V.—*Descriptions of Sponges from the Neighbourhood of Port Phillip Heads, South Australia, continued.* By H. J. Carter, F.R.S. &c.

[Continued from vol. xvi. p. 368.]

Pursuing the plan which has been adopted in revising the other orders of the Spongida, I will premise the following tabular view of the original arrangement of my order Holorhaphidota (*op. et loc. cit.*) thus :—

Order VI. HOLORHAPHIDOTA.

Families.	Groups.
1. *Renierida*	1. Amorphosa.
	2. Isodictyosa.
	3 Thalyosa.
	4. Crassa.
	5. Fibulifera.
	6. Halichondrina.
	7. Hyndmanina.
	8. Esperina.
	9. Hymedesmina.
2. *Suberitida*	10. Cavernosa.
	11. Compacta.
	12. Laxa.
	13. Donatina.
3. *Pachytragida*	14. Geodina.
	15. Stellettina.
	16. Tethyina.
4. *Pachastrellida*	17. Pachastrellina.
	18. Lithistina.
5. *Potamospongida*	19. Spongillina.

The diagnosis for this order—viz. "Possessing a skeleton whose fibre is almost entirely composed of proper spicules bound together by a minimum of sarcode; form of spicule variable,"—was proposed for those sponges which, from the absence of that amount of keratine or horny material in their fibre that renders the orders IV. and V. (although they too possess "proper spicules," that is, spicules formed by the sponge itself) more or less resilient or sponge-like, are more or less tender, fragile, and easily broken by pressure, varying in consistence from a crumb-of-bread character in the Amorphosa to the almost stony hardness of the Lithistina; so that in the more limited acceptation of the word "sponge" the latter would not be considered sponges

at all. Hence we have to deal here *not* with the "limited acceptation" of the term "sponge," but with the products of the sponge-animal in its most extended sense, although at one time, as in the Carnosa, this may be almost undistinguishable from glue when both are dried, at another, as in the sponge of commerce (which is the most familiar form), a resilient mass of horny thread-like tissue (that is the skeletal structure of the sponge from which the soft parts have been extracted by putrefaction and edulcoration), and in a third, as in the Lithistina, so compact and stone-like that it yields to nothing but a knife or hammer.

So much for the order then; let us now turn our attention to the families respectively.

Fam. 1. Renierida.

Char. Spicules more or less arranged in a fibrous form; structure yielding to pressure, like crumb of bread.

To this family my experience of the last ten years, viz. since my "Notes Introductory to the Study and Classification of the Spongida" were published in 1875 ('Annals,' ser. 4, vol. xvi. p. 177 *et seq.*), has not enabled me to add much, and I have very little to alter. Many new species I have described; but they must be sought for in the pages of this periodical, which I have not time now to specify.

Phlœodictyonina (new group).

I would, however, observe that, having found several species more or less presenting the characters of *Oceanaria*, Norman = *Desmacidon Jeffreysii*, Bk., I have put them together under the above name, and would place this new group immediately after no. 4, viz. "Crassa." More I need not state of it here, as the whole will be found in the 'Annals' for 1882 (vol. x. p. 117 *et seq.*), and an additional species in those of 1883 (vol. xii. p. 326 *et seq.*).

To the mode of circulation in the Phlœodictyons, in which no vents have been discovered, I shall have to return hereafter when describing some of Mr. Wilson's specimens of *Polymastia* from Port Phillip Heads, in which, by analogy, the position of these vents seems to be indicated.

I have also added a few remarks as well as descriptions of new species to group no. 8, viz. "Esperina" ('Annals,' 1882, vol. ix. pp. 288–301; *ib.* 1880, vol. vi. p. 49, pl. v. fig. 20; *ib.* 1874, among the "Deep-sea Sponges dredged by H.M.S.

'Porcupine,'" vol. xiv. p. 207; and *ib.* 1876, vol. xviii. p. 226, &c.). But I am not certain that I have enumerated all the places in the 'Annals' where I have described species of this or any other group of sponges, so "once for all" can only state that it will be necessary to search the pages of this periodical generally for this purpose, to which it might be added that on most occasions the references *alone* to my contributions on the classification of the Spongida will be given, which it will be easier for me to do than for the reader to find them out for himself, while it will enable me to save that time of embodying them *in extenso* which a few years ago would have been of less consequence to me.

Fam. 2. **Suberitida.**

"*Char.* Tissue cork-like; spicules matted, felt-like, cancellous, and crushable, or radiated, compact, and hard; spicule chiefly pin-like, the sharp ends projecting from the surface, like velvet."

As I have to add many new groups to this family, it will be necessary to meet this by a slight alteration in the diagnosis, which may now stand thus:—

"*Char.* Tissue loose, cork-like, or solid and tough. Skeletal spicules chiefly pin-like, varying in shape from globular-headed to simple acuate, with more or less fusiform shaft; arranged in a confused, felt-like, reticulated skeletal mass, or in bundles radiating from the centre."

Hence it will be observed that all mention of "cancellous and crushable" structure has been omitted, since this is found to obtain only in dried specimens, where the sarcode has shrunk away, and nothing is left but the more durable skeletal fibro-reticulation, a fact that I did not well realize until I began to examine Mr. Wilson's fresh or wet specimens, which shows their value in this respect and the disadvantage of framing a diagnosis *only* on specimens that are dry.

Whether or not it would be desirable in description to give the state of a sponge in both conditions I must leave future observation to determine. I think it would where this can be done, or when both conditions are present; but where, as in many instances, the specimen can only become known by its presence on the beach, washed, water-worn, and dry, having originally come from the vault of some submarine cavern, where, by accident or otherwise, it has been torn from its place of attachment, it would be desirable to add, as Dr. Bowerbank has done, "examined in the dried state." And this must be the case in many instances, unless they are

gathered by human hands, for the dredge cannot reach them on the undersides of rocks. At the same time dried specimens also may differ considerably, inasmuch as the washed-out beach-worn specimen differs greatly from those which have been carefully soaked in fresh water and dried for preservation immediately after they have been taken, alive and growing, from their place of attachment, as Mr. Wilson's dried specimens also evidence; next to the wet state, this is the best and most convenient condition for museum-collections. But still, for perfect description the wet state is also necessary.

Thus alterations in diagnosis and classification may have to be continued so long as knowledge of the subject increases.

Having again, as far as my material would allow, studied the groups 10, 11, and 12, viz. the Cavernosa, Compacta, and Laxa, after the manner detailed in the 'Annals' of 1882 (vol. ix. pp. 347–356) chiefly from *dried* specimens (as in my original classification), it seemed to me desirable to add another group to these sponges under the name of "Subcompacta" (*ib.* p. 358), and I must refer the reader to this paper for what I then stated on the subject; but since I have had the advantage of examining wet or undried specimens, the principle of this classification, viz. the degree of consistence on which I then based my divisions, as may be inferred from the names of the groups, has undergone much modification. But, as I am not prepared to alter the arrangement *in extenso* now, I would merely observe that it also seems to me desirable that these four divisions should be considered parts of one group only, for which I would propose the name of "Suberitina;" in support of which it might be stated that, although the pin-like skeletal (with or without a flesh-spicule) for the most part prevails in these sponges, and there are some to which I have alluded at the conclusion of the paper last mentioned, in which the skeletal spicule is *not* pin-like, that still appear to me to find their most appropriate place in this group, yet, however this may be, the pin-like skeletal with or without a flesh-spicule of a spinispirular form appears to be the prevailing character of the spiculation in the "Suberitina," and as the latter gradually diminishes in size and number from the genus *Spirastrella*, Sdt., to those Suberitina in which there is no longer any trace of it, I would place the whole in this group.

In the genus *Latrunculia* of Bocage, to which I have also alluded in the paper last mentioned (p. 354), the spinispirular

flesh-spicule is replaced by the sceptrella (see my descriptions and illustrations of these two forms of the flesh-spicule in the 'Annals' of 1879, vol. iii. p. 354 &c., pl. xxix. figs. 11 &c.), and the skeletal spicule is no longer pin-like, but acuate or acerate, as may be seen by the species that have been described, while in *Latrunculia corticata*, Carter (*ib.* p. 298, pl. xxvii. fig. 1 &c.), the form of the flesh-spicule *varies* from *sceptrellar to spinispirular* in the *same* specimen. So that altogether it appears to me desirable that these sponges should come in immediately after the group Suberitina under the name "Latrunculina." Schmidt has placed them in his "Desmacidinæ" (Grundz. Spongf. Atlant. Gebietes, p. 80), because his species, viz. *Sceptrella regalis*, possesses an anchorate flesh-spicule in addition to the sceptrella; but if the presence of an anchorate or any other form of flesh-spicule be allowed to determine the position of a sponge in classification, the principle, according to my experience, will be found impracticable.

On group 13, viz. the Donatina, I have also published observations in the 'Annals' of 1882 (together with a new species or growth), vol. ix. pp. 356–362, pl. xii. fig. 22, to which I must refer the reader in addition to what is stated in my original classification (p. 182).

But between Donatina and Latrunculina I would introduce the three other groups mentioned in the same paper and under the same heading, viz. "Donatina" (p. 356 &c.), *i. e.* Polymastina, Xenospongina, and Placospongina, transferring the "intensely compact" species to which I have therein alluded to a *separate* group, as I find that, having *no* mamilliform processes, the latter cannot properly be included in the group Polymastina, however much in other respects, that is in the spiculation, they may resemble each other. Thus, having established a genus of these intensely compact sponges under the name of "*Trachya*" in 1870 ('Annals,' vol. vi. p. 178), and having in 1876 ('Deep-sea Sponges dredged by H.M.S. 'Porcupine,'' vol. xviii. pp. 392 and 393) proposed to place them in the group Polymastina as a subdivision, adding at the same time a brief description of another species equally typical of this kind of sponges under the name of *Trachya durissima* ('Annals,' 1882, p. 357), I must refer the reader to the last-mentioned as well as to the genus *Trachya* (*l. c.*) for the characters of the species which I would here group together under the name of "Trachyina."

I had forgotten to allude to that remarkable sponge of which Mr. G. Clifton found branched specimens "over 6 feet in length, and when alive of a bright red colour," on the west coast of Australia, for which the late Dr. J. E. Gray proposed the generic name "*Axos*;" and which, with its allies, I should be inclined to place immediately after Donatina, under the name of "*Axosina*" ('Annals,' 1879, vol. iii. p. 284 &c. pl. xv.); substituting the latter term for "Axona," proposed in the 'Annals' for 1881 (p. 381); where, I would also observe *en passant*, the species respectively described thereafter under the names of *Axos anchorata* and *A. flabellata* should have their generic appellations respectively changed to "*Phorbas*," D. & M., and their position relegated to the group Halichondrina still among the Holorhaphidota, for the reasons mentioned in my paper on the West-Indian sponges ('Annals,' 1882, vol. ix. p. 288).

The group "Axosina" might therefore be inserted immediately after Donatina, as the structural alliances to which I have above alluded, and which will be found at p. 289 ('Annals,' 1879, vol. iii.), seem to indicate.

Lastly, I find a new structure among Mr. Wilson's sponges, which assumes a more or less globular form; but this is *without fibre*, and the sarcode, which is chondroid, as much charged with sand grains as it is with the spicules of the species, which are cylindrical and obtusely pointed, accompanied by a smaller one in the form of an acuate; so that it is questionable whether it should come under the second family of the order Carnosa, viz. the Gumminida, or under the Suberitida in the order Holorhaphidota, as hinted of the group Donatina in my paper on the then known species of Carnosa ('Annals,' 1881, vol. viii. p. 255, &c.). At all events, for the present, I shall insert it as a new group, with the name of "Chondropsina," immediately after "Placospongina" at the end of the family Suberitida, while the type-specimen under the name of *Chrondopsis arenifera*, will be more particularly described hereafter among Mr. Wilson's specimens. In the dried state the abundance of sand and its want of fibre, that is, its diffused arrangement, makes this specimen look like one of the genus *Sarcocornea* ('Annals,' 1885, vol. xv. p. 214 &c.). But the spiculation being all of one kind and the spicules *perfect*, is opposed to this.

Eccœlonida, or *Excavating Sponges* (new family, No. 3, p. 49).

Char. Sponges living in small chambers stoloniferously connected, which have been excavated by themselves or other

animals in either organic or inorganic calcareous material; communicating with the exterior through the stoloniferous canals.

Differing from all other sponges in their habitat is that family for which I have proposed the above name; but as they equally differ from each other in their spiculation it also becomes necessary to group them accordingly. Hence, at the end of my illustrated description of *Alectona Millari* (Journ. Roy. Micros. Soc. 1879, vol. ii. p. 493, pl. xvii.), they have been divided into three genera with the suggestion of a fourth for the genus "*Samus*," which, typically considered, would respectively lead to the formation of the following groups, viz. "Clionina," "Thoosaina," "Alectonina," and "Samusina." To the paper in the journal mentioned, as well as the 'Annals' of 1880 (vol. vi. p. 56 &c., pl. v.) and those of 1879 (vol. iii. p. 350 &c. pl. xxix. figs. 1–7), I must refer the reader for all the information that I have hitherto been able to contribute on this subject.

Fam. 3. Pachytragida.

"*Char.* More or less corticate with cancellous more or less radiated structure internally; well differentiated."

On this family I published a paper in the 'Annals' of 1883 (vol. ii. p. 344 &c.), therefore need not repeat any more of it here except that I found it necessary to intercalate between Stellettina and Tethyina a fourth group under the name of "Theneanina," whose history, characters, and classification will be found in the same paper (pp. 354 to 362 inclusively).

