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XXVII.—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)

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Astacoides * are large and few in number; and the young undergo no metamorphosis after quitting the egg. A large female of *Astacoides zealandicus* has but 380 eggs, measuring $2\frac{3}{4} \times 2\frac{1}{2}$ millims., under the tail; and these are attached to the appendages in the manner described by Lereboullet (in Ann. des Sc. Nat. sér. 4, vol. xiv. 1860) for *Astacus fluviatilis*.

XXVII.—*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.

[Continued from p. 240.]

Hymeraphia vermiculata, Bk., var. *erecta*, n. sp. (Pl. XII. fig. 4, and Pl. XV. fig. 26, a, b.)

General form short, cylindrical, angular, club-shaped, becoming massive, lobed and lobulated, or compressed and expanding flabellately. Colour now yellowish white. Surface hirsute, even, reticulo-pitted, more or less furrowed; dermal structure reticulate. Pores in the sarcode tympanizing the interstices of the dermal reticulation. Vents scattered here and there on the surface. Internal structure consisting of fasciculi branching and subdividing obliquely from a central axis amidst the sarcode, which again is traversed by the branches of the excretory canal-system, that terminate for the most part in the furrows of the surface, which in their natural state are converted into canals by the dermal sarcode. Colour internally the same as that of the surface, or perhaps a little deeper. Spicules of one kind only, viz. skeleton-; no flesh-spicules. Skeleton-spicules of two forms, viz. :—1, very large, long and acuminate, smooth, sharp-pointed, slightly curved towards the fixed end, which is the widest part of the spicule, but not inflated, 100- by $3\frac{1}{2}$ -1800ths inch (Pl. XV. fig. 26, a); 2, subskeleton-, a much smaller spicule, vermiculate, acerate, acuminate, or cylindrical and obtuse at the ends, 45- by 1-1800th inch (fig. 26, b). The large acuates at their fixed ends are imbedded in a mass of interwoven vermiculates, which thus form fasciculi round them (Pl. XII. fig. 4, a, b), while their

* *Astacoides*, Guérin, Revue Zool. 1839, p. 109; *Paranephrops*, White, in Gray's Zool. Misc. 1842, p. 78, and Diefenbach's 'New Zealand,' 1843, ii. p. 267.

pointed ends, projecting externally, give the hirsute appearance to the dermal sarcodæ, where the points are so arranged in linear network as to present the reticulo-pitted aspect above mentioned. Size of sponge extending from a thin lamina up to 3 inches in height, varying in thickness with the form taken by the sponge.

Hab. Marine, attached individually to little pebbles.

Loc. Atlantic Ocean, between the north of Scotland, the Shetland and the Färøe Islands, in depths varying from 114 to 640 fathoms.

Obs. In form this species only differs from *H. vermiculata*, Bk. (which is thin, laminiform, and incrusting, fig. 4, c), in being erect or vertical, but in nothing else, further than that the spicules appear to be a little larger and the vermiculates a little less vermicular in *H. erecta*. In structure, both consist of large acute spicules, whose pointed ends for the most part project externally, and are tied together internally by a mass of the vermiculates; while the less degree of vermiculation of the latter in *H. erecta*, as well as the tendency to a flabellate form, seems to point out a transition of the latter to *Phakellia ventilabrum*, where the interlacing spicules still retain a little vermiculation, until it is lost altogether in *P. infundibuliformis*, where the shape of the acute remains, but that of the undulating or vermicular spicule has passed into a simply curved acerate, which curve, it should be also remembered, approaches in form to that of a 'bend' in the centre, ending with *Axinella*. Thus we have a group of sponges extending from the lowest form, viz. *Hymeraphia vermiculata*, to *Axinella*, which may hereafter be found serviceable in dividing the group Multiformia of my suborder Axinellida in the order Echinonemata. *Hymeraphia vermiculata* bears a similar relation to *Phakellia ventilabrum* that *Microciona atosanguinea* does to *Halichondria plumosa*.

H. erecta is present in several jars, especially in No. 65, whose depth is 345 fathoms, about 40 miles N.W. of the Shetland Islands; and *H. vermiculata* is almost always found in company with it. Fragments of *Phakellia ventilabrum* and *P. infundibuliformis* also come from the same localities. At station 51 portions of *Geodia*, *Stelletta*, and *Reniera fibulata*, Sdt., were dredged up with it; and at 65, *Geodia*, *Tisiphonia*, *Donatia lyncurium*, *Trichostemma hemisphaericum*, Sars, *Polymastia brevis*, Bk., and *Phakellia ventilabrum*.

Both *Axinella mastophora*, Sdt., and *Auletta syncynularia*, Sdt. (Atlantisch. Spongienf. pp. 45 and 61, and Taf. iv. figs. 5 and 14 respectively), appear, from the form of their spicules and hirsute surfaces, to be allied to *H. erecta*.

Cornulum textile, n. sp. (Pl. XII. fig. 9, and Pl. XV. fig. 28, *a*, *b*.)

