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THE ANNALS

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[FOURTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, repletc canistrum.
At vos, o Nymphæ Crateridcs, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Partheuii Giannettasii Ecl. 1.

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I.—*A Descriptive Account of three Pachytragous Sponges growing on the Rocks of the South Coast of Devon.* By H. J. Carter, F.R.S. &c.

[Plate IV.]

The term applied by Aristotle to those compact sponges which were "very hard and rough," and grew upon the rocks near the shore, was τράγοι. Hence the term "pachytragous" in the title of this communication—a word which I should not have introduced had there been any other previously employed to designate generally the order to which the three sponges about to be described belong.

Under the head of "Pachytragiæ" I would include for the present all the "Corticatæ" of Dr. Oscar Schmidt (Die Spong. Adriat. Meeres, 1862, p. 81) and all those designated Tethyadæ and Sphærospongia respectively by Dr. Gray ("Notes on the Arrangement of Sponges," Proc. Zool. Soc. Lond. 1867, p. 540 &c.).

It may be questioned hereafter how far the chondroid species of which *Tethya lyncurium* is a type, together with its repent or incrusting allies, should not be grouped together with Schmidt's *Chondrilla nucula*, &c.; but as regards the term "Sphærospongia," of which *Pachymatisma Johnstonia* is the first example in Dr. Gray's "Notes," recent observations on the habitat of this sponge seem undoubtedly to point out the necessity of its suppression altogether.

Thus I find that it is only when a portion of *Pachymatisma* is torn from its natural place of growth, and becomes free in the sea, that it assumes a spheroidal form. Spreading horizontally in its natural habitat, on inclined surfaces, in the most sheltered bowers of the shore-rocks, it rises more or less into obtusely rounded eminences, which give to its surface a deeply undulated form. This surface, too, as is well known, is incrusted with a cortical layer or zone of globular crystalloids, which, although thickest on its free side, is nevertheless continued *all* round the sponge, and frequently extends some distance into the mouths of the larger exhalant apertures or oscules; while the exhalant system of canals is also more or less horizontally developed, and not radiating, in accordance with the mode of growth of the sponge. Hence, when a portion becomes detached from its natural habitat and free in the sea, it soon surrounds itself entirely with the thick incrustation; while, its excretory canal-system and general structure continuing as before internally, it can have no radiated arrangement of the latter, however much its form may become spheroidal externally. The same applies to the Tethyadæ, of which *T. cranium* is the type. Thus it may be observed, in my description and illustrations of *T. arabica* (Annals, vol. iv. p. 1, 1869), that I found specimens of this species growing in a fixed hemispherical and in a free subspherous form respectively. But, as the fixed form has a radiating structure, so, when a portion has been detached from the rock (for it may be assumed always to commence life in a fixed form), it retains this radiated structure in the spheroidal one. Then, as the spheroidal form is accidental in both the free specimens of *Pachymatisma Johnstonia* and *Tethya arabica*, we cannot properly call them "subspherous sponges." This, too, may be the case with the Geodidæ and Tethyadæ generally.

The only true instance of a spheroidal sponge is seen in *Tethya lyncurium* and the like, where the sponge grows into this form on a pedicel,—and here not always, as some of the specimens of this sponge which grow on the rocks of this place demonstrate. At the same time it should be remembered that this is not a *Tethya*, if we are to regard *T. cranium* as typical of the Tethyadæ; and hence Dr. Gray has very properly adopted Nardo's name of "*Donatia*" for this genus (*l. c.* p. 541).

Still it may be asked how it is that the spheroidal specimens of *Tethya lyncurium*, when cast upon the shore, always present a facet from which the pedicel has been broken off, while no such indication of previous attachment appears on the subspherous specimens of *Tethya* proper, *Geodia*, and *Pachymatisma* (see my illustrations, 'Annals,' *l. c.*).

This, it seems to me, may be explained in the following way, viz.:—the heavy chondroid nature of *Tethya lyncurium*, and the rapidity with which the chondroid material is produced (for when two or three living specimens are placed in sea-water in contact, they become so firmly united together in twenty-four hours that force is required to tear them asunder), might cause the *Tethya*, when broken off from its pedicel, to sink to the bottom directly, and at the same time to quickly unite itself to the first fixed rock with which it might come into contact, while the lighter nature of the Tethyadæ proper and the Geodidæ, together with their inability to unite themselves so quickly to foreign objects, might lead to their drifting about in the sea, until they render themselves independent of their position by fortifying themselves all round with their peculiar structures, and finally assume the subspherous form.

Again, the specimens of *Tethya lyncurium* only come on shore in heavy storms, when these have occurred at spring-tides, and thus the waves at low water have wrenched them off their pedicels; for it is only towards dead low-water mark that I have yet found them growing on the rocks. They therefore, from their tough chondroid nature, probably hold on when portions of *Pachymatisma* give way, and thus, only yielding to the heaviest gales, come on shore directly after they have become separated from their attachments, even before they have time to sink into still water and become united again to some fixed object.