Also to this family I would still add another group under the name of "Stellettinopsina," immediately after Stellettina, for species of the genus *Stellettinopsis*, which promise to be so numerous as to claim this distinction. They are principally characterized by possessing only *one* form of skeletal spicule, and this a large, smooth acerate, like the body-spicule of *Stelletta*, together with one or two forms of the stellate spicule, as noticed in the illustrated description of my type-species *Stellettinopsis simplex*, from which the rest of the characters of this group may be extracted ('Annals,' 1879, vol. iii. p. 349, pl. xxviii. figs. 16–18).

New species of all the groups in this family have also been described here and there in the 'Annals,' to which respectively I must again refer the reader for further information on *this* subject.

Fam. 4. **Pachastrellida.**

"*Char.* Without cortex; densely spiculiferous, even to stony hardness; structure confused; no fibre."

When I use the word "confused" it must be understood that the structure is so only apparently, for there is nothing confused in Nature, wherein all is harmony, and everything has its place.

With reference to the two groups of this family, viz. 17 and 18, respectively named Pachastrellina and Lithistina, I have nothing to add beyond what is stated in my original classification (*l. c.* pp. 185 to 187), the whole of which "classification was chiefly compiled to facilitate a description and location of the sponges dredged by H.M.S. 'Porcupine' ('Annals,' 1876, vol. xviii. p. 226), where, at pp. 406 to 410, some new species of *Pachastrella* will be found, together with that from Japan, described in the 'Annals' of 1885 (vol. xv. p. 403). Of new species of the group Lithistina I had, with the exception of what is stated in the 'Annals' of 1873, vol. xii. pp. 437–444, and 1876, vol. xviii. pp. 460–468, no communication to make until 1880, when my report on the specimens from the Gulf of Manaar &c. was published ('Annals,' vols. v., vi., and vii., pp. 437, 35, and 361), wherein at p. 142, pls. vii. and viii., and p. 372, pl. xviii. vols. vi. and vii., several will be found described and illustrated, together with the mode of development of the skeletal spicule which these young and perfect specimens enabled me to follow satisfactorily, so that in *Discodermia* it was easy to see that the most complex form of the tetractinellid, skeletal spicule originated in the simple nail-like disk of the surface, which, *when not more than* 1-300*th inch in diameter, presents the quadrifid canal* that characterizes the fully developed tetractinellid form. Lastly, this was again observed in the large and fresh specimen of *Racodiscula asteroides* from Japan, which I described and illustrated in the 'Annals' of 1885 (vol. xv. p. 400, pl. xiv. fig. 11).

Fam. 5. **Potamospongida.**

"*Char.* Fragile sponges bearing seed-like bodies or statoblasts and inhabiting freshwater."

For my division of the "then known species" of the sponges to be included in this family and their history generally, see my paper in the 'Annals' of 1881 (vol. vii. pp. 77 to 107, pls. v. and vi.). It has been contended that my "characters" of this family are incomplete, seeing that no seed-like bodies (gemmules or statoblasts) have yet been found in *Uruguaya corallicides*, Bk., or in *Lubomirskia baicalensis*, Dybowski;

but then no other mode of propagation in these sponges has been described; and therefore, however probable it is that this may be the case, it as yet only rests on inference; while Lieberkühn long ago made it plain that *Spongilla* might be propagated sexually (that is, by ova and spermatozoids), or by the so-called seed-like bodies respectively.

The above revision of my order Holorhaphidota may appear very short, but if the papers to which I have referred be read it will be found to be very long, for since my original classification was published in 1875 I have ever and anon been publishing the result of my considerations of different parts of it, and especially that of the Holorhaphidota, whereby several additions have been made to the latter, which, as before stated, it is much easier for me to indicate shortly with a few remarks than to embody *in extenso*. Hence, this revision will only be found interesting to those who wish to know what I have written on the subject, or might hereafter do what I should if time permitted do myself, that is publish a "handy volume" or Manual of the Spongida, including a synopsis of *all* the species that have been described, accompanied by the author's name, the date of description, and the place where described, with synonyms in like manner if there should be any. Such a compilation is now urgently required for the advancement of this branch of Natural History, which, so long as our knowledge of the subject remains inconveniently scattered through a number of books, *must continue* to lead more or less to petty classifications and the proposing of new and probably inappropriate names which may entail the inconvenience of reference and perhaps contradiction, because they have been based on a limited knowledge of the subject derived from access only to a few specimens. Species first and then classification.

All therefore that I can now do more in this respect, previously to describing Mr. J. Bracebridge Wilson's specimens which belong to the order Holorhaphidota, is to repeat the tabular view given at the commencement of this article with the additions subsequently proposed in "italics," together with the necessary changes in the numbering of the groups &c., so that the reader may see at a glance how the Table will now stand:—

Order VI. HOLORHAPHIDOTA.

Families.	Groups.	Subgroups.
1. *Renierida*	1. Amorphosa.	
	2. Isodictyosa.	
	3. Thalyosa.	
	4. Crassa.	
	5. *Phlœodictyonina.*	
	6. Fibulifera.	
	7. Halichondrina.	
	8. Hyndmanina.	
	9. Esperina.	
	10. Hymedesmina.	
2. *Suberitida*	11. *Suberitina*, for	Cavernosa.
		Compacta.
		Subcompacta.
		Laxa.
	12. *Latrunculina.*	
	13. *Polymastina.*	
	14. *Trachyina.*	
	15. Donatina.	
	16. *Axosina.*	
	17. *Xenospongina.*	
	18. *Placospongina.*	
	19. *Chondropsina* (provisional).	
3. *Eccælonida* (new family)	20. *Clionina.*	
	21. *Thoosaina.*	
	22. *Alectonina.*	
	23. *Samusina.*	
4. *Pachytragida*	24. Geodina.	
	25. Stellettina.	
	26. *Stellettinopsina.*	
	27. *Theneanina.*	
	28. Tethyina.	
5. *Pachastrellida*	29. Pachastrellina.	
	30. Lithistina.	
6. *Potamospongida*	31. *Spongillina.*	
	32. *Meyenina.*	
	33. *Tubellina.*	
	34. *Parmulina.*	

Having already at p. 351 *antea*, to avoid repetition individually, premised the circumstances under which I should describe the sponges of the order Echinonemata in Mr. Wilson's collection generally, I have only to state here that the same plan will be followed in describing those of the order Holorhaphidota.

Fam. 1. Renierida.

Group 1. Amorphosa.

1. *Amorphina anonyma.*

Massive, thick, compressed, lobed, sessile; truncated (? cut off by the dredge from the place of attachment) below. Consistence soft, loose. Colour not given, yellowish brown now. Surface smooth, covering a rough uneven structure below. Vents numerous, confined to the upper part. Spicules

of one form only, viz. acerate, varying under 75 by $2\frac{1}{2}$-6000ths in. Structure loose, traversed plentifully by large excretory canals which terminate in the vents mentioned. Size of largest specimen, 3 inches high by 9×3 horizontally. Depth 6 to 19 fath.

2. *Amorphina nigrocutis.*

Massive, flattish, sessile, irregularly lobed above, truncated below. Consistence hard, elastic. Colour when fresh, "nearly black," dark slate now. Surface very smooth, covered with a minutely reticulated spiculo-fibrous dermis. Pores in the interstices of the reticulation. Vents large, at the ends of the mamilliform or prominent processes of the upper part. Spicules of one form only, viz. acerate, but of two sizes, following their situation, viz.:—1, chiefly confined to the body, 85 by $1\frac{1}{2}$-6000th in.; 2, chiefly confined to the dermal, spiculo-fibrous reticulation, 25 to 30-6000ths long. Structure commencing from without inwards with a tough dermal coat about 1-48th in. in thickness, contrasting strongly in its dark colour with the lighter substance of the interior, which is compact and traversed by the excretory canals that end in the vents mentioned. Size $1\frac{1}{2}$ in. high by $4 \times 1\frac{1}{2}$ horizontally.

Depth 7 fath.

3. *Amorphina cancellosa.* (Dry specimen.)

Massive, sessile, erect, lobed, somewhat compressed, contracted towards the base. Consistence light, fragile. Colour whitish grey now. Surface cellular, reticulated in relief; interstices large, tympanized by sarcode charged with the spicules of the species. Vents very numerous, plentifully distributed over the surface generally, especially over the upper part. Spicule of one form only, viz. acerate, of different sizes, about 75 by $1\frac{1}{2}$-6000th in. Structure light, open and cancellous throughout, almost flimsy from the great number of large excretory canals with which the loose structure is traversed, ending at the vents mentioned. Size of specimen, which is very large (even in its dry state), 12 in. high by $12 \times 4\frac{1}{2}$ horizontally. Neither depth nor colour given.

Group 3. Thalyosa.

4. *Thalysias massalis.*

Massive, sessile, elongated elliptically, truncate below. Consistence soft. Colour, when fresh, "buff below, dark maroon-red above," now light brown. Surface smooth, con-

sisting of a spiculo-fibrous, reticulated, dermal structure. Vents on monticular elevations irregularly projected here and there, chiefly over the upper part. Spicules of one form only, viz. acerate, 37 by 1½-6000th in. Structure internally compact, much permeated by excretory canals. Size 2½ in. high by 3 × 5¾ horizontally.

Depth 20 faths.

Obs. I have placed this specimen in the group Thalyosa because the structure is more compact than that of the foregoing species; but really, at present, unless there is some peculiarity in form to distinguish the species beyond what I have mentioned in my Classification of the Amorphina, Isodictyosa, Thalyosa, and Crassa (*l. c.* p. 177), the presence of the acerate spicule alone in a massive amorphous structure for this purpose, must, for the most part, in a single specimen, be most unsatisfactory.

Group 6. Fibulifera.

5. *Fibulia carnosa* (provisional).

Fleshy, digitate, digitations branched; or digito-palmate; or long cylindrically caulescent once or twice branched, terminating in spatuliform bulbous ends; the digitations of the other forms terminating in contorted or crooked pointed ends, like deformed wasted-away fingers. Consistence solid, fleshy. Colour, when fresh, chiefly "black-red," now light brown. Surface smooth, almost slippery. Vents small, respectively projected on a papillary eminence, scattered generally over the surface where the branches are expanded, or in two lines opposite each other, where they are cylindrically digitate, that is Chalina-like. Spicules of two forms, viz.:—1, skeletal, smooth, acerate, 60 by 1¾-6000th in., more or less; 2, flesh-spicule, a minute simple C- and S-shaped bihamate (fibula) about 2-6000ths in. long; the former confined to the fibre and the latter dispersed in the sarcode. Structure compact and fleshy when wet, exceedingly hard and glue-like when dry, contrasting then, in its brown colour internally, with the white spiculo-fibre. Length of largest digitate specimen about 8 in. high by 4 × 1 horizontally; that of the long caulescent forms 12 in.; stem cylindrical, ½ in. in diameter; bulbous ends about 3 in. long and 1 in. broad.

Depth 5 to 18 faths.

Obs. This is a very remarkable sponge, partly on account of the forms which it assumes, and partly on account of its heavy, solid, fleshy consistence. I have placed it *provisionally* in the group Fibulifera under the above name, chiefly on

account of its spiculation. It seems to be very plentiful on the south coast of Australia, as there are several specimens of it in Mr. Wilson's collections, both wet and dry.

Group 7. HALICHONDRINA.

6. *Halichondria birotulata*, T. H. Higgin ('Annals,' 1877, vol. xix. p. 296, pl. xiv. figs. 11 and 12).

Obs. This sponge, which is characterized by its dark madder-red colour when dry, is also stated by Mr. Wilson to be "chocolate-black" when fresh, so that it does not lose its colour by keeping, either wet or dry. The birotulate spicule, after which it has been designated, is also peculiar in form, and so small that it is apt to pass unnoticed in the microscopic specimen when wet, but comes out well in a fragment that has been mounted in balsam. On the Australian coast it appears to be very common, occurring in the late Dr. Bowerbank's collection from thence, now in the British Museum, in large staghorn-like branched specimens.

7. *Halichondria isodictyalis*, Carter ('Annals,' 1882, vol. ix. p. 285, pl. xi. fig. 2).

Obs. The specimens of this sponge in Mr. Wilson's collection are massive and lobed, with large vents scattered over their surface, stated, when fresh, to have been "slate-brown" in colour. The principal difference between their spiculation and that of *Halichondria incrustans* (of which *H. isodictyalis* hardly amounts to more than a variety), is the spine*less* condition of the acuate. It appears to be almost world-wide in distribution.

8. *Tedania digitata*, Gray (Proc. Zool. Soc. 1867, May, p. 520).

Obs. Reniera digitata was Schmidt's earliest name for this species (Spong. Adriat. Meeres, 1862, p. 75, t. vii. fig. 11), which he afterwards changed to "*Tedania*, Gray" (Spongf. Atlantisch. Gebietes, 1870, p. 43).

There are several specimens of *Tedania digitata* in Mr. Wilson's collections whose form is massive and lobate, said, when fresh, to have been "orange" in colour. All are characterized by the same spiculation, viz.:—1, a smooth, stout, skeletal acuate; 2, sub-skeletal, fusiform acerate, inflated and scantily spined at each end, the "tibiella," first so named and described in the 'Annals' (1881, vol. vii. p. 369, pl. xviii. figs. 9, *b*); and 3, a very fine, pointed acerate, microspined all over.