General form an obconic sheath, horn-shaped, more or less twisted or bent upon itself, fixed by the narrow end, open at the large one, which is filled up by a protruding portion of the internal structure. Colour yellowish white. Surface of the sheath or dermis smooth, presenting a number of circular ridges marking the degrees of growth; composed of a horny sarcodic membrane densely charged with spicules, so as to resemble a textile fabric (Pl. XII. fig. 9, *a*). Pores and vents probably in the protruding mutilated head, in which, as usual in the histodermal forms, the structure is so delicate that all the soft parts are broken down into a confused pulp. Internal structure (fig. 9, *b*) consisting of a conical fibrous mass corresponding in form with that of the sheath, consisting of bundles of spicules dividing and subdividing from the conical to the expanded end, where they terminate in thin plumose lacinulations; supporting throughout the internal sarcode and excretory system, before the sarcode becomes broken down. Colour yellowish white. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicules of two forms, viz. :—1, large, subfusiform, smooth, sometimes slightly inflated at the ends, which are round and microspined, 27- by 1-1800th inch (Pl. XV. fig. 28, *a*); 2, subskeleton-spicule, extremely thin, acuate, smooth and pointed, subundulous, 32-55-6000ths by 1-18,000th inch (fig. 28, *b*). Flesh-spicules of two forms, viz. :—1, very small, equianchorate, navicular, 3-6000ths inch long (Pl. XII. fig. 9, *c*); 2, tricurvate or bow-shaped, smooth and pointed, 30-6000ths inch long (fig. 9, *d*). The large skeleton-spicules, which are the only ones that appear under an inch object-glass, are chiefly confined to the sheath and the fibrous bundles forming the skeleton of the internal structure, while the rest are distributed generally throughout the broken-down sarcode. Size of specimens about one inch long by a quarter to half an inch in diameter at the widest end.

Hab. Marine, attached to hard objects.

Loc. About 40 miles N.W. of the Shetland Islands, in 345 fathoms.

Obs. These specimens, of which there are three, are contained in jars bearing the same number, viz. "65," which gives the locality and depth above mentioned. One is accompanied by a fragment of *Halichondria panicea*. The spicules generally and their arrangement in the skeleton point to the second division of the Echinonemata, viz. the Axinellida, especially as many of the large ones have a tendency to an acuate

form, while the loose structure of the internal parts, unattended by any dense axial arrangement, is more like the *Halichondrina*. Pending the examination of a perfect specimen, which, I expect, from the delicate structure of the internal contents in all the "histodermal" sponges, is not likely to be soon obtained, I think this sponge had better be placed provisionally in the second division of the *Echinonemata*. In all the specimens the protruding head being fringed out, probably by friction and decomposition, thus fails to present the original form.

Halichondria foliata, Bk. (*op. cit.* vol. iii. pl. 73. fig. 1).

(Pl. XII. fig. 10, and Pl. XV. fig. 29, *a*, *b*.)

Of this sponge there is only a fragment by itself in a jar numbered 65, which station is a little N.W. of the Shetland Islands. It is about $\frac{3}{4}$ inch square and $\frac{1}{8}$ inch thick, and belonged to a compressed, erect or vertical sponge entirely composed of a reticulated, anastomosing structure, whose interstices are open from side to side—that is, directly through the sponge fenestrally. The reticulated fibre, which is ragged and hirsute from the projection of spicules, is now of a pale whitish-yellow colour. Pores and vents not evident. Spicules of two kinds, viz. skeleton- and flesh-spicules. Large skeleton-spicule acuate, smooth, sharp-pointed towards the large end, 94- by 4-6000ths inch (Pl. XV. fig. 29, *a*); small or subskeleton-spicule also acuate, smooth, sharp-pointed, inflated at the large end, scantily spined over the extremity, 78- by 1-6000th inch (fig. 29, *b*). Flesh-spicules of two forms, viz.:—1, equianchorate, navicular or shuttle-shaped, 4-6000ths inch long (Pl. XII. fig. 10, *a*); and, 2, a tricurvate, whose arms are very thin and spread out horizontally to a great extent, with a sudden bend in the centre, often converted into a loop, 140-6000ths inch long (fig. 10, *b*). It is by the projection of the large skeleton-spicules chiefly that the hirsute surface is produced. The remarkable form and size of the tricurvate are not confined to this sponge; for they are to be found in *Microciona armata*, Bk.; but here the ends are spiniferous. I learn this more particularly from a mounted specimen of this sponge which I have found here (Budleigh-Salterton).

Isodictya spinispiculum, n. sp. (Pl. XV. fig. 42.)

On the rough flat stone bearing a specimen of *Macandrewia azorica* before mentioned, with one of *Geodia nodastrella*, n. sp., to be hereafter described, is a portion of *Isodictya spinispiculum*.

The jar in which this is contained bears on its label "25, 75-374 fathoms, a few miles north of Cape St. Vincent." Here 75-374 may mean "from 75 to 374" fathoms. Besides the sponges mentioned, the jar contains *Corallistes Bowerbankii*, *Azorica Pfeifferæ*, *Pachastrella abyssi*, *Stelletta pachastrelloides*, n. sp., *Phakellia ventilabrum*, &c. The portion of *Isodictya* is laminiform, about half an inch in diameter, and 1-24th inch thick. Its surface is even and covered with holes (? pores and vents respectively), while the interior consists of an areolar structure easily crushable, and composed of sarcode charged with one kind of spicule only, which is arranged in bundles end to end, and crossing each other in accordance with the kind and form of the areolar structure common to the *Isodictyosa*. The spicule is straight, cylindrical, bent abruptly close to each end and rounded terminally; but while one end is turned in one direction, the other is not turned in the opposite, but laterally, so that when the bend of one end is seen the other is obscured by being in a line with the shaft; besides this, the shaft is sparsely covered throughout with short erect spines, except at the ends which are smooth, about 50- by 2-6000ths inch (Pl. XV. fig. 42). Size of entire specimen half an inch in horizontal diameter.