Such observations may account for the presence of the facet of attachment in *Tethya lyncurium*, and for its absence in the subspherous forms of the Tethyadæ proper and the Geodidæ.

Lastly, I would take this opportunity of noticing that my description and illustrations of *T. lyncurium* (Annals, *l. c.*) are wholly fallacious where they point out the existence of interlobular grooves on the surface, except for the dead state, since, in some specimens which I kept alive for a few days in sea-water, the chondroid substance increased to such an extent on the surface as not only to efface all the interlobular grooves, but, if any thing, to leave depressions over the centre of the lobules themselves, just in the opposite position to that which they have in the dried specimens. So much for describing objects of natural history in the dead state; let us now direct our attention to the description of the three pachytragous sponges to which I have alluded in the *living* one.

Dercitus niger, mihi, n. var. Pl. IV. fig. 1.

Massive, spreading, fixed, variable in thickness, following the sinuosities of the rock on which it grows; compact, hard,

tough, resistant. Surface undulating, smooth, soot- or bottle-black, shining, puckered towards projecting points of the rock beneath. Dermal layer (figs. 1 *a*, 2 *a*) thin, colourless, transparent, rugose, charged with minute bacillar spinous spicules; presenting here and there large exhalant apertures (oscules), singly or in groups, with raised margin, crateriform, also minute inhalant apertures (pores) generally all over the surface of the sponge, amidst the projecting points of the large spicules of the interior, and numerous circular, papillary eminences of a lighter colour, caused by the projection of certain cells (beyond others) of the subjacent celluliferous layer. Celluliferous layer (*b*) cortical, thick, continuous all round the sponge, and often for a short distance into the mouths of the larger oscules, much thicker on the free surface than at any other part; covered by the dermal layer above, in contact with the next or spiculiferous layer internally; composed of cells imbedded in a kind of sarcodal trama; cell (fig. 6) globular or oval, consisting of a cell-wall in which is contained a large transparent nuclear (?) body (*a*) and a small nucleolar (?) one (*b*), together with a great number of free cellules (*c*), in each of which is one or more black granules (*d*), the black granules collectively giving a black colour to the cell, and an intense black colour to the layer composed of them (fig. 1 *b*). Spiculiferous layer (fig. 2 *c*) thin, composed of the large trifid spicules of the sponge densely packed together; in contact with the celluliferous layer externally, and with the body-substance of the sponge internally. Body-substance (figs. 1 *c*, 2 *d*) composed of more or less areolar sarcode, which is in direct connexion with the pores, and traversed by the branches of the excretory canal-system, which, uniting together, finally terminate in their respective oscules; charged more or less with the spicules about to be described, and a great number of the black cells (fig. 3 *c*), which thus give it a dark tint, although always much lighter than that of the black cortical celluliferous layer. Spicules of three kinds:—1, trifid (fig. 3), large, stout, consisting of a straight, smooth, pointed shaft and three expanded arms, so much like a quadriradiate spicule, from the rays being so much like each other, that, but for the shaft being a little longer and straight, while the arms are slightly flexuous, the difference would be inappreciable; 2, minute bacilliform or fusiform spicule (figs. 3 *a*, 4), covered with spines, which are vertical in the centre, but become more inclined towards the extremities of the shaft; 3, minute tricurvate or bow-shaped spicule (figs. 3 *b*, 5), of hair-like thinness and equal in size throughout, except at the ends, which are slightly pointed and slightly turned up. The large trifid spicules are scattered

throughout the sponge, but chiefly brought together in the spiculiferous layer; the minute spinous one also, but chiefly confined to the dermal layer, and the tricurvate spicule confined to the body-substance.

Size variable; largest specimens found, about 4 inches in diameter and a little under an inch in thickness. Black cells variable, largest about 1-170th of an inch in diameter. Shaft of largest spicules about 1-80th inch long. Spinous spicule about 1-1200th inch long; tricurvate about 1-300th inch long.

Loc. Budleigh-Salterton, south coast of Devon, Straight Point.

Hab. Fine red-sandstone conglomerate rocks of the New Red Sandstone series. About two-thirds below high-water mark and downwards; on inclined surfaces, deep in under the bowers of the rocks, never pendent from their under surfaces.

Obs. This sponge, if not the same, is closely allied to *Hymeniacidon Bucklandi*, Bowerbank (Brit. Spong. vol. ii. p. 226), but wrongly classed, as conjectured by the author in the following passage at the end of his description, viz.:—

"This sponge varies so widely from the ordinary structure of *Hymeniacidon* that I doubt much whether it should not be made the type of a new genus."