The "tibiella" in Schmidt's *type*-specimens in the British Museum is not spined at the ends, nor is it in his descriptions and illustrations; but the "fine, pointed acerate" *is* microspined in them, although *not* described nor illustrated by him as such. But according to my observations generally, the spination of the ends of the "tibiella" is not constant, therefore of no specific value; while the microspination of the "fine acerate" can be seen only where it is strongly developed, and therefore, when otherwise is very likely to pass unnoticed.

9. *Tedania digitata*, var. *verrucosa*.

The same, but with the surface more generally convex and less lobate; the surface scattered over with small wart-like processes, and the colour, when fresh, stated to be "dull orange" and "venetian red" in the two specimens respectively. Besides being on a level with the surface, each little wart-like process terminates in a single vent, so that the structure is not like that described by Schmidt in his *Tedania suctoria* (Atlantisch. Spongf. *l. c.*).

10. *Forcepia colonensis*, Carter ('Annals,' 1885, vol. xv. p. 110, pl. iv. fig. 2).

[To be continued.]

VI.—*On the Occurrence of Sowerby's Whale* (Mesoplodon bidens) *on the Yorkshire Coast.* By Thomas Southwell, F.Z.S., and William Eagle Clarke, F.L.S.

On the 11th September last Prof. Turner communicated to the British Association, then assembled at Aberdeen, a paper on the anatomy of Sowerby's Whale, *Mesoplodon bidens*, Sowerby (=*M. Sowerbiensis*, Blainville), the material for which was mainly derived from the dissection of an individual obtained on the 25th of the preceding month of May, in Voxter Voe, on the north-east portion of the main island of Shetland, which island had already become noted as having yielded a previous specimen of this species as well as two other Ziphioids. Seeing the interest which attaches to this rare Cetacean we have great pleasure in being able to record the occurrence of yet another individual of the same species, the first, we believe, which has been met with on the English coast; but we regret to add that, owing to the ignorance of its captors as to the value of their prize, the carcase was cast adrift before the occurrence came to our knowledge, and was thus irretrievably lost to science. This is the more to be

Fig. 11. *Colpidium putrinum*, × 300.
Fig. 12. *Colpidium striatum*, × 450.
Fig. 13. *Diplomastax frontata.* Ventral, × 250.
Fig. 14. *Diplomastax frontata.* Reproductive fission.
Fig. 15. *Histiobalantium agile.* Dorsal, × 300.
Fig. 16. *Histiobalantium agile.* Lateral, × 450.
Fig. 17. *Rhabdostyla pusilla*, × 500.
Fig. 18. *Vorticella Lemnæ*, × 360.
Fig. 19. *Balanitozoon agile*, × 810.
Fig. 20. *Uroleptus Sphagni*, × 135.
Fig. 21. *Vaginicola ampulla*, × 137.

Trenton, New Jersey, U. S. America.

XII.—*Descriptions of Sponges from the Neighbourhood of Port Phillip Heads, South Australia, continued.* By H. J. Carter, F.R.S. &c.

[Continued from p. 53.]

Fam. 2. **Suberitida.**

Group 11. Suberitina (new group).

(Proposed instead of the original groups 10, 11, and 12, viz. Cavernosa, Compacta, Laxa, and the subsequently added group, viz. Subcompacta, which the group Suberitina is intended to include as subdivisions.)

Spirastrella, Sdt. (Spongf. Küste v. Algier, 1868, p. 17, taf. iii. fig. 8).

General Observations.

This genus is chiefly characterized by its spiculation, consisting of a pin-like skeletal and spinispirular flesh-spicule, the latter, like most flesh-spicules, congregated more or less thickly into a layer on the surface; hence Schmidt placed it among his "Corticatæ" (!), our Pachytragida. But inasmuch as there are two kinds, if not species, of this sponge which possess the same form of spiculation, it becomes necessary to seek in the size of their spicules, their structures, and their adult forms respectively for their differences. Thus while the spicules in the original species, viz. *Spirastrella cunctatrix*, Sdt., may be set down as longer and thinner, those of the other kind or variety, which we shall term *Spirastrella cunctatrix*, var. *robusta*, are shorter and stouter (a fact of general occurrence too with adult spicules of all kinds even in the same specimen, as I have often stated).

It is to these two kinds of *Spirastrella* that I have long since alluded as coming both from the south coast of Australia and the Mauritius ('Annals,' 1882, vol. ix. p. 351).

Again, while the adult form of *Spirastrella cunctatrix* is more or less massive, pyramidal, and sessile, and has a comparatively open fibro-reticulate structure in the interior and a pinkish or lilac, more or less brown colour externally in the dried state; that of the variety is compressed, erect, flabellate, lobed, and stipitate, with a comparatively compact structure in the interior of a chalky consistence and an "orange-red colour" when fresh, but in its dried state light ochre-yellow throughout. Lastly, the surface of *Spirastrella cunctatrix* presents slight scar-like elevations in juxtaposition, which, becoming more and more prominent towards the lower part, may pass from simple elevations into proliferous growths or processes at the base, while the surface of the variety is uniformly smooth, especially towards the stem.

Thus contrasted, so far as my observation extends, let us pass to a brief description of the typical species as well as the variety, both of which occur in Mr. Wilson's collection.

11. *Spirastrella cunctatrix,* Sdt.

Massive, compressed, sessile, elongated, convex or arched longitudinally, wider below than above, where it terminates in a longitudinal narrow space, bounded throughout by a slight elevation of the sides, which thus converts it into a kind of trough or gutter. Consistence firm. Colour, when fresh, "tawny brown," now lilac dark-grey or lilac dark-mouse-colour. Surface consisting of a smooth dermis covering the slight elevations of the subjacent structure, which are in juxtaposition, more or less uniform in size and shape, scar-like, subsiding to a common level upwards, increasing in prominence downwards, until at the base they pass into enlarged proliferous growths. Vents numerous, confined to the longitudinal space or trough which forms the summit. Spicules of two forms, viz.:—1, skeletal, pin-like, of which the prevailing shape of the head is subglobular, varying to simple acuate (as is usually the case with this spicule wherever it occurs), shaft fusiform, finely pointed, 200 by $2\frac{1}{2}$-6000ths in.; 2, flesh-spicule a spini-spirular of four bends, varying under 12 by 3-6000ths in., including the spines, shaft without the spines about 1-6000th in. in diameter. Structure from without inwards consisting of a tough fibrous dermis, which covers a thick compact layer plentifully charged with the flesh-spicules of the species, passing gradually into a less compact interior mottled grey and

yellow, in accordance with the transparency of the spiculo-fibrous reticulated skeleton and the sarcode filling its interstices respectively. Size 3 in. high by 9×3 horizontally.

Depth 19 fath.

Obs. There is another specimen in the collection apparently of the same species, which is simply conical, with a very *smooth* surface throughout. It is $3\frac{1}{2}$ in. high by $2 \times 3\frac{1}{2}$ in. in the base.

As an instance of the occurrence among the Suberitina of a form almost identical with that first described, although apparently a different but closely allied species, I might cite *Suberites capensis*, Carter, which is now, in its dried state, $14\frac{1}{2}$ in. long and $5\frac{1}{2}$ in. in diameter at the base. It is the specimen to which I have alluded in the 'Annals' for 1882 (vol. ix. p. 350) as having been brought from Port Elizabeth (Cape Colony), and now in the British Museum, bearing my running no. "10," and registered "71. 6. 5. 1." The pin-like spicule is stouter and shorter than that of *Spirastrella cunctatrix*, and the spinispirula only half the size; so that with the identity in form it can hardly be considered more than a variety of the latter.

The structural elevations of the surface in both cases appear to me to occur so often in the Suberites under different forms as to be of characteristic value, while they are most typically developed in *Rhaphyrus Griffithsii*, Bk. (*Cliona celata*), where they present themselves in defined polygonal spaces in juxtaposition, with a papilliform area in the centre, which led Schmidt to call this sponge "*Papillina suberea*."

12. *Spirastrella cunctatrix*, var. *robusta*, Carter.

Massive, stipitate, or much contracted at the base, compressed, flabellate, about $\frac{1}{3}$ in. thick; proliferously lobed, especially on one side; lobes more or less compressed, with round, more or less crenulated, border. Consistence firm, mealy when dry. Colour when fresh "orange-red," now light ochre-yellow. Surface smooth. Vents small, congregated about the margin of the lobes. Spicules of two forms, viz.:—1, skeletal, pin-like, prevailing shape of head globular, but very variable; shaft fusiform, rather obtusely pointed, about 105 by $2\frac{1}{2}$-6000ths in. more or less; 2, flesh-spicule a robust spinispirula, the thickest and largest altogether that I have seen, consisting of $2\frac{1}{2}$ bends varying under 11 by 8-6000ths in., including the spines; shaft without spines, 2-6000ths in. thick; the former chiefly confined to the interior and the latter to the surface, where it forms a thick layer,

as in the typical form. Structure from without inwards, consisting of this compact stratum of flesh-spicules, passing inwards into a less compact structure composed of sarcode and skeletal spicules, the latter forming a spiculo-fibrous skeletal reticulation of a grey colour, whose interstices are filled up by a yellowish sarcode, and the whole when *dry* of course not only still more compact, but mealy in appearance and fracture. Size variable, the largest of several specimens 7 in. high by 8 × 6 horizontally.

Depth 20 fath.

Obs. This presents the same characters in structure, colour, and spiculation as that on the little crab's back now in the Liverpool Museum, which came from the Mauritius, and to which I have already alluded.

In both these forms there is a great variety in the size of the spinispirular flesh-spicule as well as in the form of the head and dimensions of the pin-like or skeletal spicule, of which only those of the largest have been given, since, as may be easily conceived, where the spicules must be small before they are great (like everything in nature), and are continually and successively being formed, this *must* be the case.

13. *Spirastrella cunctatrix*, var. *porcata* (dry).

This specimen appears to have been pyramidal in form when fresh, with a smooth surface, or only slightly characterized by the suberitic elevations to which I have alluded; but now presents a number of thick rugæ running from the base towards the apex, which appear to have arisen from a glue-like nature of the cortical layer, that has thus been thrown into folds whilst drying; but whether this consistence, of which the less compact structure of the interior more or less partakes, is natural or caused by partial decomposition I am unable to state. Certainly specimens of a similar species and form have passed through my hands; but then other similar species have, when half decomposed, presented a gluey flabby nature when wet, and a correspondingly compact glucy character when dry, although still retaining part of their original structure in a glutinized condition. In every other respect this specimen resembles *Spirastrella cunctatrix*, and has been designated a variety of it under the name "*porcata*" on account of the ploughed-field like form of the surface.

This glue-like character of the sarcode often presents itself in dried specimens. Is it owing to partial decomposition or to a naturally more inspissated condition of the sarcode?

General Observations.

Here it might be again stated that the spinispirula or flesh-spicule in the Suberitina becomes gradually diminished in size from *Spirastrella cunctatrix* downwards, so as to at last disappear altogether and leave nothing but the skeletal or pin-like spicule, as shown in the "List" to which I have referred ('Annals,' 1882, vol. ix. p. 347 &c.). Hence there may be Suberitina *without* the spinispirula or any other form that the flesh-spicule in these sponges may assume, as the following will show:—

14. *Suberites Wilsoni*, Carter ('Annals,' 1885, vol. xv. p. 113).

In this sponge, so remarkable for its carmine colour, there is *no* flesh-spicule, as may be seen by a reference to the description (*l. c.*).

15. *Suberites Wilsoni*, var. *albidus* (dry).

This is precisely the same as the foregoing in respect of its pyramidal shape, spiculation, and areniferous composition, but the surface is more even, although still retaining traces linearly of the suberitic elevation or polygonal division to which I have alluded, and, where there has been a vent, more or less torn from contraction when drying. It only seems to differ from *Suberites Wilsoni* in the absence of colour. The specimen is 6 in. high by 7×5 at the base. Neither original colour nor depth is given.

16. *Suberites globosa.*

Massive, globular in one specimen, globular-elongate in the other, for there are two specimens, both stipitate, rising from a thick, round, short stem. Consistence firm. Colour in the former when fresh "wax-yellow," now whitish grey; in the latter "orange-buff," now much the same. Surface smooth as glass from the compactness of the dermis. Vents in plurality on the summit of the globular form, reduced to one very large one with everted edge in the centre of the elongated one. Spicules of one form only, viz. pin-like, comparatively small, shaft fusiform, finely pointed, about 75 by $\frac{3}{4}$-6000ths in. Structure from without inwards, consisting of an extremely thin skin in the globular form, but thick (1-24th in.), tough and fibrous in the elongated one; internally the same in each, viz. very compact, mottled grey and yellow by the

presence of the sarcode in the midst of the spiculo-fibrous skeleton. Size of globular form $1\frac{5}{8}$ in. in diameter; that of the elongated one 3 in. high by $4\frac{1}{2} \times 2\frac{1}{2}$ horizontally.

Depth 19 and 18 fath. respectively.

Obs. Somewhat different as these two forms are they nevertheless appear to me to belong to the same species; hence they have been described together under the same designation.

17. *Suberites flabellatus.*

Massive, thick, flabellate, stipitate, lobate on the surface; stem thick. Consistence soft, resilient. Colour when fresh "dull orange-brown," now dull ochre-yellow. Surface smooth, presenting every degree of lobulation from simple elevation to proliferous processes. Vents rather large, surrounded by a thin projecting margin, scattered irregularly over the surface and on the prominent ends of the proliferous growths. Spicules of one form only, viz. pin-like, prevailing form of head subglobular, varying to simple acuate; shaft fusiform, fine-pointed, about 190 by 3-6000ths in. Structure internally from without inwards, consisting of a thin dermal covering, followed by spiculo-fibrous skeletal reticulation imbedded in sarcode, which becomes brown, stiff, and glucy when dry. Size $5\frac{1}{2}$ in. high by $5\frac{1}{2} \times 2\frac{1}{2}$ in. horizontally.