Hab. Marine, on hard objects.

Loc. Above mentioned.

Obs. The most remarkable point about this little specimen is the peculiar character of its spiculum.

THALYSIAS, Duchass. de Fonb. et Michelotti.

There are three small specimens of *Thalysias*, two of which are on large fragments of *Corallistes Bowerbankii* from station 25=374 fathoms near Cape St. Vincent, and the other separate in a jar numbered 6=345 fathoms N.W. of the Shetland Islands. All present the chalky-white appearance characteristic of the sponge to which Duchassaing de Fonbressin et G. Michelotti have given the name "*Thalysias*" ('*Spongiaires de la Mer Caraïbe*, pl. xvii. fig. 1), and consist of two or three papillæ, open respectively at the summit; but when examined microscopically two are found to present only one kind of spicule, which is nearly cylindrical, curved, smooth, and round at the ends, 28- by $1\frac{1}{2}$ -6000th inch; and the other two kinds of spicules, viz. a skeleton- and a flesh-spicule; of which the skeleton-spicule also is nearly cylindrical, curved and smooth, but abruptly pointed at the ends, 45- by $2\frac{1}{2}$ -6000ths inch, and the flesh-spicule a fine tricurvate, 9-6000ths inch long.

This is the first time that I have found the skeleton-spicule of

a *Thalysias* to be accompanied by any flesh-spicule; and hence I propose for it the name of *T. tricurvatifera*; it is one of those on *Corallistes Bowerbankii* from Cape St. Vincent. The value, however, of the presence or absence of a flesh-spicule for specific designation will, I think, as I have before stated, be found very doubtful in many instances.

Reniera crassa, n. sp.

General form irregular, massive, lobate. Colour pale ochre-yellow. Surface even, undulating with the form of the mass, provided with a beautiful dermal reticulation (composed of sarcode charged with the spicules of the species) whose free side is smooth and the other rough where it intermingles with the subjacent structure. Pores in the sarcode tympanizing the interstices of the dermal reticulation. Vents congregated in large deep depressions or holes here and there, where they open through a large cribriform dermal layer at the bottom. Internal structure massive, areolar, composed of sarcode densely charged with the spicules of the species and traversed by the branches of the excretory canal-system, which finally open at the cribriform vents mentioned. Spicule of one kind only, viz. acerate, curved, smooth, abruptly pointed, 85- by $4\frac{1}{2}$ -6000ths inch, accompanied by others of all sizes, some of which are not more than 6-6000ths inch long, although of the same thickness (that is, nearly as thick as long), with rounded ends, sausage-like. Size of specimen about 6 inches long by 3 inches thick.

Hab. Marine.

Loc. A little south of the Färöe Islands, in 167 fathoms.

Obs. The number on the jar containing this specimen is "60," which station gives the locality and depth above mentioned. It is one of the coarse, large Renierida which I intend to place under the group "Crassa." They much exceed in size the Thalyosa, which they otherwise resemble in consistence and spicule, being of a chalky friable nature when dry, and, for the most part, of an ochreous yellow colour. There is one in the British Museum, which is crateriform in the centre, measuring 18 inches in diameter by 12 inches high. The coarseness in structure, arising chiefly from the greater size of the spicule, is the chief character that distinguishes the Crassa from the Thalyosa.

Halichondria forcipis, Bk., var. *bulbosa*, n. sp. (Pl. XIII. fig. 19, and Pl. XV. fig. 37, *a*, *b*.)

General form, surface, pores, vents, and excretory canal-system —? (being a mere fragment). Internal structure can-

cellous, crumb-of-bread-like. Colour yellowish white. Spicules of two kinds, viz. skeleton-and flesh-spicules. Skeleton-spicules of two forms, viz. :—1, large, acuate, smooth, curved, abruptly pointed, 40- by 1-1800th inch (Pl. XV. fig. 37, *a*); 2, subskeleton-spicule, small, acerate, subfusiform, smooth, curved, with slightly inflated oval ends, 22- by $\frac{1}{2}$ -1800th inch (fig. 37, *b*). Flesh-spicules of three forms, viz. :—1, a small equianchorate, shaft slightly curved, arms slightly expanded, 9-6000ths inch long (Pl. XIII. fig. 19, *c*); 2, bihamate (*fibula*), C- or S-shaped, simple, smooth, sharp-pointed, 16-6000ths inch long (fig. 19, *d*); 3, a tricurvate or bow, compasses-like, a little open, microspined, bulbous at the extremities, 9-6000ths inch long, distance between the ends 6-6000ths inch (fig. 19, *e, f*). The large acuates and small acerates with inflated ends make up the cancellated skeleton-structure, while the flesh-spicules are dispersed throughout the sarcode occupying its interstices. Size of specimen, that of the concavity of the piece of the bivalve shell which it occupies, viz. about 1 by $\frac{1}{2}$ inch square; wholly incomplete in general form—in short, as before stated, a “mere fragment.”

Hab. Marine, on hard objects.

Loc. In a jar numbered “24 and 25—1870;” that is, in 292–374 fathoms on the north side of Cape St. Vincent.