Now there is no doubt in my mind about the matter, nor could there have been in Dr. Gray's when he proposed a place for this sponge among his Tethyadæ (Notes, &c. *l. c.* p. 542, 1867) under the new name of "*Dercitus*." Schmidt subsequently (Spong. Algier, p. 15, 1868) proposed the name of "*Pachastrella*" for this genus in his Compagineæ, finally placing it among his Corticatæ, *i. e.* under Ancorinidæ, in 1870 (Spong. Faun. Atlantisch. p. 64); but he errs in his note to Dr. Bowerbank's synonymy (p. 76), where he considers the presence of the tricurvate spicule "accidental," as may be seen by my description and illustrations; nor is Schmidt right in stating that this kind of spicule belongs to the character of his Desmacidinæ, if this remark means exclusively; for he himself has figured a tricurvate spicule as partly characteristic of his *Pachastrella connectens* (Spong. Faun. Atlantisch. Taf. vi. fig. 5). Dr. Gray's arrangement therefore claims priority; and hence the name of "*Dercitus*" for this genus.

The dried specimen, from Guernsey, which was sent to and described by Dr. Bowerbank under the name of *Hymeniacidon Bucklandi* was of a "dark purple colour" externally, and internally "light brown;" and all that is stated of the specimen that was sent to him, preserved in salt and water, from Torbay is that it was "almost as solid as a piece of boiled

bullock's liver." Now, assuming, in accordance with Dr. Bowerbank's experience, that this is the best way to preserve sponges for description, we can hardly think that the colours of the wet were different from those of the dried specimen; or this would have been noticed.

Hence, as the species which I have been describing is jet-black when dry, and the body or internal substance inclining, if any thing, to dirty green, while the same colours are presented by the portions which have been preserved in spirit and water, I cannot but infer that at least, as before stated, the black sponge which I have designated by the specific name of "*niger*" is a variety of *Dercitus Bucklandi*, and therefore deserving of this separate denomination.

But whether the reader chooses to admit this or not, he can hardly fail to see that, *cæt. par.*, there is a vast difference between the description of a sponge from "the life," and that of one which the author has only seen after death.

It is not difficult to find this sponge, because it does not grow, like many, on the under surface of the rock, but grows on its sides in deep bowers, sought for apparently by the sponge for protection from the waves. Then, its black-velvet-looking appearance strikes the eye immediately; but the difficulty of getting at it, except in a more or less horizontal position, and its toughness and firm adherence, rendering it necessary to take off a portion of the rock on which it grows with hammer and chisel to obtain the whole of the specimen, make its collection by no means an easy task for a stiff old collector.

Perhaps the most remarkable point, after all, about this sponge is the presence of the celluliferous cortical layer and the characters of the cells of which it is composed—since, by their accumulation here, and being scattered through the substance of the sponge, they, although totally different in composition, do occupy a position exactly like that of the globular crystalloids which form a crust round and are scattered generally through the substance of the Geodidæ. But of this more under "General Observations."

The puckered state of this sponge on the surface, while *in situ*, seems to arise from contraction occasioned by the falling of the tide, or absence of water, when its substance becomes drawn towards the more prominent points of the rugged portion of rock beneath, over which it may be growing. But, whether this explanation be correct or not, the puckered radiating lines from particular points on the surface of the sponge are remarkable.

It is also worthy of remark that, although the sponges of

this order usually possess a large, acerate, long fusiform spicule in addition to the rest, there is none in *Dercitus niger*.

Stelletta aspera, mihi, n. sp. Pl. IV. fig. 7.

Massive, spreading, fixed, variable in thickness, following the sinuosities of the rock over which it grows; compact, rough, and resistant. Surface undulating, even, asperous, of a light grey tint, sometimes cream-colour, occasionally green. Dermal layer (Pl. IV. figs. 7 *a*, 8 *a*) colourless, thin, transparent, charged with minute, spinous, sub-bistellate spicules, presenting here and there, though mostly in sheltered parts, groups of large exhalant apertures (oscules) of different sizes, whose orifices are not bordered by an elevated margin, but more or less contracted by a circular expansion of the dermal sarcode extended inwards like the so-called "diaphragm" in *Pachymatisma*; also minute inhalant apertures (pores) scattered over the surface generally, but most evident in the vicinity of the oscules, amidst the projecting ends of the large spicules, which have the peculiarity of lying almost horizontally on the surface, and thus imparting to it the asperous character mentioned; in contact internally with the celluliferous layer. Celluliferous layer (figs. 7 *b*, 8 *b*) so thin as to be hardly perceptible, except under an inch compound power, when, in many parts of the surface, the cells of which it is composed may be seen to be arranged in a tessellated manner under the dermal layer; and when portions are torn to pieces and placed under a quarter-inch compound power, the cells are found to be imbedded in distinct cavities (fig. 14 *e*), in a kind of sarcodal trama (*d*) like that of *Dercitus niger*, and to correspond with them in composition in every particular but the black colour, those of the species under description being colourless. Cells (fig. 14) globular or oval, consisting of a cell-wall, in which is contained a large transparent nuclear (?) body (*a*) and a small nucleolar (?) one (*b*), itself apparently nucleated and attached to the larger one; also containing a great number of free cellules (*c*), each enclosing one or more colourless granules (*f*); cells not only congregated towards the surface, but scattered throughout the sponge generally, together with here and there a cell with black granules, or "black cell," precisely like those of *Dercitus niger*; celluliferous layer in contact with the dermal sarcode externally, and internally continuous with the body-substance of the sponge. Body-substance (figs. 7 *c*, 8 *c*) cream-coloured, densely charged with large, long, acerate spicules, which so project, when it is torn to pieces, as to give it an echinated appearance and equally asperous feel; composed of