Depth 7 fath.

18. *Suberites biceps.*

Massive, stipitate, terminating above irregularly in pointed lobes; stem thick. Consistence firm. Colour when fresh "crimson," now pinkish grey. Surface smooth, minutely reticulated. Vents scattered over the surface, chiefly towards the lower part. Spicule of one form only, viz. acerate, slightly fusiform, globularly inflated at each extremity (hence the designation), 185 by $1\frac{1}{2}$-6000th in. Structure from without inwards, consisting of a thin reticulated dermis followed by a subcompact tissue imbedding the spicules of the species in a fibro-reticulated skeletal mass traversed by the excretory canals which end at the vents mentioned. Size 3 in. high by $2\frac{1}{2}$ horizontally.

Depth 19 fath.

Obs. This form of skeletal spicule is not uncommon in combination with flesh-spicules (anchorates and tricurvates &c.); and with sparsely-spined ends occurs in *Suberites fistulatus*, Carter, from South Australia ('Annals,' 1880, vol. vi. p. 53, pl. v. fig. 22). The pin-like inflation at each end of

this spicule shows that the *pin-like form alone* cannot be considered "monactinellid" (one-rayed) any more than the simple acerate, which consists of two rays growing in opposite directions from the central cell. "Diactinellid" would etymologically suit this form best (two-rayed).

19. *Suberites insignis.*

Massive, sessile, depressed, elliptical, slightly convex, truncated below; covered with warty tubercles at one end and with large thin-mouthed vents at the other, each in juxtaposition, with a smooth space in the centre between them, altogether looking very much like a large sea-slug. Consistence firm, tough. Colour when fresh "dark slate-grey," now much the same, with a tinge of violet-red. Surface smooth, dermis thin. Vents congregated chiefly over one end. Spicules of one form only, viz. pin-like; head varying from subglobular to simple acuate, 100 by $1\frac{1}{2}$-6000th in. more or less. Internal structure cavernous, tissue compact. Size $1\frac{1}{2}$ in. high by $4 \times 2\frac{1}{2}$ horizontally.

Depth 19 fath.

Obs. This is a very remarkable sponge on account of its structure, which consists chiefly of enormously dilated excretory canals, into which the water &c. entering through the pores and their subdermal cavities is received and discharged by the vents; while the surface of the excretory canals as usual presents the characteristic subcircular rugæ together with the apertures of small canals between them. Passing from the surface inwards the dermis may be observed to be composed of a finely reticulated structure, in each interstice of which are several pores whose apertures lead into the subjacent subdermal cavities, which together form a layer that is continued *over* the warty tubercles as well as *over* every other part of the surface, forming in many parts the outer wall or roof of the great dilated excretory canals, which thus receive the contents of the subdermal cavities through holes corresponding to the pores externally, and finally eject them, or such parts as are not necessary for the nourishment of the sponge, through the large thin-mouthed vents at the other end of the specimen, thus affording another instance of a *direct communication* between the pore and excretory canal systems. The "cavernous" structure seems to find an analogue in the similarly-dilated canal-structure (*lacunæ*) of *Chondrosia reniformis*, Nardo, and *C. Ramsayi*, Von Lendenfeld (Proc. Linn. Soc. N. S. Wales, vol. x. pt. 1, p. 147, pl. iii), of which there are two or more specimens in Mr. Wilson's collection from "Western Port."

20. *Suberites parasitica.*

This consists of a thin layer of small pin-like spicules about 40 by 1-6000th in., together with others of ? *Hulichondria panicea* about twice the length, parasitically covering a fucus (*Thamnoclonium flabelliforme*, Harvey, Freemantle. See 'Annals,' 1878, vol. ii. p. 162 &c., "Parasites on the Spongida").

Group 13. Polymastina (new group).

21. *Polymastia bicolor.*

Massive, flattish, slightly convex, circular, sessile, bossed with slightly convex circular knobs of a dark grey-brown colour, set as it were in a yellowish flat mass; "bosses" varying in diameter under $\frac{3}{4}$ in. Consistence hard, firm. Colour when fresh "dark grey-brown," now, as just mentioned. Surface dermally smooth, especially over the dark projecting portions or "bosses." Vents lateral and towards the base. Spicules of one form only, but of two sizes, according to their position:—1, skeletal, subpin-like, varying to simple acuate, 150 by $2\frac{1}{3}$-6000ths in.; 2, the same, but much smaller, viz. 10 to 20-6000ths long; the former radiating in bundles from the interior to mingle their points with a layer of the latter, which are confined to the surface. Structure consisting from without inwards of an areniferous dermal layer of a yellow colour, followed by a tough compact basal tissue composed of radiating bundles of the large spicule traversing a yellow sarcode and extending in a diminishing degree, core-like, through the centre of the bosses, where its presence at the summit can just be distinguished; bosses otherwise composed of the same radiating kind of spicular structure, but in a dark grey sarcode, which makes the difference on the surface that led to the designation "*bicolor*." Excretory canal-systems traversing the whole in such a peculiar form that it will be desirable to describe this particularly in the "Observations." Size $1\frac{1}{2}$ in. high by $3 \times 4\frac{1}{2}$ horizontally.

Depth 7 fath.

22. *Polymastia bicolor*, var. *glomerata.*

The same, but with the bosses enlarged and elongated so as to obscure the yellow basal structure beneath, and thus only present a conglomeration of mamilliform processes.

23. *Polymastia bicolor*, var. *crassa*.

The same, with only three or four processes of much greater length, one of which is 2 in. long by ½ in. in diameter at the base.

Obs. Not being able at first to see any vents about the specimens, which, as before stated, present a more or less areniferous dermal coat of a yellow colour over the basal structure, that is between the bosses or mamilliform appendages, I slit open the largest process of no. 23, and found that the excretory canal commenced in small branches towards the summit, in a spongy tissue which, formed of a labyrinthic hypertrophy of the pore and subdermal cavity-structure, filled up the end and sides of the mamilliform extension; and tracing these downwards by means of their size and the subcircular folds which characterize an excretory canal, they were observed to unite into a single trunk, which, when pursued through the yellow tissue of the body, was found to end in a vent situated laterally towards the base of the specimen; thus affording still another instance of a direct communication between the pore and subdermal cavity and the excretory canal-systems at the surface of a sponge. This was also found to be the case in the bosses of *Polymastia bicolor* and in the mamilliform processes of no. 22.

There is a dry specimen of *Polymastia bicolor* among the late Dr. Bowerbank's specimens from the south coast of Australia, now in the British Museum; but it must have been much larger when fresh, for it is now 1½ in. high by 7½ × 5½ horizontally. Indeed there are so many specimens of this species in Mr. Wilson's collection that it, like many others, must be very abundant about Port Phillip Heads. Dr. v. Lendenfeld states that his *Aplysilla violacea* covers "many thousand square metres in Port Phillip" (Proc. Linn. Soc. N. S. Wales, vol. ix. p. 311).

Here I would observe with reference to a former statement as to the "vents" of *Desmacidon Jeffreysii*, Bk.= *Oceanapia*, Norman, not having been discovered ('Annals,' 1882, vol. x. p. 119), that it is just possible that they may be found on a level with the surface of the sponge quite independently of the long tubular appendages, which, being in structure very much like the mamilliform processes of *Polymastia*, may in like manner be simply for *inhalent* purposes; except by accident, when the end of the tube may be converted into a vent.

24. *Polymastia massalis.*

Massive, irregularly hemispherical, truncated (? cut off by the dredge) at the base; scattered over with small wart-like conical processes, like mamillæ in miniature, not being more than $\frac{1}{6}$ in. long. Consistence compact, firm. Colour when fresh "purplish brown," now light yellow-grey throughout. Surface smooth. Vents in plurality, partly at the ends of the warty processes and partly on a level with the surface. Spicules of two forms, viz.:—1, skeletal, acuate, very long, 130 by $\frac{2}{3}$-6000th in.; 2, subpin-like, 30 by $\frac{1}{2}$-6000th and under; the former in bundles radiating from the body, and the latter confined to the surface, where they form a layer intermingled with the points of the skeletal bundles. Structure compact, traversed by the canals of the excretory systems, which open at the vents mentioned. Size of specimen $1\frac{1}{4}$ in. high by 3×3 horizontally.

Depth 19 fath.

Obs. The mamilliform processes in this species differ in structure from those of the foregoing species and its varieties, inasmuch as "the vents" are distinctly in some of the mamilliform processes, which then seem to be entirely devoted to them, while in others the same kind of structure prevails as in *Polymastia bicolor* &c.

Group 14. Trachyina (new group).

25. *Trachya globosa.*

Globular, stipitate; stem thick, cylindrical. Consistence firm, unyielding. Colour when fresh "bright ochre-yellow," now whitish grey. Surface smooth, but uneven, from the dermal layer overlying slight elevations of the subjacent structure. Vents scattered round the summit coronally. Spicules of two forms, viz.:—1, skeletal, acerate, exceedingly long, fusiform, gradually diminishing on each side to a very fine point, 1000 by 9-6000ths in., or about $\frac{1}{6}$ in. long; 2, flesh-spicule, bihamate (fibula), C- and S-shaped, very minute, viz. about 2-6000ths in. long; the former arranged in bundles radiating from a condensed centre to the circumference, the latter confined to the sarcode. Structure from without inwards consisting of a thick dermis, followed by a radiating arrangement of the skeletal spicules in bundles from the condensed centre to the circumference, imbedded in sarcode, which is abundantly traversed by excretory canals, especially towards the border. Size of head about $2\frac{1}{4}$ in. in diameter; stem, which is truncated (? cut off by the dredge), $\frac{1}{2}$ in. in diameter.

Depth 19 fath.

Obs. There are four specimens of this sponge, all more or less alike, but one is double-headed. At first they look so much like specimens of *Donatia* that one is inclined to place them in the same group; however, the stipitate form (there is no stem in *Donatia*) and the spiculation soon dispels this delusion.

Group 15. Donatina.

26. *Tethea Cliftoni*, Bk.

Tethea Cliftoni, Bk., Proc. Zool. Soc. 1873, p. 16, pl. iii. figs. 14 &c.
Donatia, Gray, *ib.* 1867, p. 541.

This seems to me to be only an enlarged form of our *Donatia lyncurium*, and therefore ought to be considered a variety rather than a distinct species. The surface is more prominently tuberculated and the root-like appendages larger and more prolonged than in the British species; but the colour is pink or orange when fresh and the spiculation and internal structure are nearly the same. There are several specimens in Mr. Wilson's collections averaging 2 inches in diameter, which is twice the size of the British species (see my illustrated description of the latter, 'Annals,' 1869, vol. iv. p. 7, pl. ii. figs. 1–3). In distribution it seems to be "world-wide."

Group 19. Chondropsina (new group, provisional).

27. *Chondropsis arenifera.*

More or less globular, sessile. Consistence firm, almost unyielding. Colour when fresh "buff or reddish grey," now whitish grey externally. Surface irregular, but smooth. Vents numerous, irregular in size, large, scattered over the surface, especially round the summit. Spicules of two forms, accompanied by a great quantity of sand:—1, Skeletal, cylindrical, with obtuse ends, 70 by $\frac{2}{3}$-6000th in.; 2, acuate, much smaller, viz. 50 by $\frac{2}{3}$-6000th in. Sand diffused, not circumscribed, that is not in the form of fibre. Structure from without inwards consisting of a thin reticulate dermis whose fibre is charged with minute acuates mixed with grains of sand, passing into a cartilaginous fibreless tissue partly charged with the spicules above mentioned in yellow sarcode, and partly with grains of sand *throughout*, that is presenting no nuclear condensation. When dry the sand appears in aggregations distinct from the yellow sarcode, then of a brown colour like glue, in which the spicules are chiefly imbedded. Size of

largest specimen (of which there are three) globular, nearly 3 in. in diameter.

Depth 20 fath.

Obs. This specimen is infested with a short oscillatorian parasite in great abundance, whose filaments vary in length under 25-6000ths in. The species has been *provisionally* inserted here for the reasons mentioned in my observations on the "group," p. 45 *antea*).

Group 25. Stellettina.

28. *Stelletta bacillifera*, var. *robusta*, Carter ('Annals,' 1883, vol. xi. p. 351).

Massive, globular, sessile, or attached by one part of its circumference. Consistence hard. Colour when fresh "dull maroon-red," now sulphur-yellow, *internally*. Surface hard, minutely granulated. Vents scattered here and there over the body, chiefly towards the point of attachment. Spicules of four forms, viz.:—1, "the body-spicule," as usual, a large acerate, 245 by $1\frac{1}{2}$-6000th in.; 2, "zone-spicule" or tetractinellid, arms simple, expanded laterally and rather recurved, head 11-6000ths in. broad, shaft 120 by $1\frac{1}{2}$-6000th in.; 3, flesh-spicule, bacillar, 12 by 1-6000th in., spined all over; 4, flesh-spicule, stellate, 2 6000ths in. in diameter. No "forks" or "anchors" were seen, which may or may not be a constant feature. Flesh-spicules confined to the dermal layer, which is thin and receives the heads of the zone-spicules, together with the outer ends of the body-spicules or large acerates. Structure internally consisting of the body-spicule chiefly, imbedded in sulphur-yellow sarcode, which still retains its brilliancy, traversed largely by the canals of the excretory systems, especially about the centre. Size of specimen $1\frac{3}{4}$ in. in diameter.

