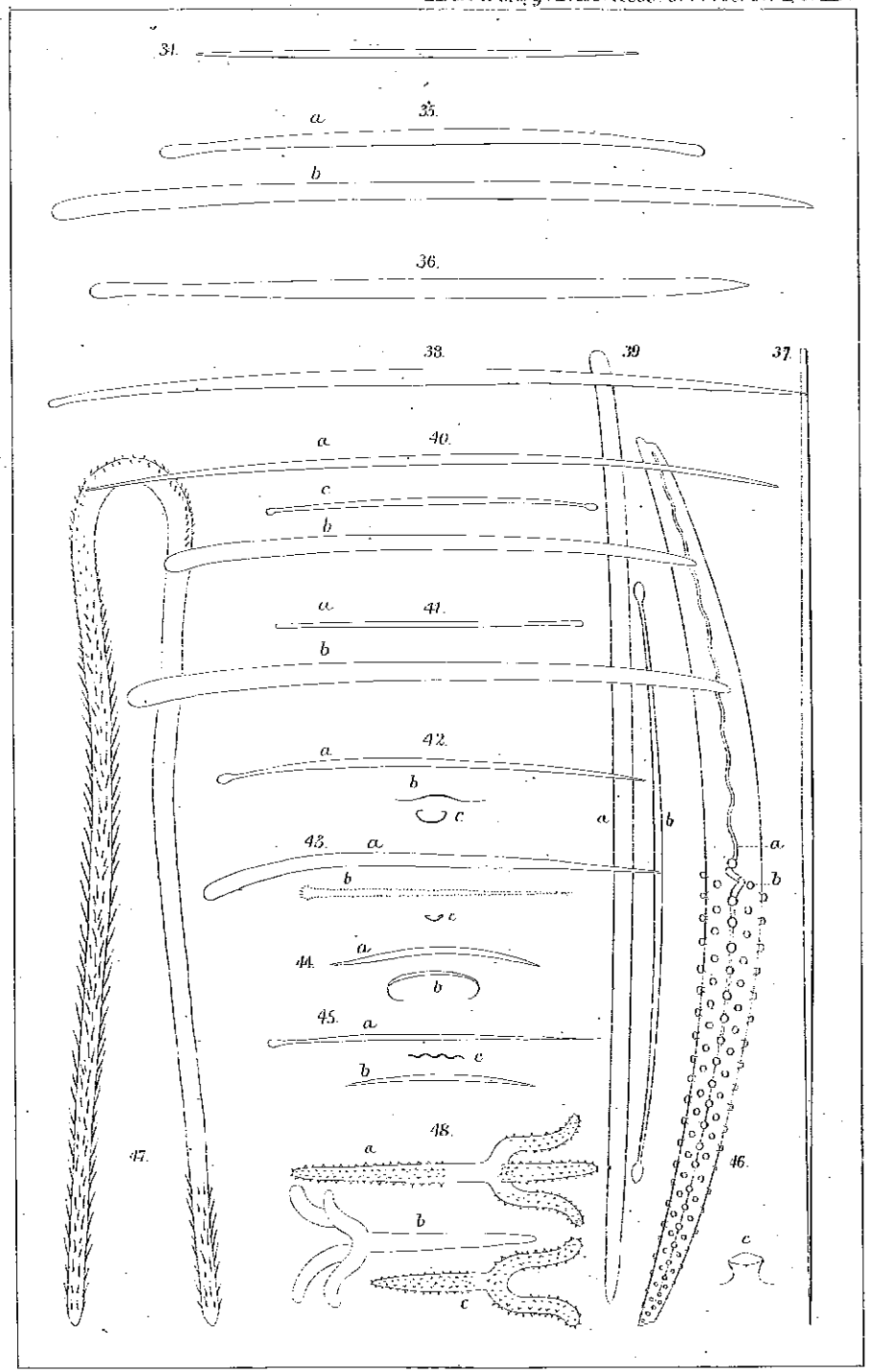

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