more or less areolar sarcode, which is in direct connexion with the pores, and traversed by the branches of the excretory canal-system, which, uniting together, finally terminate in their respective oscules; charged more or less with the spicules about to be described. Spicules of four kinds:—1, the largest (fig. 9), smooth, fusiform, acerate, slightly curved; 2, smooth, trifid (figs. 10 & 11), with shaft pointed at one end and furnished with three arms at the other, spreading horizontally in the opposite direction, slightly inclined forwards towards the long axis of the shaft, vase-like, each terminated by bifurcation, which extends to a variable degree down the arm; 3, minute spinous spicule (fig. 12), sub-bistellate—that is, where the spines are chiefly confined to the ends of the short shaft; 4, minute stellate spicule (fig. 13), a little larger than the latter, with small body and long arms, which are incipiently spinous. The large acerate spicules are very numerous and scattered equally throughout the sponge; the trifurcate spicules chiefly confined to the surface, where, with the former, they lie almost horizontally (fig. 8); the minute sub-bistellate spicules are chiefly confined to the dermal layer, and the stellate spicules to the body-substance of the sponge.

Size variable; largest specimens found about 4 inches in diameter and about an inch thick. Cells variable, the largest about 1-170th of an inch in diameter. Largest acerate spicule about 1-10th inch long; longest shaft of trifid spicule about 1-30th inch; minute sub-bistellate spicule about 1-2000th inch long, and stellate about 1-1000th inch in diameter.

Loc. Budleigh-Salterton, south coast of Devon. Straight Point.

Hab. Same as the foregoing species, viz. *Dercitus niger*.

Obs. This sponge possesses the spicule-character of Schmidt's genus *Stelletta*, and has hence been so named; but the celluliferous layer has not, I think, been yet noticed or described, and hence it may be necessary hereafter to unite those sponges which possess it into a separate group, if not one also with a different appellation.

It answers somewhat to the description of *Ecionemia ponderosa*, Bowerbank (Brit. Spong. vol. ii. p. 56); but there is no "dark-purple" sarcode on the surface, nor is the surface "smooth;" nor are the furcated ends of the trifid spicule *recurved*, as stated in the text and shown in the representation of the type specimen (vol. i. pl. 28. fig. 355). Nor can it be his "*Tethya muricata*, MS.;" for there are no "skeleton fasciculi," the substance of the interior is all confused like that of *Pachymatisma*, and the minute dermal spicule sub-bistellate, not "elongo-attenuato-stellate," like that of Dr. Bowerbank's figure 35. Nor is there any spicular combination given by Schmidt like it.

It is frequently overgrown by other sponges, especially *Halichondria panicea* and *H. simulans*, Johnston. And in one specimen which I possess, where it has been overgrown by a *Microciona* (Bk.), the areolar structures of the two sponges have grown so much into each other, that a section represents the same condition between the two as that which would be seen in making a section of the union between a shoot of one tree and another on which it is grafted.

When preserved in spirit, this sponge assumes a lead-colour—and when dried, a very light brown or dirty white. In the latter state it is much less compact than *Dercitus niger*, owing to the more open condition of its areolar structure and the larger size of the excretory canals, which are therefore much more evident than in the more compact structures.

How far the horizontal position of the spicules may be owing to its shore habitat, where it is exposed to the beating influence of the waves, I am not prepared to say; nor can this be determined until a specimen of the same sponge is obtained from a deep-sea habitat, if any exist there, where it would be more at rest during development.

Nitric acid applied to the cell of the celluliferous layer, here as well as in *Dercitus niger*, causes the whole to contract slightly, and breaks down the cellules, but does not alter much the large nuclear (?) or small nucleolar (?) bodies.

Liquor potassæ causes the whole to expand, breaks down the cellules, and allows them to run together in the form of several globular masses of oleaginous or albuminous-looking matter.

Iodine breaks down the cellules, but does not render the nuclear and nucleolar bodies more evident.