Depth 19 fath.

Obs. If not the same this seems to differ so slightly from *Stelletta bacillifera*, var. *robusta*, Carter (*l. c.*), as not to require a distinct appellation; but as the latter was described in the *dried* state, in which the colour of the interior when fresh could not be determined, I have thought it desirable to describe Mr. Wilson's specimen also, as the *yellow colour* of the interior is so bright and striking. Of course, to become better acquainted with the species it will be advisable to read what I have published on the subject where the original has been described.

29. *Stelletta æruginosa.*

Globular, sessile, that is adhering by one part of the cir-

cumference only to the object on which it may be fixed. Consistence hard. Colour verdigris-green or blue throughout. Surface smooth. Vents irregularly scattered over the surface. Spicules of five forms, together with a large pigmental cell, viz. :—1, body-spicule, as usual, a long acerate, 288 by $2\frac{1}{2}$-6000ths in. ; 2, zone-spicules or tetractinellids, arms simple, remarkably long, at first projected for a little distance anteriorly and laterally, and then horizontally for the rest of the course, head 100-6000ths in. in diameter, shaft 344 by 3-6000ths in. ; 3 and 4, anchors and forks, each with short thick arms and, as usual, long shafts, the former plentiful, the latter small and scanty ; 5, flesh-spicules, stellates of two sizes, the largest about 6- and the smallest 2-6000ths in. in diameter, rays spined verticillately. Pigmental cell globular or slightly elliptical, distinctly nucleated and granuliferous, granules brown ; cell 4-6000ths in. in diameter, granules strongly marked, 1-6000th in. Structure compact, consisting from without inwards of a fibrous dermis in which are imbedded the pigmental cells (which, from their comparatively large size, are striking objects), together with the smaller stellates, the outer points of the body-spicules, and the heads of the zone-spicules all mixed together. Size variable, under an inch in diameter.

Depth about 6 fath.

Obs. There are upwards of a dozen specimens of this sponge under the size above mentioned down to that of a pea, and all attached to different objects, sometimes one or two together or following each other, especially on the stalks of *Chalina polychotoma*. Like the foregoing, they do not part with their colour on being kept in spirit. Direct communication between the pore-structure and the cavities of the excretory canals is presented at their circumference.

30. *Stelletta mamilliformis.*

Globoconical, mamilliform, sessile. Consistence tough, dense. Colour whitish, colourless. Surface rough, being more or less covered with grains of sand agglutinated to the dermis. Vent single, terminal, large. Spicules of five forms, together with a pigment-cell, viz. :—1, body-spicule, as usual, a long large acerate, 345-6000ths in. in length ; 2, zone-spicule or tetractinellid, arms at first simple, then bifurcate, the simple or proximal part projected anteriorly and laterally, and the forked part horizontally, head 84-6000ths in. in diameter, shaft 344-6000ths in. long ; 3 and 4, anchors and forks present as usual, with long slender shafts and more slender arms than those of the foregoing species ; 5, flesh-

spicules, stellates of two sizes as usual, viz. 6- and 4-6000ths in. in diameter respectively. Pigmental cells globular or slightly elliptical, distinctly nucleated and granuliferous, granules brown, sometimes colourless; cell 4-6000ths in. in diameter, granule 1-6000th in. Structure compact, consisting from without inwards of a thin fibrous dermis charged with grains of sand, pigmental cells, and stellates, in which are imbedded the distal ends of body-spicules together with the tetractinellid heads of the zone-spicules. Size about $\frac{1}{2}$ in. in diameter.

Depth not mentioned, being one of a great number of small specimens tied up in a cloth.

Obs. There are two of these which have grown together, indicative of their having belonged to a group, thus growing like the yellow variety of *Tethya* (*Stelletta*) *dactyloidea*, Carter, in the sandy estuary of Mahim at Bombay ('Annals,' 1869, vol. iii. p. 15, and 1872, vol. ix. p. 82).

31. *Stelletta geodides.*

Subglobose, sessile. Consistence hard. Colour when fresh "dark slate," the same now. Surface minutely granulated over low mulberry-like elevations. Vents small, numerous, in the grooves between the elevations. Spicules of four forms, together with a pigment-cell, viz.:—1, body-spicule, as usual a long large acerate, about 600 by 6-6000ths in.; 2, zone-spicule or tetractinellid, in which the arms are simple, very short and thick comparatively, rather recurved and projected forwards and laterally, head 20-6000ths in. in diameter, shaft 375 by 6-6000ths in. No anchors or forks seen. 3, flesh-spicules, solid, elliptical, microspined all over, 2 by $\frac{2}{3}$-6000th in.; 4, flesh-spicule, stellates varying under 5-6000ths in. in diameter. Pigmental cell large, globo-elliptical, 10 by 8-6000ths in. in diameter, distinctly nucleated and granuliferous, granules large and brown-coloured. Structure from without inwards consisting of a dark cortex about $\frac{1}{24}$ in. in thickness, of which the outer half is composed of a layer of the flesh-spicules, nos. 3 and 4, imbedding the distal ends of body-spicules and the heads of the zone-spicules; and the inner half is composed of the subdermal cavities circumscribed by tissue charged with the pigmental cell, followed by the body-substance, which chiefly consists of the body-spicules and the sarcode scantily charged with stellates and plentifully traversed by the canals of the excretory system which end in the vents mentioned. Size $2\frac{1}{2}$ in. in diameter.

Depth 13 fath.

Obs. The cortical layer, which in its outer half is chiefly

composed of the spiniferous, elliptical, solid bodies, gives this sponge very much the character of a *Geodia*; hence the designation. But the alliance is between these flesh-spicules and the bacilliform bodies of *Stelletta bacillifera*, var. *robusta*, rather than with the siliceous balls of *Geodia*, as may be seen by their structure and development, together with a reference to the illustrations of the varieties in form assumed by the *bacillar* flesh-spicules given in connexion with my description of *S. bacillifera*, var. *robusta* ('Annals,' 1883, vol. xi. p. 351, pl. xiv. fig. 3, *g*).

Group 26. Stellettinopsina (new group).

32. *Stellettinopsis simplex*, Carter ('Annals,' 1879, vol. iii. p. 349, pl. xxviii. figs. 16–18).

33. *Stellettinopsis tuberculata.*

Massive, sessile, nodularly tuberculated; tubercles agglomerated into groups. Consistence hard. Colour when fresh "dull purple-brown," now dark brown. Surface rough, *i. e.* minutely and uniformly granulated. Vents small, numerous, and in the sulci between the agglomerated tubercles. Spicules of two forms, viz.:—1, skeletal, a large, smooth, acerate, 180 by 3-6000ths in.; 2, flesh-spicule, a minute stellate about 2-6000ths in. in diameter. Structure from without inwards consisting of a thick dark dermal layer charged with sand and stellates, traversed by the distal ends of the body-spicules which are situated near the surface, followed by a compact body-substance composed of the large acerate spicule imbedded in sarcode of a lighter colour than the dermis charged with the minute stellate. Size $4\frac{1}{2}$ in. high by 4×3 horizontally.

Depth 3 fath.

34. *Stellettinopsis coriacea.*

A large, irregularly shaped (*i. e.* amorphous) fragment. Massive, enclosing bivalve shells an inch in diameter in its tissue; partly covered by a remarkably thick smooth skin. Consistence firm. Colour when fresh "dull purple," now dark pinkish slate, turning to madder-red under the action of liq. potassæ or nitric acid. Surface characteristically smooth. Vents in small groups here and there. Spicules of four forms, viz.:—1 and 2, skeletal, large acerates and acuates about the same dimensions, viz. 324 by $4\frac{1}{2}$-6000ths in.; 3, small acerates, about 25-6000ths in.; 4, flesh-spicule, the usual small stellate, about 2-6000ths in. in diameter. The skeletal spicules are

chiefly confined to the body and the small spicules to the surface. Structure from without inwards consisting of a thick, fibrous, tough, and smooth dermal layer, now of a dark pinkish slate-colour, as above stated, charged with the small or flesh-spicules, and contrasting strongly in colour with the body-substance, which is much lighter and composed of the body-spicules chiefly. Fragment about 3 in. in diameter.

Depth 20 fath.

Group 28. Tethyina.

35. *Tethya cranium*, var. *australiensis*.

Massive, elliptical, convex, truncate, sessile (? cut off at the base by the dredge). Consistence tough, firm. Colour when fresh "yellow," now much the same, but faded. Surface finely hispid. Vents small and numerous, here and there among the pores of the reticulated dermis. Spicules of four forms, viz.:—1, skeletal, the body-spicule, an extremely long acerate, fusiform, with elongated and finely pointed extremities, 1350 by 9-6000ths in., *i. e.* about $\frac{1}{4}$ in. by about 1-600th; 2, zone-spicule or tetractinellid, arms simple, extended fork-like, about 32-6000ths in. long, shaft a little less than that of the body-spicule; 3, a fine, minute, fusiform acerate, microspined throughout, about 50-6000ths in. long; 4, bihamate or fibula, C- or S-shaped, about 4-6000ths in. long. Structure from without inwards consisting of a thin fibro-reticulate dermis, charged with the bihamate flesh-spicule, in the interstices of which reticulation the pores are situated, and through which the distal ends of the body-spicules and the trifid ones of the tetractinellids project, which gives the surface its fine, delicate, hispid character, followed inwardly by a compact structure, composed of bundles of the skeletal acerates radiating from the centre towards the circumference, held together by the sarcode, charged with the microspined acerates and the bihamate flesh-spicules, and traversed by the canals of the excretory systems. Size $4\frac{1}{2}$ in. high in the centre by $2\frac{1}{2} \times 1\frac{1}{2}$ horizontally.

Depth 20 fath.

Obs. The presence of the fine microspined acerate in great abundance throughout the body-substance is the chief distinguishing character of this variety. I saw no anchors (smaller tetractinellids with *recurved* arms); but as their heads when exposed are generally broken off (for they catch in everything that they touch), it does not follow that they do not form part of the spiculation, particularly as they are present in most of the other species that have been described.

XL.—*Descriptions of Sponges from the Neighbourhood of Port Phillip Heads, South Australia, continued.* By H. J. Carter, F.R.S. &c.

[Continued from p. 127.]

Order VII. HEXACTINELLIDA.

Families.	Groups.
1. *Vitreohexactinellida*	1. Patulina. 2. Tubulina. 3. Scopulifera.
2. *Sarcohexactinellida*	4. Rosettifera. 5. Birotulifera.
3. *Sarcovitreohexactinellida*	Only one species known, viz. *Euplectella cucumer*, Owen.

This arrangement, based on a hasty study of almost all the then-known species of Hexactinellida, whose result may be seen in the 'Annals' of 1873 (vol. xii. p. 349, pls. xiii. to xvii.), will be found towards the end of my Classification (*ib.* 1875, vol. xvi. pp. 199 and 200), accompanied only by the names of the species respectively which illustrate the groups that have been more particularly noticed in the paper to which I have just alluded. Two more species were described and illustrated in 1877 ('Annals,' vol. xix. p. 122, pl. ix.) and two or three more in 1885 (*ib.* vol. xv. pp. 387–406, pls. xii. to xiv.), among which is the famous *Farrea occa*, now deposited in the British Museum. Those which have been described by others since the date of publication to which I first alluded, and which are very few in number, must be sought for by the student himself.

Unfortunately all that I have stated has been from dry specimens, and the only instance worth mentioning in which the structure of the soft parts has been described from a Hexactinellid sponge preserved in the *wet* state is the description by Prof. Dr. F. E. Schulze of a specimen of *Euplectella aspergillum*, which he received in "January 1880 from the 'Challenger' Office, Edinburgh," for this purpose ('Challenger' Reports, Sponges Hexactinellidæ, pl. A). To mention the author's name is a sufficient guarantee for the authenticity of this kind of work, in which he has never been equalled and can, with his power of delineation, hardly be surpassed. Referring the student to the paper itself, I would only here observe that, at p. 6 of the "separate copy" which the author

kindly sent me, it is stated that the ampullaceous sacs (Geisselkammern), which have a peculiar elongated shape and are placed side by side, with their apertures directed towards the centre of the exhalant canal, like the radial chambers of *Grantia ciliata* around its cloaca, average "about 100 μ" in length and "about 60 μ" in breadth; while those which he had previously described and illustrated in *Spongelia* (Zeitschrift f. wiss. Zoologie, Bd. xxxii. p. 134, Taf. viii. fig. 5) are stated to have averaged "von 0·06–0·1 mm." in diameter. The radial chambers of *Grantia ciliata* vary of course with the size of the specimen, but may be 1-24th in. long by 1-60th in. in diameter and even more, that is about 1·0159 by ·5079 millim., so that there is a great difference in size between the ampullaceous sac of *Euplectella aspergillum* and its apparent analogue in *Grantia ciliata*, however much in other respects they may resemble each other.

As there are no specimens of the order Hexactinellida in Mr. Wilson's collections, let us pass on to the next, viz. the Calcarea, wherein will be included not only the specimens which came "from the neighbourhood of Port Phillip Heads," but those also which were subsequently obtained by Mr. Wilson from "Western Port," about 15 miles to the westward.

Order VIII. CALCAREA.