Obs. This small imperfect specimen, designated “*bulbosa*,” from the bulbous ends of the tricurvate, was obtained from the locality and depth above mentioned, during the cruise of the ‘Porcupine’ to the Mediterranean Sea (see Report, Roy. Soc. Proc. No. 125, vol. xix.). It is accompanied by a small fragment of *Reniera fibulata*, Sdt., a rolled one of *Coralistes Bowerbankii* (?), about $\frac{3}{4}$ inch in diameter, and two rolled portions of *Askonema*-spicules matted together with sand and mud. The pincers or compasses-like form of the tricurvate is not uncommon (see ‘Annals,’ 1874, vol. xiv. p. 248, under *Halichondria forcipis*). Schmidt also represents one in *Desmacidon (Esperia) anceps*; but here only one arm has the bulbous extremity (Exped. German. 1871, “Kieselspongien,” Taf. i. fig. 4, described at p. 432); this specimen, which came from the coast of West Greenland, is figured with an *inequi-anchorate* flesh-spicule (fig. 7).

Cribrella hospitalis, Sdt. (Pl. XIII. fig. 18, and Pl. XV. fig. 36, *a, b*.)

As this sponge has already been named and described by Schmidt (Atlant. Spongienf. p. 56), and I have identified our specimens with his slide in the British Museum, there can be

little doubt that the figure and spicules respectively of ours are those of *Cribrella hospitalis*. But as Schmidt has only given one of the circular or oval cribriform areæ (fig. 19, *b*) as an illustration of this sponge, I have thought it desirable to add that of the best specimen of the *entire* sponge as dredged up on board the 'Porcupine,' together with its spicules.

There are three specimens in a jar by themselves, numbered "57," which gives a depth of 632 fathoms, and a locality midway between the north of Scotland and the Färöe Islands. They have all grown on hard objects, such as small pebbles, coral, &c.; and the largest, which is irregularly pear-shaped and has been figured (Pl. XIII. fig. 18), is $1\frac{1}{2}$ inch high, $\frac{7}{8}$ inch diameter in the head, and $\frac{1}{4}$ inch diameter in the short, stem-like base.

It belongs to my group "*Halichondrina*," as the two skeleton-spicules, viz. one a spined acuate (Pl. XV. fig. 36, *a*), and the other a smooth acerate with rounded ends (fig. 36, *b*), together with the equianchorate spicule (which is very stout and broad, Pl. XIII. fig. 18, *d*), and general structure indicate.

Halichondria phlyctenodes, n. sp. (Pl. XIII. fig. 17, and Pl. XV. fig. 35.)

General form blister-like, convex, depressed, sessile, irregularly elliptical, fixed by its marginal circumference throughout to the object on which it has grown; presenting a funnel-shaped extension of the surface here and there, which terminates respectively in a short cylindrical tubular prolongation, slightly enlarged outwards and truncated at the extremity; tubular prolongations seven in number. Colour yellowish white now. Surface even, smooth; dermal structure textile-like, formed by spicules horizontally imbedded in the dermal sarcode so as thus to form a firm membranous covering. Pores in the sarcode tympanizing the interstices between the dermal spicules. Vents respectively at the extremities of the tubular prolongations of the dermal membrane, constricted as usual, at the free end, by a sphinctral diaphragm of sarcode. Internal structure originally delicate, now pulpy, composed of spicules held together by sarcode, in which the branches of the excretory canal-system, now broken down, originally ramified. Sarcode cream-yellow. Skeleton-spicule of one form only, viz. acerate, smooth, slightly curved and obtusely pointed, 42- by 1-1800th inch (Pl. XV. fig. 35). Flesh-spicules of two forms, viz. :—1, equianchorate, short and stout, shaft much curved, bow-like, arms falcate or webbed nearly to their

ends respectively, much expanded, 8- by $3\frac{1}{2}$ -6000ths inch (Pl. XIII. fig. 17, *f*); 2, bihamate or fibula, simple, C- or S-shaped, subspiral, 20-6000ths inch long (fig. 17, *g*). The skeleton-spicules make up the chief part of the dermal and internal structures, both of which are plentifully charged with each kind of flesh-spicule. Size of specimen $1\frac{1}{4}$ inch long, $\frac{1}{8}$ inch broad, and $\frac{1}{8}$ inch high; tubular prolongations $\frac{1}{2}$ inch long by $\frac{1}{8}$ inch broad at the free extremity, which is rather larger than the fixed end.

Hab. Marine, on hard objects.

Loc. Atlantic Ocean, in 374 fathoms, a few miles north of Cape St. Vincent; on a fragment of *Corallistes Bowerbankii*, Carter.

Obs. There is only one specimen of this sponge; and it is fixed to the flat surface of one of the fragments of *Corallistes Bowerbankii* in the large jar bearing the figures 374 fathoms, = station 25 of the 1870 cruise.

The spicular complement approaches nearest to that of the group Halichondrina; but I have never been able to find the spined acute spicule common to the sponges of this group, except in one mounted instance, where it appears to be accidental, as I have sought for it in vain in many other fragments both of the dermal and internal structures. This again is another of the "histodermal" sponges dredged up on board the 'Porcupine.'

Halichondria abyssi ('Annals,' 1874, vol. xiv. p. 245, pl. xiv. figs. 26-28). (Pl. XIV. fig. 24, *a, b*.)