Thus these agents do no more than render the nuclear and nucleolar bodies more evident by breaking down the cellules. Perhaps, too, the *nucleolus* under nitric acid becomes a little more consistent or opaque.

Stelletta lactea, mihi. Pl. IV. fig. 15.

Massive, spreading, fixed, following and filling the cavities of deciduous small boring shells (*Saxicavæ*) and Annelids, which confine themselves to the surface of the sandstone rock in which they live, almost entirely concealed by overgrowths of small Cirripedes and Fuci, and communicating with the exterior only through the openings of the cavities mentioned. Dermal layer (figs. 15 *b*, 16 *b*) thin, white, densely charged with

minute stellates; agglutinating to its surface minute rounded grains of sand, amidst which are situated the exhalant apertures (oscules) *in* the layer, without a raised margin, also the inhalant apertures (pores), somewhat smaller, scattered generally throughout the exposed area; grains of sand (fig. 16 *a*) blackened by a pigmental layer, which also lines all the cavities occupied by the sponge; in direct contact with the body-substance of the sponge internally. Body-substance (figs. 15 *c*, 16 *d*) opalescent, soft, compact, composed of areolar sarcode traversed in all directions by the branches of the excretory canal-system, which, uniting, finally terminate in their respective oscules; charged more or less with the same kind of stellates as those in the dermal layer, together with minute sheaf-like bundles of acerate spicules (figs. 20 *a*, 22), which in certain directions reflect the light like the micaceous particles in granite. Spicules of five kinds:—1, the largest (fig. 17) smooth, acerate, fusiform, slightly curved; 2, smooth, trifid (figs. 18, 19), with shaft pointed at one end and provided with three arms at the other, spreading horizontally in the opposite direction, more or less inclined forwards towards the long axis of the shaft, vase-like, straight or slightly flexuous, smooth, pointed; 3, the same (fig. 19), with the ends of the arms more or less bifurcated; 4, stellate spicules, with large body (fig. 21, *a*) and short thick rays, or with long rays and hardly any body (*b*); 5, sheaf-like bundles of minute, smooth, acerate spicules lying parallel to each other (fig. 22). The large acerate spicules are more or less spread throughout the sponge; the trifid ones of both kinds chiefly confined to the surface, where they are arranged vertically with their heads towards the dermal layer and their shafts internally (fig. 16 *c*); the stellates, although most numerous and packed together crust-like in the dermal layer, are also scattered throughout the body-substance; while the sheaf-like bundles of minute acerate spicules are entirely confined to the latter.

Size variable, depending chiefly upon the size of the excavations, the largest of which are seldom more than half an inch long and a quarter of an inch in diameter. Largest acerate spicule a little less than 1-20th of an inch long; longest shaft of trifid spicules about 1-30th inch; stellates about 1-2000th inch in diameter, and sheaf-like bundles of acerate spicules about 1-1000th inch long.

Loc. Budleigh-Salterton, south coast of Devon. Straight Point.

Hab. Cavities of the surface of sandstone rock made by *Saxicavæ* and Annelids; communicating with the exterior through their openings, obscured by overgrowths of Cirripedes

and Fuci; growing from two-thirds below high-water mark downwards.

Obs. I found this sponge by accident when chipping off a portion of the rock on which *Grantia nivea* was growing; otherwise I should have passed it over; for, living in the cavities and under the overgrowths mentioned, it is almost impossible to see it until the rock is broken. Having once found its habitat, it was very easy to procure specimens afterwards; for it is very abundant.

Although occupying the cavities of *Saxicavæ*, whose deciduous shells are frequently present in the midst of the sponge, I could never find any indication on them of its having bored into them after the manner of the Clionidæ.

On breaking open the rock, the contrast between the opalescent aspect of the sponge-substance and the black pigment that it secretes over the cavities which it occupies is very striking. By transmitted light, under the microscope, this pigment presents a dark brown colour, which to the unassisted eye is black; but the layer is never continued over the dermal sarcode, although the minute grains of sand and bits of shell agglutinated to it are thus more or less blackened. The dermal layer, therefore, is always white, and particularly so in the dried state, from the number of stellates which it contains, while the rest of the substance in drying shrinks up into a gum-like consistence and colour. In spirit and water, however, this retains its original bulk and compactness; but the opalescent aspect becomes changed to opaque lead-colour.

On account, perhaps, of its isolation and its existence in small portions while it remains *in situ* in the rock, when fractured, those portions which are not much injured live for several days afterwards; and thus, from their smallness, being easily brought under a high power of the microscope, the currents outward and inward of the oscules and pores respectively are as easily seen.