Here I cannot premise as heretofore any classificatory arrangement of the species of this order, as I had not studied them sufficiently for this purpose when my Classification of the Spongida generally was published ('Annals,' *l. c.*); and not having done much more since in this way I must still, as I did then, recommend the student to study Häckel's work entitled 'Die Kalkschwämme' (eine Monographie in zwei Bänden Text und einem Atlas mit 60 Tafeln Abbildungen, 1872), to which, however, I must now add the judicious criticism on this work of Dr. N. Polèjaeff, in his "Report on the Calcarea collected by the 'Challenger' Expedition" ('Challenger' Reports, Zoology, vol. viii. pt. xxiv. 1883), and his proposed alterations, throughout which he has not forgotten the respect due to Häckel nor the advantage he has derived from that first and brilliant step into this field of inquiry which Häckel has put forth in 'Die Kalkschwämme.' Doubtless there are shortcomings in every man's work, and thus every man's work helps primarily to supply them; hence, as Dr. Polèjaeff properly remarks, "every one is son of his time" (Report, p. 6).

The calcareous sponges were divided by Häckel into three families, viz. "Ascones, Leucones, and Sycones," which, for very satisfactory reasons, Dr. Polèjaeff (Report, p. 22) has reduced to two divisions, viz. "Homocœla and Heterocœla," the former including the single family of Asconidæ (Ascones), and the latter those of the families Syconidæ (Sycones), Leuconidæ (Leucones), and Teichonidæ (Teichone, Teichonellidæ),—the chief differences between the two being that in the division Ascones or Homocœla there is apparently no parenchymatous tissue, that is, the sponge is almost entirely reduced in structure to a mere tube whose wall hardly amounts to more than a thin layer of spicules held together by and supporting the sarcode (syncytium, H. in part) which contains the soft portions of the species, but branching, anastomosing, and rebranching continually during growth, at length may reach a more definite form; while in the Heterocœla the tissue supporting the soft parts fills up as it were the spaces between the bends of the tortuous tubulation in the Ascones, and thus produces a massive sponge like *Teichonella prolifera*, which in structure closely approaches an ordinary non-calcareous sponge. I have said "as it were," because the "tubulation" does not exactly represent the excretory canal-system of *Teichonella prolifera*, which is dendriform, while that of a tubular Ascon is more or less of the same calibre throughout. However, this broad distinction will do for the present, as I shall have to return to the subject more particularly hereafter.

But in so far as many of the Sycones are as much reduced to a simple tube in their structure as many Ascones, so I shall transpose Häckel's primary or family divisions as Dr. Polèjaeff has done, by placing the Sycones before the Leucones and the Teichonellidæ last; thus we shall have an uninterrupted evolution in structure from the simple tube in the Ascones to the most complicated form of that in the Teichonellidæ, or, at least, *T. prolifera*, for we shall find by-and-by that it will be necessary to place *T. labyrinthica* among the Sycones, as its structure is almost precisely that of *Grantia compressa*.

Meanwhile it is necessary to begin by defining what a calcareous sponge is, and this may be done by stating that it is a spiculiferous sponge in which all the spicules are calcareous.

After which it may be added that it possesses *no fibre*, which, together with its tender structure generally and the delicate structure of the excretory canals, renders its tissue more or less *fragile* in every instance.

To examine a calcareous sponge for description it is necessary to sectionize the specimen, so that one part or half may be dried and the other kept wet, *i. e.* in a preservative fluid. Thus the sections may be either partial or general, one or more depending on the amount of material at command; but under any circumstances there must be dried sections of the specimen as well as wet for this purpose.

Where time is not an object, as it is with me, for I may have little left, *microscopic* sections of dyed portions should be made, since without this a complete description of no sponge can be written. *My* descriptions therefore will be incomplete so far as this goes; but it is to be hoped that they will fulfil their purpose in other respects, that is in providing an introduction to this inquiry for those who may take it up hereafter.

At first, in the description of a calcareous sponge, the form generally of the specimen should be notified, and, if possible, an accurate sketch of the natural size *recorded* before it may be disfigured by the sectionizing. Then the colour, both in the fresh and dried states, should be mentioned. After this the surface described, generally and in detail. The pores noticed, and also the vent or vents, as the case may be, followed by the cloaca. All this may be regarded as belonging to the *general* form, outwardly and inwardly. After which the internal structure, viz. that which is situated between the skeletal layer of the surface on the outside and that of the cloaca on the inner side, should be described in detail. Finally the spiculation or spicules, generally and particularly, followed by the size of the specimen, its habitat, locality, and any further observations that may be desirable. At least this is the plan that will be adopted in my descriptions.

In describing the "form" it may be necessary to use the words "individualized" or "agglomerated," the former meaning single or complete in itself, the latter in plurality and more or less sunk into a general mass. Again, the former may be "solitary," that is when alone, or "social," when accompanied by others of the same kind, young or old. Of course the "description" of the "form" can only apply to the specimen in hand, unless there are sufficient examples to afford an average.

In the matter of colour, which is generally the same, I would premise here that this is some shade of "white" or "sponge-brown," approaching more or less to that of snow, as in *Leuconia nivea*, Bk. (*Leucandra nivea*, H.), and that when *dry* the exposed parts, viz. the surface and the cloaca, are always whiter than the internal structure, on account of

the greater abundance of sarcode in the latter (where the ova are generally seen), which, when dry, assumes a sponge-brown colour. These observations are premised to avoid unnecessary repetition in the text, so that hereafter in the descriptions the colour may not be noticed, unless differing from that above mentioned.

The "structure of the surface" or cortical portion needs no remark beyond the fact that the holes of the cribrated dermal sarcode, *i. e.* the *pores*, are generally much larger than in the non-calcareous sponges; then the spongozoa are nearly double the size also, and in the fresh state so large that they may often be seen to contain the *green zoospore of an alga*, which, by its colour, contrasts strongly with the translucent white of the spongozoon, thus favouring the view that it was taken in for nourishment, just as when fed with carmine or indigo *paint* the gummy part appears to be retained for the same purpose and the colouring-matter rejected, as I have long since shown ('Annals,' 1857, vol. xx. pp. 28 and 29). In short, as regards this subject I know of no other means of ascertaining these facts satisfactorily than by watching the development of a sponge under water, that is while growing, which can only be done in *fresh* water, with the gemmule or statoblast of a living *Spongilla*, as I have mentioned (*op. et loc. cit.*); for here there is no tearing to pieces or interfering with the sponge, which may be transferred to the field of the microscope (in the watch-glass in which it may be growing) for observation, as long and as often as the student thinks necessary, while a very high power (immersed of course) may be brought to bear upon it during the time that a solution of the carmine paint is added to the water in its neighbourhood. I do not mean to state that this is the only course by which the sponge is nourished, for Lieberkühn has long since shown that an Infusorium may be taken in by the general substance of a sponge, and there digested in a similar manner to the nutritious fragments which the Infusoria themselves employ for this purpose, ex. gr. *Amœba*.

The terms "cortex" and "structure of the surface" will be often used synonymously; but it should be remembered that generally the surface-layer is so thin that it hardly deserves this name, since it is only in one species, viz. *Hypograntia infrequens*, which will be hereafter described, that I have found this layer so thick as to deserve the name of "cortex," and of this it is impossible to get a better idea than that conveyed in Polèjaeff's illustration of *Ute argentea* (*op. cit.* pl. iv. fig. 3).

Returning to our vocabulary: I have used the term "vent"

for what is generally called the "mouth" or "osculum" in a calcareous sponge, after the manner that this would be applied to a sack; and the word "cloaca" for the cavity to which it leads explains itself; while the apertures on the surface of the latter will be termed "holes," and that or those, as the case may be, which are seen to open into them, more or less below the surface, the "openings," that is of the chambers or canals of the internal structure or that of the wall; the whole of which is precisely similar to corresponding parts in the non-calcareous sponges.

For the interval between the surface or cortex of the body and that of the cloaca the term "wall" will be adopted; its structure consists of empty spaces accompanied by a variable quantity of minutely cancellated tissue. The former will be termed tubes, chambers, or canals, according to their shapes respectively. Thus they will be called "radial chambers" (radial tubes, H.) when they are more or less cylindrical or prismatic, straight and extending directly across the "wall" horizontally, from under the pores on the surface to under the holes of the cloaca respectively, as in *Grantia ciliata*, Bk.; or they may be "subradial," that is more or less branched under the same circumstances, as in our *Hypograntia*; or with no appearance of radiation at all, as in our *Heteropia*; or with the empty spaces canalicular and branched, tree-like, as in *Teichonella prolifera*; while the minutely cancellated tissue which accompanies them will be termed "parenchyma."

Again, as regards the form and arrangement of the spicules in the structure of the wall; this, in his Sycones, has been divided by Häckel into "articulate" (gegliederte) and "inarticulate" (ungegliederte), that is respectively where the skeletal structure of the radial chambers (tubes, H.) is entirely composed of a number of small radiates about the same size, or where it is formed by the simple extension across the wall of the long shafts of large radiates, whose heads support the cortex or dermal structure on one side and that of the cloaca on the other, thus leaving horizontal intervals between them which correspond to the radial chambers; or these two forms of skeletal structure may be mixed, *i. e.* where one portion of the radial chamber is "articulated" and the other "inarticulated;" but in all cases the sarcode tympanizing the intervals of these spicules to complete the chamber is pierced by intercommunicating *pores*; while in the subradial or branched chambers and the still further divided forms, up to that which is dendritic, the chambers, now as it were become canals, are rendered continuous with one another by larger or smaller holes of intercommunication, according to the species and the degree

of subdivision of these canals, that is, of course, where the latter are very small the holes are in proportion.

It may also be observed that the chambers immediately under the pore-dermis are often much more dilated than further in, thus resembling the "subdermal cavities" of the non-calcareous sponges; and a similar dilatation may often be seen immediately under the cloaca, which, to a certain extent, may account for the plurality of openings in the wall-structure appearing through the holes of the latter, as will be noticed hereafter in the descriptions of the respective species where this presents itself; I say "to a certain extent," because where the holes in the cloaca are in proportion to the number of radial chambers, as in *Grantia ciliata* &c., this cannot occur.

Lastly we come to the "spiculation," *i. e.* a description of the different forms of spicules, which are generally found to be more or less constant in particular parts. Thus, beginning with the acerates, it will be noticed that those which fringe the vent or mouth of the cloaca present a peculiarly glistening aspect *en masse*, which, when they are separate, is found to depend on their long, straight, cylindrical, delicate form, closely resembling "spun glass," and these, similarly pointed at each end and arranged like a palisading around the *inside* of the mouth, where their fixed ends are on a level with the surface of the cloaca and their free ones project more or less beyond the mouth or vent, will be called the "peristome;" on the other hand, when there are *none*, and this feature is consequently absent, the mouth will be called "naked." At the same time it should be remembered that the two states may occur in a group of the *same* individuals, so that the presence or absence of the "peristome" must not be always regarded as an infallible distinction.

Again, the acerates may be more or less scattered over the surface either echinatingly or altogether imbedded in it *longitudinally*, when they will generally be found to be much stouter, more or less curved equally throughout, or more in one half than the other, which is generally the outside one; also more or less equally fusiform, in which case the thickest part is outwards and the other more or less sunk into the wall. Occasionally the outer end is "lanciform," in a line with the shaft, or bent to one side, like a "fixed bayonet" on a musket, and limited in its extent by a more or less prominent annular inflation, which extends obliquely or circularly across the shaft at the point of union; or the outer end may be more or less sharply curved or club-shaped &c.

Lastly, there is often a minute straight or sinuous acerate

with more or less lanceolate or, rather, "fixed bayonet" end, like that just described, sometimes serrated, with which the cribriform sarcode of the dermis is charged. Taking the place of the flesh-spicule in the non-calcareous sponges, and thus also strengthening this structure, while it acts in combination with the sarcode as a kind of cement in binding down the larger spicules of the surface generally, it has been termed by Häckel "Stäbchen-Mörtel." Hence these spicules may be termed "mortar-spicules," so that when this term is used the reader will know what is meant by it. This form again sometimes attains a larger size, when, as is the wont of the dermal acerates generally, they become mingled with the internal ends of the spicules of the mouth and thus form part of the proximal end of the peristome.

But the staple and, therefore, most characteristic spicule of most calcareous sponges is a "radiate," which may be regular or irregular; that is to say, when the arms or rays are all equal in size and all separated from each other at equal angles it may be termed "regular," and when the reverse "irregular."

The radiates, again, may be divided into three-armed and four-armed spicules, *i. e.* triradiates and quadriradiates, which may be more or less equally mixed together according to the species or their position in that species.

Noticing the triradiates first, it may be observed that they are generally more or less elevated in the centre, so that if on a level surface with the points of their arms downwards they would rest on these points, a feature which attains its maximum in the peculiar form that characterizes the surface of *Clathrina tripodifera*, as will be more particularly mentioned hereafter. It may also be observed that when the triradiates depart from their "regular" form they for the most part become more or less bow-and-arrow shaped (whence they have been termed "sagittal"), in which two of the arms may be variously expanded laterally in a more or less curved or undulating form, backwards or forwards, while the third remains more or less straight, and hence will be termed the "shaft." Under this form they may be generally small or generally large. Thus, as before stated, when generally small and numerous they form the skeletal structure of the radial tube or chamber in the Sycones, which has been termed "articulated;" while when large, with long shafts, the latter alone extending across the wall simulates that which has been called "inarticulated."