Since describing and illustrating the fragment of this sponge (*l. c.*), Mr. T. Higgin of Huyton, near Liverpool, has brought to my notice that the embryonic form (*l. c.* fig. 27, *c*) is birotulate—that is, that each end terminates in a dome-shaped or umbrella-like head composed of twelve spines webbed together (Pl. XIV. fig. 24, *b*) like the birotulate of *Hyalonema* &c. That this spicule is still what I have termed it, viz. "embryonic," is proved by my having found that the fully developed spicule (*l. c.* fig. 27, *b*) presents the same kind of head when a favourable view can be obtained of it (which is rather difficult, as the matured form generally lies on its side). The shaft, too, is often evidently bent, even in the embryonic state. Lately Mr. Higgin has found a West-Indian sponge of a purple-brown colour charged with this embryonic form only, which is identical with a fragment of the same kind of sponge in the British Museum stated to have come from Blackwood Bay in Australia. As the spicules of this species somewhat differ from *Halichondria abyssi*, Mr. Higgin, who has now

several good specimens from the locality mentioned, is about to describe it under the name *H. birotulata*. The locality of *Halichondria abyssi*, as before stated, is station 65, = 345 fathoms, north-west of the Shetland Islands.

Esperia placoides, n. sp. (Pl. XIII. fig. 12, and Pl. XV. fig. 32.)

General form fir-cone-like, scaly, oblong, almost cylindrical, round at the summit, rising from a stipitate base composed of a hard perspiculiferous stem, which branches upwards into the interior. Colour now yellowish grey. Surface uniformly divided into plates of various sizes and shapes (Pl. XIII. fig. 12, *a a a*), separated from each other by deep grooves (fig. 12, *b b*), except at the summit, which is formed of one continuous large scale pierced with many vents; margin of the scale scarped all round and circumscribing a somewhat convex villous area (fig. 12, *a, a*); grooves between the scales concave, smooth (fig. 12, *i*); structure of the scale spiculous, consisting of a dense layer of small spicules, which project externally, giving the villous surface (fig. 12, *f*), and interlap internally with larger ones, which, in bundles, project into the sponge (fig. 12, *g*), while the two are knit together, textile-like, by a thin transverse layer at their point of contact, thus forming a plate or scale which easily comes off entire; structure of the groove (fig. 12, *k*) sarcodic, consisting of obliquely reticulated rugæ whose interstices are pierced by the "pores" so as to form a sieve-like area, like that in *Tisiphonia agariciformis*. Pores about 1-1000th inch in diameter, situated in the sarcode tympanizing the interstices of the rugæ in the grooves (fig. 12, *k, l, & v*). Vents chiefly on the summit, where they consist of short conical elevations, terminated respectively by an aperture about 3-48ths inch in diameter, sometimes singly, in one or more of the larger scales (fig. 12, *c c & m*). Internal structure consisting of the spiculiferous stem (fig. 12, *d*), which, branching out in all directions, supports the sarcode charged with the spicules of the species and traversed by the excretory canal-system, which ends in the vents mentioned. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form, viz. sub-pinlike, almost acuate, fusiform, smooth, sharp-pointed and slightly curved, with the obtuse end less in diameter than the centre of the shaft, 60- by 1¼-1800th inch (Pl. XV. fig. 32). Flesh-spicules of three forms, viz. :—1, inequianchorate of the common *Esperia* form, separate and in rosette-like groups, 18-6000ths inch long, head 7-6000ths inch long (Pl. XIII. fig. 12, *n*); 2, bihamate

or fibula, C-shaped, simple, $4\frac{1}{2}$ -6000ths inch long (fig. 12, o); 3, fine acerates in bundles, which represent the tricurvates, 17-6000ths inch long (fig. 12, p, q). The skeleton-spicules make up the general structure, and almost entirely that of the stem and its branches, while the flesh-spicules are scattered throughout the sponge generally. Size of the most perfect specimen $2\frac{1}{2}$ inches high by $1\frac{1}{2}$ inch in transverse diameter; largest part of the stem at the base $\frac{3}{8}$ inch in diameter.

Hab. Marine.

Loc. Atlantic Ocean in 345 fathoms, at station 65, about 40 miles N.N.W. of the Shetland Islands.

Obs. There are three specimens of this sponge, viz. two in one jar and one in the other, unaccompanied by any other sponge. Both jars are labelled "65," which gives the locality and depth above mentioned. In its spicules it does not differ much from the forms most common to the group *Esperina*; but the presence of the plates and the cribriform grooves between them, as above described, gives it a distinctive scale-like character; hence the designation "*placoides*." The scales are not imbricated, but separate and arranged like slabs of stone in a pavement with a groove between them, although probably susceptible of being drawn together by general contraction when the closure of the pores becomes necessary. From the expanded and flattened state of the end of the stem it would appear that the sponge had been attached to some hard submarine object, growing erect perhaps, as the dredge could not have reached it if it had been suspended from the roof of a submarine rock-cavern. The specimens are charged with spherical ova, whose largest size measures 25-1800ths inch in diameter, and in many instances are sufficiently developed to present the rudimentary forms of the spicules of the sponge to which they belong.

Esperia borassus, n. sp. (Pl. XIII. fig. 13, and Pl. XV. fig. 33.)

So called from the groups of spicules of which it is composed resembling so many minute palmyra trees in a row. The head of each, windmill-like and supported on a stem formed of a bundle of spicules, consists of the usual forms common to *Esperia*, viz. a sub-pinlike fusiform skeleton-spicule (Pl. XV. fig. 33), and three forms of flesh-spicules, viz. the usual *inequianchorate*, separate and in rosettes (Pl. XIII. fig. 13, c), the *bihamate* or *fibula* (fig. 13, d), and the *tricurvate* or *bow*, which is here represented as usual in *Esperia*, viz. in *navicular* or *sheaf-shaped* bundles of minute

acerates, that, when separate, often present the tricurvate undulation. The entire specimen, which is not more than 5-24ths inch long by 2-24ths inch high, is situated in a small surface-depression of a large *dried* fragment of *Pachastrella abyssi*, about 3 inches square and 2 inches thick; hence it now presents no appreciable amount of sarcode; but from its striking appearance I have thought it worth illustrating, although, after all, it may be a surface portion of an *Esperia* which grows much larger and ultimately assumes a totally different aspect. No label being on the specimen of *Pachastrella*, I conclude that it came from station 25, near Cape St. Vincent, since other like specimens of the same kind of *Pachastrella* in a wet state are in the jar bearing on its label "374" fathoms.