In the specimens which I have mounted in balsam, the variety of spicules is so great, and their abnormal forms so numerous, that it is not easy to find out those which are the staple ones. This variety, which is greater in some than in other specimens, I am inclined to think may be induced by the disturbing influence of the waves, from which the sponge seems to shelter itself as much as possible by growing solely in the excavations mentioned. Possibly, if it also grows in the deep sea, the quiet there may enable it to acquire larger dimensions, and to present a less variable development of the spicules.

It is desirable to add that in *Stelletta lactea* there are no cells like those of the "celluliferous layer" in the two sponges previously described.

General Observations.

The chief point of interest, perhaps, in the foregoing descriptions is the presence of the peculiar cells mentioned in *Dercitus niger* and *Stelletta aspera*, corresponding in multiplicity, position, and general distribution, though not in composition, to the globular crystalloids or little siliceous balls in the crust and body of the Geodidæ; add to this their contents, which render them so much like reproductive agents, and, lastly, their occurrence in the two sponges mentioned, and not at all in the third, viz. *Stelletta lactea*. Nor do they exist in *Pachymatisma Johnstonia*; but in the dried specimens of *Geodia gigas*, presented to the British Museum by Dr. Oscar Schmidt, there are similar cells in abundance, together with the globular crystalloids.

Although analogous in multiplicity, position, and distribution to the globular crystalloids in the Geodidæ, they not only differ from them, as just stated, in composition, by the former being cellular and albuminous, while the latter are solid and siliceous throughout (Annals, 1869, vol. iv. p. 16 &c., pls. 1 & 2. figs. 12 & 14), but also in size; for the largest crystalloids are three or four times as large as the largest cells, and the latter much larger than the smallest or youngest crystalloids, so that in these respects, viz. in composition and size, they cannot be confounded.

Formerly I thought that the colour of the sponges might be always sought for in the ampullaceous sacs ("Wimperkörbe," Schdt.), and therefore that the black cells of *Dercitus niger* might be ampullaceous sacs (Annals, 1870, vol. vi. p. 332); but the result of more particular examination subsequently, as given above, has caused me now to regard the latter more as reproductive agents.

I have also alluded (Annals, *l. c.*) to the presence of ampullaceous sacs in *Geodia gigas*, Schdt.; but on examining these also again, now that I have become more intimately acquainted with the composition of the cells in *Dercitus niger* &c., I am led to conjecture that they also may be of the same kind as the latter, in which case, should I be right, we shall have an instance in this sponge where both the globular crystalloids and the cells occur together, and thence have to seek for the ampullaceous sac under some other form than that in *Halichondria simulans* (see Annals, *l. c.*), not only in *Geodia gigas*, but in *Pachymatisma Johnstonia* and in *Stelletta lactea* &c., where there is nothing of the kind like the ampullaceous sac of the *Halichondria* mentioned, so far as the larger size of its cellules and peculiar grouping go. The ampullaceous sac with

smaller and thus less-marked cellules may exist in all; but as yet I have not been able to substantiate this.

Of course, after having been dried, it is impossible to make out any thing in these cells so satisfactorily as in living ones; and hence, although such cells are present in great abundance in their contracted state in the dried specimens of *Geodia gigas* mentioned (measuring about a 1000th of an inch in diameter and filled with a number of cellules), liquor potassæ, although it causes the cellules to run together into one homogeneous mass, does not yield any satisfactory demonstration of a nucleus under the addition of nitric acid, nor is the cell-wall well marked—two points in which the cell of *Dercitus niger* differs distinctly from the ampullaceous sac.

Hence the desirableness of examining these cells of *G. gigas* in the recent state.

We too often content ourselves with describing sponges as well as other objects of natural history in their dried or dead condition; and although this is the only way in which they often come to us, yet we might as often repeat to ourselves as well as to others under such circumstance the words of Hamlet to Horatio:—

> "There are more things in heaven and earth, Horatio,
> Than are dreamt of in your philosophy."

Too often the living state of such objects is disregarded when we have the opportunity of adding this *sine quâ non* to their natural history. Describing the skeleton or dried specimen of a sponge only is little better than making it a matter of mere curiosity; and hence the want of general interest and comparatively little advancement which characterizes our knowledge of this more than any other division of the animal kingdom.

I am not, however, yet satisfied with my examination of the cells of *Dercitus niger* and *Stelletta aspera*, although partly made in the living state; for I cannot yet fully comprehend the nature of the nucleus in respect of its large size, resemblance to an aqueous cavity, and indisposition to change its appearance under the application of chemical agents.

In short, we have yet much to learn about this cell before we come to its real import; meanwhile its notice adds another feature to the Pachytragous Sponges, some of which possess analogous elements, as the globular crystalloids or little siliceous balls in the Geodidæ, akin to which are the siliceous disks of a like nature in *Stelletta discophora*, Schdt.; while others possess neither cells, globular crystalloids, nor disks, as *Stelletta lactea*.

EXPLANATION OF PLATE IV.