The "sagittal" form appears to be often used for binding down the subjacent spicular structure, and, following it up-

wards from the surface of the cloaca, this becomes particularly striking and beautiful at the base of the peristome, where the arms are not only expanded almost perpendicularly across the lower ends of the spicules of the peristome, like cross bars in a palisading, but, to still further extend their use, are absolutely flattened vertically, while the shaft remains more or less aborted, thin, round, and directed backwards in a line with the spicules in the layer of the peristome.

The quadriradiates, on the other hand, do not differ from the triradiates except in the addition of what is termed a fourth arm; but inasmuch as this is for the most part different in form from any of the rest, it has been termed by Dr. Bowerbank the "spiculum" or "spiculated ray" (Mon. Brit. Spong. vol. i. p. 241, pl. iv. figs. 85 and 86); we shall call it the "fourth ray." It may be larger or smaller, longer or shorter than either of the other rays, curved or straight, simple or ensiform, according to the species and its position in that species, situated perpendicular to the rest of the rays or inclined forwards in the sagittal forms. In the body of the cloaca, where these spicules constitute a characteristic feature, the fourth arm, which projects into the interior, is perpendicular to the other three (which are fixed in the surface of this cavity), with the curve *always* directed *towards* the mouth, and in this form they may be traced more or less into the canals leading into the cloaca. On the other hand, when the quadriradiate is large or constitutes, from its size and predominance, the greater part of the spiculation, as in *Leuconia Johnstonii*, Carter (*Leucandra Johnstonii*, H.), it may be more or less like the rest; but under these circumstances this spicule may *in situ* be frequently distinguished from the triradiate by presenting a dark triangular space in the centre of the other three rays, whose angles are coincident with those of the triradiate portion, and whose darkness arises from the rays of light at this part passing *through* the surface instead of being reflected from it; while in the triradiate there is no "dark space" visible unless the spicule be viewed laterally, when a similar thing happens through the position of the third ray; but its shape is quadrangular and more or less concave at the sides, like an hour-glass; hence, as these spicules lie *in situ* on the surface in *L. Johnstonii* &c., where the fourth ray is directed inwards and the triradiate portion lies flat on the surface, the "dark space" is only seen in the former.

Among the triradiates may be mentioned in particular a form very much like a "tuning-fork," in which the arms are projected forwards almost parallel to each other and closely

approximated, whilst the shaft is continued backwards in the opposite direction. The interest attaching to this spicule is that it was first noticed and represented by Dr. Bowerbank in a mounting from a calcareous sponge, found at or near Freemantle, at the south-western angle of Australia (Phil. Trans. 1862, pl. xxxvi. figs. 18 and 19, repeated in his Mon. Brit. Spongiadæ, vol. i. p. 268, pl. x. fig. 237), of which Dr. J. E. Gray made a genus under the name of "*Lelapia*," and a species under that of "*L. australis*" (Proc. Zool. Soc. 1867, p. 557), and which Dr. G. J. Hinde, F.G.S., discovered in two fossilized calcareous sponges, respectively named *Sestrostomella rugosa* and *S. clavata* ('Annals,' 1882, vol. x. p. 185), confirmed by myself in a specimen of the former from the Jura; and, further, that I have now found it abundantly in a recent calcareous sponge from the neighbourhood of "Western Port," Victoria, S. Australia, among Mr. Wilson's collection from this part, as will be seen hereafter, when it will be found to be described under Dr. Gray's name, i. e. "*Lelapia australis*." Häckel observed the same form in his *Leucetta pandora*, also from the south coast of Australia (*op. cit.* 'Atlas,' Taf. 23. fig. *h*), and in his "connective variety" of *Leucortis*, viz. *Leucandra pulvinar* (*ib.* vol. iii. p. 166), from the western coast of Australia &c.; but in neither is the spiculation the same as in our species, which, as just stated, will be called "*Lelapia australis*."

As regards the *measurements* of the spicules, I would premise that, where given, they are intended to represent the largest size of their kind, or the size of the most characteristic forms of the species *that I have seen*; for to go further would be only to multiply assumptions, since in the hasty observation of the minor radiates, which are by far the most numerous, it is difficult to find two which are exactly alike; besides, as I have before stated, the triradiate is always more or less raised in the centre, so as to become tripod-like, whereby it becomes next to impossible to measure *its* arms accurately. Hence, both in the smaller and the larger spicules, the measurements must always be taken as approximative; while they will for the most part be given in "6000ths" of an inch, that the student may realize their relative dimensions. I regret that I cannot go more into detail in this matter; but as stated above respecting the dyeing and making microscopic sections, which is a comparatively long process, it is to be hoped that what I am not able to do now may be supplied by others hereafter.

Also, to avoid unnecessary repetition in the text, I may at once state that, except in a few instances, neither the "habi-

tat" nor the "depth" will be mentioned, and the same with the "locality." For, in the first place, all calcareous sponges are marine; in the second place, most of the specimens that I have discovered among Mr. Wilson's collections have, as a matter of course, been *un*accompanied by their "depths," on account of their insignificant size; and, lastly, the "locality" being either "Port Phillip Heads" or "Western Port," about 15 miles further to the west, their neighbourhood may be considered the same from a natural-history point of view.

With these preliminary remarks let us proceed to the description of all the specimens of Calcareous Sponges that I have been able to find in Mr. Wilson's collections generally, beginning with that structure which seems to me most simple, viz. *Clathrina cavata*, and ending with the most complicated, viz. *Teichonella prolifera*. I have no further classification to offer, and therefore must refer the reader to the works of Häckel and Polèjaeff for this purpose, as before mentioned, my own being regarded as only a contribution to the subject. There are forty species, of which many are represented by several specimens, some of which are of considerable size, viz. 6 to 7½ in. in their longest diameters, and all in a good state of preservation—far exceeding in every way what is to be found on the British coasts.

[To be continued.]

XLI.—*On the British Weevers, the Bib, and the Poor-Cod.*

By Prof. M'Intosh, M.D., LL.D., F.R.S., &c.

Two species of weever * have been described by most authors who have treated of the fishes of our own and continental countries, viz. the greater and the lesser weever. So far as previous and present examinations, however, can guide me, I am inclined to think there is a very close relationship between them; indeed it is possible that the one is only a young stage of the other, and that certain distinctions, such as the absence of spines above the orbit in the smaller form and its greater depth in proportion to its length, disappear with age. It is well known, indeed, that noteworthy modification in outline occurs during the growth of several fishes. Moreover, in the large form (greater weever) there is considerable variation, for instance, in the semi-membranous prolongation of the free

* *Trachinus draco*, L. (greater weever), and *T. vipera*.

XLVII.—*Descriptions of Sponges from the Neighbourhood of Port Phillip Heads, South Australia, continued.* By H. J. Carter, F.R.S. &c.

[Continued from p. 441.]

Order VIII. CALCAREA.

Structure composed of contorted, repeatedly branched, anastomosing, tubular threads, forming a reticulated mass which at length assumes a more or less definite form.

1. *Clathrina* cavata.*

Individualized. Massive, compressed or round, contracted towards the base; composed of tortuous, hollow or tubulated thread-like filaments, almost infinitely and irregularly branching and anastomosing; compactly reticulated above, becoming looser and more open in structure below, where it finally ends in a few of the same kind of hollow filaments, which are attached to the object (mussel-shell) on which it may be growing. Colour sponge-brown when fresh, lighter when dry. Surface even, irregularly reticulated. Pores numerous, passing *through* the wall of the hollow thread. Vents of two kinds, viz. spurious and real; the former more or less in plurality scattered over the surface generally or confined to the upper border, consisting of short, thin-walled, cylindrical prolongations extended from the *outside* of the wall of the tubulated thread, which prolongations are in direct communication with the interstices of the reticulated mass generally, but more especially with dilated portions of this mass extending for a short distance inwards in the form of a cavity; *real* vents consisting of circular holes here and there in the wall of the reticulated tubulation, which not only open into the so-called cavities or dilated portions, but in all probability exist throughout the structure, where they would open into the interstices generally of the reticulated mass. Structure that above mentioned, whose staple is the "tubulated thread," of which the wall is very thin and skeletally composed of a single layer of radiate spicules held together by sarcode supporting the softer parts, which here appear to consist chiefly of a layer of spongozoa in juxtaposition, and not gathered into the form of ampullaceous sacs, together with a remarkable quantity of those organs which consist of nucleated cells surrounded by an abundance of glistening spherical granules, which Häckel has figured and named

* Dr. J. E. Gray's name for this kind of sponges (see 'Annals,' 1884, vol. xiv. p. 17 &c.).

"nuclei" (Kerne) of his "syncytium" (*op. cit.* 'Atlas,' Taf. i. fig. 3). Spicules of two forms, viz. triradiates and quadriradiates, the latter in very subsidiary quantity. Triradiates comparatively small, variable in form and size, but chiefly equiarmed and equiangled. Quadriradiates about the same size. Ray of the largest triradiates on the surface about 30 by 4½-6000ths. The latter composing the skeletal structure of the tubulation generally, the former sparsely scattered throughout, but most numerous about the "spurious vents," apparently without any particular position, as the fourth arm appears here and there, both inside and outside the wall of the tubulation, and the same about the cylindrical prolongations or spurious vents. Of this species there are four specimens, the largest of which is compressed and somewhat triangular in shape, 1½ inch high by 2 × ½ horizontally at the upper border.

Obs. This is evidently a representative of the *Clathrina* which grows so abundantly on the under surface of rocks in this neighbourhood, viz. Budleigh-Salterton ('Annals,' 1884, vol. xiv. p. 18); but as there appear to be no rocks at the sea-bottom in Australia, where it was dredged, it grows on shells or the agglomerated material of these parts. Moreover, it differs from the *Clathrina* of this place, in which the cylindrical prolongations on the surface are in *direct* continuation with the *interior* of the tubulation, like that of the next species that will be described, while in *C. cavata* they are *only* in communication with the *dilated parts* of the interspaces.

We have evidently here a foreshadowing of the vent and cloaca, which are more perfectly developed in *C. tripodifera* and following species.

It belongs to Häckel's Ascones of course, and seems, but for the presence of the spurious vents, to be almost identical with his *Ascetta clathrus* (*op. cit.* Atlas, Taf. iv. figs. 1–3). As for the difference in spiculation which the presence of the quadriradiates makes in Häckel's classification, this may be cancelled under the view that it is a "connective variety," like his *Ascetta primordialis* (vol. ii. p. 17).

2. *Clathrina osculum.*

Individualized, social. Globular, stipitate, presenting on the summit a short, cylindrical, hollow process, and ending below in one or more filiform stems fixed to the object on which it has grown, composed throughout of a mass of tubulated thread-like filament growing by almost infinite and irregular branching and anastomosis into the form above

mentioned. Colour sponge-brown when fresh, when dry dark grey. Surface even, uniformly reticulate, interstices about 1-120th in. in diameter. Pores numerous, passing *through* the wall of the hollow thread. Vent single, tubulated, at the summit of the specimen, composed of a thin, cylindrical extension of the *walls of the tubulation*, which at this part opens into it by a plurality of holes, and thus enters into its composition. No defined cloacal dilatation. Structure already stated, composed of the same kind of staple thread as *C. cavata*, but smaller and more compact in its reticulation; wall of the tubulated thread very thin and skeletally composed of a single layer of triradiate spicules held together by sarcode, and lined by the softer parts, which here also appear to consist chiefly of a layer of spongozoa in juxtaposition, that is without being gathered into the form of ampullaceous sacs, together with a remarkable quantity of those organs which consist of nucleated cells respectively surrounded by an abundance of glistening spherical granules, which Häckel has figured and named "nuclei" (Kerne) of the syncytium, as before stated. Stem apparently an extension of the tubulated thread, but more solid. Spicules of one kind only, viz. triradiates of different sizes, but for the most part equiarmed and equiangulated, intercrossing each other on the surface so as to give the interstices of the reticulation here a polygonal border; spicules more plentiful and *larger* than in *C. cavata*, ray of the larger ones averaging 42 by 5-6000ths in. in its greatest dimensions. Size of individual, of which there are two joined together, about 5-24ths in. in diameter; stem about 1-24th in. long and 1-48th in. in diameter.

Obs. To what size this species might ultimately grow I am ignorant, but that above described appears to be very small. It is, however, amply large enough to show in the section that the tubular vent is the *outlet of the tubulated structure*, and that, although there is no absolutely cloacal dilatation, this is indicated by the reticulated structure in the centre immediately under the vent being more open than towards the circumference. In these two particulars, then, it differs from *C. cavata*, not more so, perhaps, than in the size and abundance of its spicules, especially on the surface, whereby the thickness of the wall of the tubulation here appears to consist of a plurality of layers instead of one only as in *C. cavata*. The tubulation is charged internally with *ova* in the unsegmented state, large, and presenting the germinal vesicle.

Upon the authority of Häckel I have stated that the "nuclei," mentioned in the two last species, are in his "syn-

cytium;" but, entertaining a different view of their nature, I must refer the student for my explanation of this assumption to the 'Annals' of 1884, vol. xiv. pp. 20 and 21. The species is very like Schmidt's *Nardoa reticulum* (Spong. Küste v. Algier, p. 28, Taf. v. figs. 7 and 8).