Esperia cupressiformis, var. *bihamatifera*, n. sp.
(Pl. XIII. fig. 14, and Pl. XV. fig. 34, a, b.)

Of this sponge there is only a fragment, viz. about $\frac{1}{17}$ inch of the head or free end, with no label on the jar, where it is in company with several specimens of *Esperia cupressiformis* ('Annals,' 1874, vol. xiv. p. 215, pl. xiv. fig. 16, &c.), and also a portion of the stem of another specimen covered with *Corticium parasiticum*, together with several specimens of *Polymastia ornata*, Bk. No difference can be seen between it and *E. cupressiformis* until examined microscopically, when the presence of a large inequianchorate of a peculiar shape (Pl. XIII. fig. 14, a), and an abundance of small bihamates or fibulæ (fig. 14, c), together with the absence of the forceps-tricurvate, points out that it must be made a variety of *E. cupressiformis*; and thus it has been designated "*bihamatifera*." Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. acuate or subcapitate, smooth, fusiform, abruptly pointed, larger and less capitate in the stem than in the branchlets, 195-6000ths inch in the stem (Pl. XV. fig. 34, a), 133-6000ths inch long in the branchlet. Flesh-spicules of three forms, viz. two inequianchorates, small and large, and one bihamate. Small inequianchorate the same as that of *E. cupressiformis* (Pl. XIII. fig. 14, b); large inequianchorate of the common form, but rounded at the small end, 11-6000ths inch long (fig. 14, a); bihamate simple, 4-6000ths inch long (fig. 14, c). It is not improbable, from the presence of *Corticium parasiticum* on the portion of the stem of this species, that the whole of the contents of this jar came from the "chops" of the English Channel (see *Corticium parasiticum*, anteà).

Cladorhiza abyssicola, Sars, var. *corticocancellata*, n. sp.
(Pl. XIII. fig. 16.)

General form short-branched shrubby stems, covered with a thick cancellated cortex, echinated with short, erect, spine-like processes; ends of the branches tumid, round. Colour cream-yellow in spirit. Surface irregular, cancellate, with the holes bordered by short spine-like processes, which consist of pointed bundles of spicules. Pores in the dermal sarcode covering the cancellated structure. Vents indistinct. Internal structure consisting of the axis or stem, which is hard, compact, and colourless, being composed of spicules of the species closely approximated and arranged together longitudinally and parallel to each other, tending to the formation of a spiral cord, at right angles to which bundles of spicules issue, supporting (as they branch outwards and terminate on the spine-like processes of the surface) the cancellated sarcodic substance of the cortex, traversed by the branches of the excretory canal-system, whose openings at the vents have been stated to be indistinct. Spicules of two kinds, viz. skeleton- and flesh-spicules. Skeleton-spicule of one form only, viz. acuate, fusiform, attenuatingly pointed, smooth and nearly straight, head less in diameter than the body, 100- by 1-1800th inch. Flesh-spicules of two forms, viz.:—1, inequianchorate, exactly like that of *C. abyssicola* ('Annals,' 1874, vol. xiv. pl. 14. fig. 22); 2, bihamate or fibula, simple, smooth, with nearly a straight back or shaft and a prolonged, whip-like, everted end to each extremity, 39- by 1-6000th inch (Pl. XIII. fig. 16, a). The skeleton-spicules are chiefly confined to the stems and branches supporting the sarcode, while the largest are in the former, and the flesh-spicules scattered profusely (especially the inequianchorate) throughout the sarcode generally. Size of entire sponge unknown, as the specimens are all in fragments.

Hab. Marine.

Loc. Between the north of Scotland and the Shetland and the Färöe Islands, in 345 and 632 fathoms.

Obs. There are four jars containing specimens of *Cladorhiza abyssicola*, Sars, and *C. corticocancellata*, all more or less fragmentary and mixed together, and all bearing the same number, viz. "57," which gives the locality and depth above mentioned: add to these another jar, No. 65, which gives a locality about 40 miles N.N.W. of the Shetland Islands in 345 fathoms, containing a single specimen of *C. abyssicola* so different in form to all the rest, that it requires the short and separate description which will be given presently.

Cladorhiza abyssicola and *C. corticocancellata* differ in the following particulars, viz. :—The former (Pl. XIII. fig. 15) is more or less slender and pinnatifid in its branching, the branches long and attenuatingly pointed, and the cortex consisting of long drooping filaments issuing from a thin stratum of sarcode at their base; while the bihamate or fibula flesh-spicule is simply C-shaped (fig. 15, *a*). The latter, on the other hand, is irregularly branched, the branches thick, short and tumid towards the free end, and the cortex thick, cancellous, and covered with short, erect, spine-like processes around the holes of the surface (fig. 16), while the bihamate or fibula flesh-spicule is an elongated C-shape, whose extremities respectively are everted and prolonged into a whip-like form (fig. 16, *a*).