N.B. Figures 3, 9–11, and 17–19 are all drawn to the same scale, viz. 1-24th to 1-1800th of an inch; and figures 4, 5, 12, 13, 21, and 22, also to the same scale, viz. 1-6th to 1-6000th of an inch, to show their relative sizes respectively.

Fig. 1. *Dercitus niger*, n. var.: section of a portion, natural size, showing surface (*a*), black cortical layer (*b*), and body-substance (*c*) presenting truncated ends of excretory canals.

Fig. 2. The same, diagram section, much magnified, showing dermal layer charged with minute spinous spicules (*a*), black cortical layer composed of cells (*b*), layer of trifid spicules (*c*), body-substance (*d*) less densely charged with the trifid spicules, together with minute tricurvate or bow-like spicules, and black cells.

Fig. 3. The same, trifid spicule with minute dermal spinous (*a*) and tricurvate (*b*) ones, together with black cells (*c*), all relatively magnified.

Fig. 4. The same, dermal spicule, greatly magnified.

Fig. 5. The same, tricurvate spicule, greatly magnified, on the same scale.

Fig. 6. The same, black cell, still more magnified, showing large subcircular nuclear (?) body (*a*), small nucleolar (?) body (*b*), minute globular cellulos (*c*), charged respectively with one or more black or dark-brown granules, which collectively give the dark colour to the cell, and the latter collectively the intense black colour to the cortical layer; *d*, separate cellule.

Fig. 7. *Stelletta aspera*, n. sp.: section of a portion, natural size, showing surface (*a*), cortical layer (*b*), and body-substance (*c*), presenting truncated ends of excretory canals.

Fig. 8. The same, diagram section, much magnified, showing dermal layer charged with minute sub-bistellate spicules (*a*), cortical layer of cells (*b*), body-substance (*c*) charged with large acerate, trifid, furcate, and minute stellate spicules, of which the former are most aggregated towards the surface, where they are inclined so much as to be almost horizontal.

Fig. 9. The same, large acerate fusiform spicule; viewed from above, straight; but slightly curved when viewed laterally: *a*, real length.

N.B. For convenience, this spicule has been drawn from that point of view in which it appears straight, as the curved form, when slight, is so difficult for an engraver to etch truthfully; also, to make this easier, its sides have been drawn with a rule, diminishing equally from the centre to the extremities, which is not the case with this nor, indeed, with most spicules, which diminish more abruptly towards the ends than in any other part. These observations will apply also to the representation of the large acerate spicule in the next species.

Fig. 10. The same, trifurcate spicule, lateral view: *a*, real length.

Fig. 11. The same, trifurcate head, of larger size, where the rays are more deeply furcated, end view: *a*, end of shaft; *b*, central canal, bifurcating like the arms.

Fig. 12. The same, dermal spicule, much more magnified.

Fig. 13. The same, stellate spicule of the body, magnified on the same scale.

Fig. 14. The same, three cells of the cortical layer, less magnified than fig. 6, the same as those of *Dercitus niger*, only colourless, showing large, transparent, subcircular, nuclear (?) body (*a*), small nucleolar (?) body (*b*), minute globular cellules charged with one or more colourless granules (*c*), sarcodal subfibrous trama in which the cells are imbedded (*d*), cavity of the same in which the cell is situated (*e*), separate cellule much more magnified (*f*).

N.B. This figure is taken from cells in a portion of the sponge which had been placed in spirit and water, where the cellulos were much broken down and the nucleolar body appeared not only to be nucleated itself, but to be in contact with the nuclear body.

Fig. 15. *Stelletta lactea*, n. sp.: fragment of sandstone rock, showing three portions of the sponge in the excavations made by *Saxicavæ* respectively (*a a a*), natural size; dermal surface bearing minute grains of sand (*b*), body-substance (*c*), black pigment lining the cavities occupied by the sponge (*d*).

Fig. 16. The same, diagram section, much magnified, showing rounded grains of sand adhering to the dermal layer (*a*), dermal layer densely charged with minute stellates (*b*), zone of trifid and trifurcate spicules which have their heads in contact with the dermal layer (*c*), body-substance (*d*) charged with acerate, trifid, and stellate spicules, together with the sheaf-shaped bundles of minute acerate ones.

Fig. 17. The same, acerate fusiform spicule, straight in this point of view, but slightly curved when viewed laterally: *a*, real length.

Fig. 18. The same, trifid spicule, lateral view: *a*, real length.

Fig. 19. The same, trifid form with furcate extremities.

Fig. 20. The same, portion of body-substance greatly magnified, showing the stellates (*a*), the sheaf-like bundles of minute acerate spicules (*b*), and the large acerate fusiform spicules.