Lastly the peculiar form in jar 65, to which I have alluded, is like that of a pinnatifid *Gorgonia*, in which the round stem is bordered on each side by long undivided branches, coming off somewhat irregularly on each side, but all opposite or on the same plane. The cortex is uniformly granulated and hirsute, but without filamentous prolongations, and the branches and stem round and of the same size throughout, the former obtusely rounded at the free extremity. In other respects (that is, in colour and the form of its spicules respectively, together with the structure of the cortex and stem) it is exactly like *C. abyssicola*. The specimen is imperfect, inasmuch as, both the distal and proximal ends having been broken off, it gives no idea of what the entire form of the sponge was. There are four inches of the stem left, which is $\frac{1}{8}$ inch in diameter, and the longest of the branches, which are irregular in this respect, $2\frac{1}{2}$ inches in length, with a little less transverse diameter than that of the stem. Of its being identical with *C. abyssicola* in all but form, there can be no doubt; and the form, although it may constitute a variety, cannot make a distinct species. I have thought it worth while to give a short description of this specimen, because it has evidently been placed in the jar by itself under the idea that it was a distinct species, and that hereafter it might not be taken for such.

Schmidt's *C. pennatula* (Nordsee-Exped. 1872, Spongien, p. 119, Taf. i. figs. 14, 15, and 16) seems to me to be so like *C. abyssicola*, Sars, that as Schmidt states that Sars's work, wherein the latter is described and illustrated, is not accessible to him, I cannot help thinking that with more opportunities Schmidt would have pronounced his specimen to be identical with that of Sars. Indeed Schmidt himself, a little further on, questions whether the specimens of *C. abyssicola*, Sars,

alluded to by Wy. Thomson ('Depths of the Sea,' p. 113), may not be the same as his *C. pennatula*; but I cannot see among these specimens (all of which are now before me) any that are not mere modifications *in form only* of Sars's *C. abyssicola*, viz. a main stem with pinnate branches corticated with the drooping filaments or branchlets.

The "peculiar form in jar 65" above described is in no way like Sars's *C. abyssicola*, while *C. corticocancellata* is the "fourth" species of this kind of sponge to which I have alluded, but have omitted to mention further ('Ann.' 1874, vol. xiv. p. 218), wherein the anchorate possesses such a peculiar shape in the arrangement and number of the divisions of its head-like extremities. These, however, in *Halichondria abyssi*, which I thought were *lateral*, have now been found, as I have before stated, by Mr. Higgin to be circular, so that the minute spicules of which they are part are therefore as birotulate as the birotulate spicules of *Hyalonema* &c., but divided also, as before stated, into twelve arms in the way already mentioned under *Halichondria abyssi*.

Hymeraphia verticillata, Bk. (Pl. XIV. fig. 21 &c.,
and Pl. XV. fig. 39, *a*, *b*.)

General form thin, laminiform, incrusting, covered irregularly with aculeations of different heights, here and there presenting a short tubular prolongation. Colour cream-yellow or dark grey. Surface uniformly aculeated, each aculeation prolonged by the projection of a large spicule from its summit, surrounded by a number of smaller spicules, while the aculeation itself or sponge portion is chiefly composed of the dermal layer, which is densely charged with its spiniferous spicules; dermis thick, membranous, textile-like. Pores in minute depressions between the aculeations. Vents respectively at the ends of the tubular prolongations? Internal structure soft, composed of spicules held together by sarcode, traversed by the excretory canal-system, which terminates at the vents mentioned. Sarcode much yellower in the interior than on the surface. Skeleton-spicules of three forms, viz. :—1, very large, long, and acuminate, sub-pinlike, smooth, curved, sharp-pointed, often bulbous, and sometimes doubly inflated at the fixed end, 200- by 6 $\frac{3}{4}$ -1800ths inch (Pl. XV. fig. 39, *a*); 2, sub-skeleton-spicule or acerate, of a remarkable shape, viz. fusiform, nearly straight, inflated in the centre, once (sometimes twice) obtuse at the extremities, which are respectively fissurate (that is, divided into three pointed arms approximated at the points so as to form an apiculated termination); central

canal, although *not* inflated in the *centre*, is so at the *extremities*, which leads to an optical delusion, in which one arm appears to be twisted backwards (see Dr. Bowerbank's illustration, *op. cit.* vol. i. pl. x. fig. 240), 65- by 1-1800th inch (fig. 39, *b*, and Pl. XIV. fig. 21, *e-h*); 3, acerate, fusiform, curved more or less, evidently inflated in the centre, especially in the smaller forms, verticillately spined throughout at regular intervals, the spines becoming general towards the ends (Pl. XIV. fig. 21, *i*)—or moniliform, with smooth, elliptical inflations only, decreasing in size from the centre towards either end (fig. 21, *k*), 20-1800ths inch long. The large spicules, viz. no. 1, project singly, for the most part, from the summits of the aculeations respectively (fig. 21, *m-p*), while no. 2, the centrally inflated subskeleton-spicule, is chiefly congregated round them at their exit from the aculeation (fig. 21, *oo*); and the verticillately spined and moniliform spicules, viz. no. 3 (fig. 21, *i, k*), make up, in their smaller sizes, the greater part of the dermal layer (fig. 21, *n*), while the larger ones are confined to the inner sarcode. Size of specimen about $\frac{1}{12}$ inch in horizontal diameter and about $\frac{1}{12}$ inch thick in the centre, including the aculeations, which amount to half this.

Hab. Marine, on small pebbles.

Loc. Atlantic Ocean, in 345 fathoms, about 40 miles N.N.W. of the Shetland Islands.