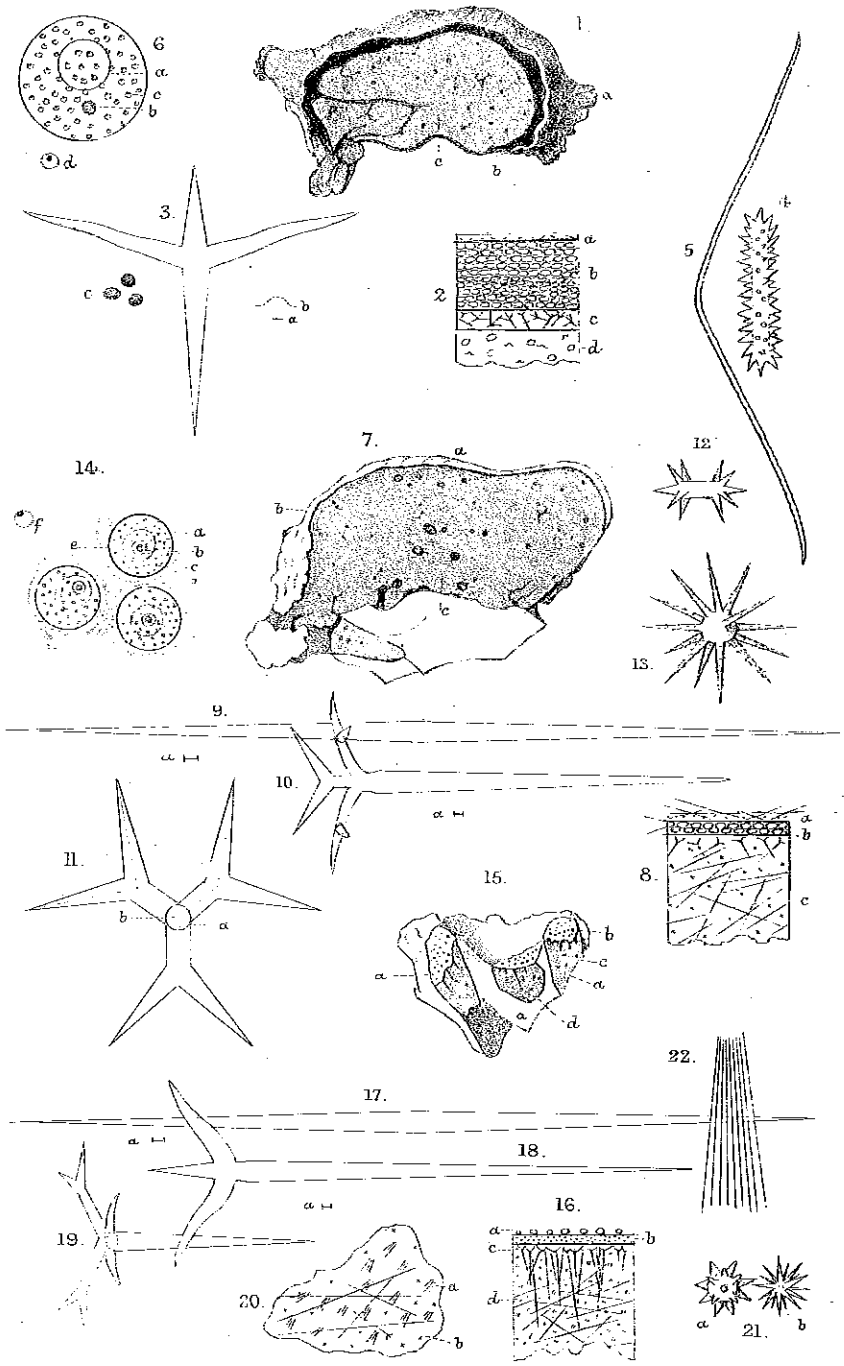
Fig. 21. The same, stellates of the dermal layer, much magnified: *a*, with large body and short rays; *b*, with small body and long rays.

Fig. 22. The same, sheaf-like bundle of minute acerate spicules of the body-substance, magnified, on the same scale.

II.—*Reply to* Dr. Sclater's *Paper in the 'Annals' on* Testudo chilensis *&c.* By Dr. J. E. Gray, F.R.S. &c.

In reply to Dr. Sclater on *Testudo chilensis* &c., in the 'Annals' for December 1870, p. 470, I have only to observe that for the accuracy of the habitat of the animals which I described as coming from the Zoological Society, I am solely dependent on the information which I obtained from that institution; and in the case of the tortoise, I took particular trouble, as the discovery of another tortoise in America was a matter of interest. This being the case, whatever inaccuracy there may be in the habitat is no fault of mine, but that of Dr. Sclater and his subordinates.

It is much to be regretted that an accurate record is not kept of every animal as it is received by the Society, stating how it was obtained, and giving the details of its habitat,



H.I.C. del. T. West lith.

W. West & Co. imp.