Obs. There are three specimens of this sponge, all about the size mentioned; two are light cream-coloured and the other dark grey. The two light ones are in a jar labelled "65," whose locality and depth is that above mentioned, and the dark specimen in a jar labelled "78," = 290 fathoms, about 65 miles N.N.W. of the Orkneys. Associated with the latter is *Hymeraphia pyrula*, n. sp., and with the former *Phakellia ventilabrum*, *Tisiphonia*, *Tethya cranium*, *Desmacella pumilio*, and *Hymedesmia Johnsoni*.

This sponge has already been named, described, and illustrated by Dr. Bowerbank (*op. cit.* vol. ii. p. 145, vol. i. pl. x. figs. 238, 239, and 240, and vol. iii. pl. xxvii. figs. 1-3); but as the additional inflation towards the end of the large spicule (fig. 2) in the latter illustration and the recurvature of the third spine in fig. 240 (vol. i.) appear to me to be rather exceptional than ordinary forms, while the observation in vol. i. p. 146, that the "moniliform" is the "young state" of the verticillate spicule, is not borne out by the fact that both moniliform and verticillately spined spicules are present of all sizes, from the smallest to the largest, which are of equal length, however much the absence of the spines in the monili-

form ones may be considered as "incomplete development." (If there is one thing more to be *deprecated* than another in the description of sponges, it is the figuring of exceptional forms of spicules as characteristic of the species.)

There is, however, a great diversity of form in all three kinds of spicules, since the terminal inflation of the large spicule is not only occasionally double, and that of the centrally inflated spicule also, but the extremities of the latter, although always more or less fissurate or spined, are equally varied.

Then, again, the verticillately spined and moniliform spicules vary in size from 2- to 20-1800ths inch in length, while the absence of any particular form of flesh-spicule may be supplied by the smallest verticillate ones, in which the central inflation then causes them very much to resemble the centrally inflated flesh-spicule of *Halichondria suberea* and *H. ficus*, Johnst., *Suberites domuncula*, Sdt. (Dr. Bowerbank, *op. cit.* vol. ii. p. 202, is wrong in restricting the presence of these centrally inflated flesh-spicules to *H. ficus*, inasmuch as they are equally present in both the type specimens of *H. suberea* and *H. ficus* respectively, of the Johnstonian collection in the British Museum.)

The only approach in form to the centrally inflated subskeleton-spicule with fissurate ends of *Hymeraphia verticillata*, that I know of, is in *Halicnema patera*, Bk. (vol. iii. pl. xv. figs. 31 and 32); but here the ends are sharp-pointed, although the centre of the shaft is once and sometimes twice inflated; still these spicules are congregated round the great sub-pinlike acuates of the fringe at the circumference of *H. patera*, where they thus bear the same relation to each other that the centrally inflated spicules do to the great sub-pinlike spicule in *Hymeraphia verticillata*. The double *terminal* inflation of the latter, too, is common in *Halicnema patera*, while the staple spicule of the body generally, which is smaller, consists of a curved acerate, inflated in the centre, and thickly (although not verticillately as in *Hymeraphia verticillata*) spined throughout. So that the spicule-complement of *Halicnema patera* comes nearest of all known sponges to that of *Hymeraphia verticillata*; and the former I have thought best for the present to place among the Suberitida. Perhaps *Halicnema patera* and its like may have to come there also.

It has been above stated, conjecturally, that the great sub-pinlike-spicule which projects from the summit of the aculeation is about 200-1800ths inch long (that is, $\frac{1}{5}$ inch); but as this spicule from its extreme length is generally broken off just outside the summit of each aculeation, while its inner

extremity rests on the pebble, the entire length has been computed by allowing two thirds for the inner and one third for the outer portion, reckoning the total thickness of the sponge from the pebble to the summit of the aculeation as above stated. The position of the vents must also be taken as provisional; for I have never seen one with an unmistakably defined margin and only the "tubular prolongations" above mentioned, which, having been broken off at the extremities, may after all *not* have been tubularly prolonged vents.

In several sponges there is a subskeleton-spicule, which presents two or three spines at one or both ends (*ex. gr.* Pl. XV. figs. 25, *b*, 29, *b*, and 28, *a*), which so far are like the fissurate ends of the spicule in *Hymeraphia verticillata*; and this often passes into ends which are inflated and spined all over in other species. The remarkable spiculation of *Hymeraphia verticillata* has necessitated this long description.

[To be continued.]

XXVIII.—*On a new Genus and Species of Collembola from Kerguelen Island.* By Sir JOHN LUBBOCK, Bart., M.P.

AMONG the Thysanura submitted to me by Mr. Eaton was a form of the *Lipuridæ*, which I propose to dedicate to M. Tullberg, who has so largely contributed to our knowledge of this group.

Genus TULLBERGIA, n. g.

Corpus elongatum. Antennæ non clavatæ, quadriarticulatæ. Or-gana postantennalia transversa. Unguiculi inferiores nulli. Spinæ anales magnæ.

Tullbergia antarctica, n. sp.

White (colourless in spirit). Skin granular, and with scattered hairs. Ocelli absent (I could see none). Postantennal organ situated directly behind the antenna; it has numerous oval tubercles. Feet with only one claw, and without tenent hairs. Anal spines large and strong; their apex oblique and outwardly prolonged into a somewhat slender triangular point, not acuminate.

Length $\frac{1}{8}$ inch.

Hab. Common in wet moss on hill-sides and low ground in the neighbourhood of Observatory Bay, Royal Sound.