3. *Clathrina tripodifera.*

Conical, rather compressed, sessile, fixed, with cloaca and wide mouth; or ovoid and free, with cloacal cavity, but *no* mouth, that is Häckel's "Auloplegma"-form. Texture delicate. Colour of the former pinkish brown (?derived from having been in proximity with a similarly coloured sponge); that of the other specimens whitish grey. Surface even, uniformly presenting a ridged *quasi* fibro-reticulated structure whose interstices are more or less triangular, owing to the sigmoid flexure of the ridges, which thus resemble a "plaited frill." Pores in the ridges. Vents of two sizes, viz. small and large: 1, small, numerous, situated in the bends or interstices of the sigmoid ridges, about 1-96th in. in diameter; 2, large, about 1-48th in. in diameter, scantily and irregularly scattered over the surface; both on a level with it, and both irregular in their outline, which is unmarginated, and all leading into the intervals between the *echinated* tubulation, which intervals are shut off from the cloaca by the lining membrane of the latter, as will be more particularly mentioned hereafter. This applies to all the forms, both open and closed, while in the "open" there is, of course, the addition of the vent or mouth to the cloaca, which is smooth and naked, and the cloaca in all presents a blistered-like surface, rendered uneven by a great number of infundibular depressions irregularly scattered over it; echinated throughout with the fourth ray of radiate spicules, and in direct communication at the bottoms of the "infundibular depressions" with the *echinated* tubulation of the general structure; also here and there with the "intervals" between this tubulation, by a few subsidiary apertures, which thus appear to be more accidental than general. Structure massive, tubular; tubulation subcircular, averaging 1-48th to 1-72nd in. in diameter, composed of a *single* layer of radiate spicules held together by sarcode, supporting the other soft parts, extending almost directly, that is being scantily branched, from the cloaca to the surface, leaving the "intervals" before mentioned between, which are very irregular in form, and for the most part much wider. Tubes *densely and strikingly* echinated with the fourth ray of quadriradiates, whose curve is directed *in*wards; while the other rays, imbedded in the sarcode, go to form the

wall of the tube, thus leaving the surface towards the "intervals" *smooth*, by which the "tube" and the "interval," by contrast, are sharply differentiated; tubes or tubulation, as before stated, in direct communication with the cloaca through its infundibular depressions, becoming more or less tortuous, branched, and anastomosing as they extend outwards towards the surface, where they become divided and sigmoidally plicated, ending in the *quasi* fibro-reticulate ridges, whose structure is pierced by the pores, as above noticed. "Intervals" smooth, more or less in communication with each other, so as to apparently form a general chamber, which is shut off from the cavity of the cloaca, except through the "subsidiary apertures" just mentioned, opening on the surface through the "small and large vents" already described. "Subsidiary apertures" in the cloaca on a level with its surface, *not* in the infundibular depressions, *not* echinated, but marginated by a thin rim of sarcode, irregular in shape, size, and position. Wall of the "tubes" plentifully pierced by pores between the arms of the radiates, and the same with the lining structure or membrane of the cloaca; in short, there seems to be no surface in which *they* are absent, on all occasions. Spicules of two kinds, viz. triradiate and quadriradiate. Triradiate of two forms, viz.:—1, large, equiarmed and equiangulated, with the arms bent downwards and outwards sigmoidally, all together, like a "three-legged stool," each arm about 29 by 6-6000ths in., and the summit of the tripod about 24-6000ths in. from the base; 2, simple, triradiate, equiarmed, equiangulated, arm about 25 by $2\frac{1}{3}$-6000ths in. in the average largest size; 3, quadriradiate, about the same size as the foregoing, with the addition of the fourth ray, which for the most part is long, curved, and varies in length under 30-6000ths in. The tripodal form of the triradiate is confined to the ridges on the surface, where it is rather sparse; the common form to the surface generally, and the quadriradiates to the tubulation and surface of the cloaca respectively. Size of the largest specimen possessing a mouth (for there are three or more in the collection) $2\frac{1}{4}$ in. high by a maximum of $1\frac{3}{4} \times 1$ in. horizontally; cloaca $\frac{3}{4}$ by $\frac{2}{8}$ in. horizontally; mouth $\frac{3}{4}$ by $\frac{2}{8}$ in., also horizontally. Auloplegma-form like a goose-egg, 3 in. in its longest diameter by a maximum of $2\frac{1}{2} \times 1\frac{3}{4}$ in. horizontally; cloaca $2\frac{1}{2}$ in. in its longest diameter, by $1\frac{1}{4} \times \frac{2}{8}$ in. horizontally; wall about $\frac{3}{4}$ in. thick.

Obs. The most striking part of this species is the tubular *echination*, with regard to which it may be observed that, if the current is to be indicated by the direction of the *curve* of the fourth ray of the quadriradiates, as in the cloaca of *Grantia*

ciliata, in which it is directed outwards, it should here be in the opposite direction, viz. towards the cloaca; while the reproductive elements, viz. large ova presenting the germinal vesicle, as will be more particularly described presently, are on the *inner* surface of the *echinated* tube; therefore the analogy here is not between the echinated tubes and the cloaca of *Grantia ciliata*, but between the echinated tubes and the radial chambers of the latter; while the "intervals" would be analogous to the intercameral spaces or "intercanal system" of Häckel.

It may also be observed that the spiculation would be identical with that of my *Leucetta clathrata* ('Annals,' 1883, vol. xi. p. 33, pl. i. figs. 13–17), which came from the south-west coast of Australia, but for the *presence* of the quadriradiate spicule, and the *comparatively* scanty presence of the tripod spicules on the ridges of the surface.

The Auloplegma-form is plentifully charged with ova filled with minute spherical granules, in the midst of which is the germinal vesicle &c. The ova are about 1-24th in. in diameter, the germinal vesicle about 1-1200th, and the germinal spot 1-6000th in. in diameter. There are also much smaller nucleated granuliferous cells about twice as large as the spongozoa, that is about 1-2000th in. in diameter. What may they be?

Besides this the specimen is abundantly infested by a minute oscillatorian filament in bacillform fragments of different lengths, very much resembling in form the *Trichodesmium Ehrenbergii* which colours the Red Sea.

4. *Clathrina tripodifera*, var. *gravida*.

Individualized. Small when compared with the foregoing specimens, to which it will be found to be closely allied. Triangular, compressed, contracted towards the base or point of attachment, expanded above, composed of tortuous, branching, anastomosing reticulate tubulation more or less interstitially separate. Colour sponge-brown when fresh, whitish yellow when dry. Surface uniformly even, retiform, consisting of the superficial part of the tubular reticulation of which the whole body is composed, rendered prominent and glistening by a great abundance of the tripod spicules. Pores in the wall of the tubulation throughout. Vent-like openings three or four in number, chiefly in the upper border, defined by simple circular apertures in the general tissue, *not* marginated, leading into cloacal cavities below, which consist of equally simple dilatations of the reticulate tubulation at this part. Structure generally consisting of a minute, tortuous, branching and anastomosing hollow thread

or tubulation, around the cloacal cavities just mentioned, which respectively descend, narrowing towards the base and widening upwards until they become contracted again towards the vent. Tube composed of a single layer of triradiate spicules *only*, held together by the sarcode and its accompanying soft parts, among which, in this instance, a number of ova are present, which, by their size and the presence of the germinal vesicle, indicate that they are near to segmentation; traversed plentifully by pores, and opening here and there by circular holes into the cloacal dilatations, which is probably the case throughout the interstices of the reticulation generally; both the tubulation and the interstices varying greatly in diameter under 1-100th in., largest on the surface of the cloaciform dilatation, smallest towards the circumference. Spicules of *one kind only*, viz. triradiate, but of *two* distinct forms, as in the foregoing, viz.:—1, tripod-like, stout, with the arms bent downwards and outwards sigmoidally, about 20-6000ths in. high, spreading to about 20-6000ths at the base, arms about 21 by 6-6000ths in their greatest dimensions respectively; 2, the common form of triradiate, but much thinner than the foregoing, with arms more or less equal and more or less equiangled, varying in measurement under 20 by 1-6000th in. The former very abundant and almost entirely confined to the ridges formed by the reticulated tubulation *on the surface*, the latter to the interior. No quadriradiates. Size of specimen, which is compressed and nearly equilateral, $\frac{6}{12}$ in. high, upper border $\frac{1}{2}$ in. long, thickness of body $\frac{1}{6}$ in.

Obs. There can be no doubt that this is the same sponge as, only in a larger form than, that which I described and illustrated under the name of "*Leucetta clathrata*" ('Annals,' 1883, vol. xi. p. 33, pl. i. figs. 13–17); but we have here the tubular thread in a larger and distinctly *hollow* state, and not solid as assumed to have been the case in *Leucetta clathrata*, where, from contraction during desiccation, it had become solid, which, together with the smallness of the specimen, misled me into stating that it was "not hollow" (*op. cit.* p. 34), a mistake that I am thus able to have the opportunity of correcting, and of changing at the same time the name to *Clathrina tripodifera*, var. *gravida*, on account of the presence of the ova, above mentioned, which are in much the same condition as those in *Clathrina tripodifera*, whose description and dimensions have just been given. Hence the necessity of extended experience in laying down specifically the typical form of a sponge.

Of course, here we have the same structure as in *Clathrina*

tripodifera, but the tubulation, instead of being echinated and closed in, is without echination and separate; still, our "intervals," which in *C. tripodifera* we have considered to be analogous to Häckel's "Intercanal System," are here simply open vacuities. Not considering these differences sufficient to constitute a distinct species, it has been designated as a variety of *C. tripodifera*.

Hitherto the *structure* has not presented any indications of that cancellous kind which we have called "parenchyma," although there has been a more or less distinct cloaca and general vent, especially in *Clathrina tripodifera*, that is there is no additional structure of this kind to be seen outside or inside the wall of the tubulation; but now we come to a structure in which there is a faint trace of this parenchyma in the angles of union of the lamina of which it is composed, as will be described in the following species.

5. *Clathrina laminoclathrata* (dry).

Specimen a subcircular patch about $\frac{3}{4}$ in. in diameter and $\frac{1}{12}$ in. thick, which has grown over a rocky substance. Clathrous, massive, sessile, spreading, lamino-reticulate. Colour now (that is in its dry state) steel-grey. Surface even, smooth, reticulated by the clathrous holing of the structure generally, which here makes its appearance in the form of circular interstices of different sizes up to $\frac{1}{24}$ in. in diameter. Pores in the lamina. No appearance of a vent or vents of any kind, *i. e.* spurious or real. Structure lamino-clathrous; lamina solid, composed of a thin layer of radiate spicules supporting the sarcode and other soft parts. Spicules of one form only, viz. triradiate, equiarmed and equiangled, varying in size under 75-6000ths in. in diameter, ray alone about 45 by 5-6000ths in. Size above given.

Obs. In this instance, which is unique among the calcareous sponges so far as I know, the tubulated staple thread of *Clathrina*, which so generally characterizes this genus, is replaced by a flat, solid, "tape-like" form or staple, whose edge when cut presents no appearance of mesodermal structure or parenchyma whatever, although towards the angles of union, where of course the lamina branches off to form the clathrous structure of the mass, there is a small angular space left which bears a faint trace of parenchyma, and this seems to introduce us to what in this way will become so much more evident hereafter. It is represented among the non-calcareous sponges by "*Echinoclathria favus*" ('Annals,' 1885, vol. xvi. p. 292).

In the next species that will be described, viz. *Clathrina primordialis*, the reticulated flat lamina of *C. laminoclathrata* appears to be replaced by a vermiculated *tube*, in which the walls are just as thin as the lamina of this species, but which tubulation by repeated branching, contortion, and anastomosis, all more or less in apposition, assumes the form of a solid mass of this kind of structure in which the intervals between the tubulation afford a much larger space for parenchymatous structure than in *C. laminoclathrata*; in short, wherein the quantity of parenchymatous structure is much greater.

6. *Clathrina primordialis*.

(See *Ascetta primordialis*, H. *op. cit.* Atlas, Taf. ii. fig. 13.)

A massive, shapeless, sessile, sublobate, smooth, solid lump, attached by a plurality of portions of the body elongated into podal points below, whose interspaces extend upwards in an irregularly excavated manner towards the surface, where the lobes of the mass terminate in thick, irregularly interuniting, round, submeandering ridges, with intervening depressions, some of which extend down to the interspaces between the points of attachment; ridges on a level with each other, forming the crown of the mass. Texture delicate, light as cork when dry. Colour when fresh not given, probably whitish, as in one of the specimens, but now more or less pinkish brown, probably, as before stated of *Clathrina tripodifera*, from having been in the proximity of a similarly coloured sponge. Surface minutely ridged, *quasi* fibro-reticulately, with more or less lozenge-shaped interstices, smooth, even, covered throughout with an epithelial layer of cells more or less transfixed by the rays of subjacent spicules. Pores *in* the *quasi* fibrous ridges. Vents of two sizes, viz. small and large, both *un*marginated and on a level with the surface, viz.:—1, smaller, circular, numerous, in the interstices of the fibro-reticulated ridges, averaging 1-48th in. in diameter, and about the same distance apart; 2, larger, also circular, but flabby and comparatively scanty, scattered irregularly among the rest, chiefly over the projecting portions of the crown. Structure tortuously tubular, the tubes composed of a single layer of triradiates, held together by sarcode, averaging about 1-72nd of an inch in diameter, but very irregular in their calibre, branched, anastomosing, and in juxtaposition but for the presence of a narrow strip of *parenchymatous* tissue, which here and there becomes widened out into angular spaces, where the circular walls of the tubulation fail to come in contact with each other. Angular

spaces differentiated from the cavities of the tubulation by the presence of reproductive bodies and sarcode, which, especially in the dried state, presents a sponge-brown colour, while the surface of the tubulation is white and without this; so the two are easily distinguished. The parenchymatous part terminates externally in the thin *quasi* fibro-reticulate ridges of the surface, where, as before stated, it is traversed by the pores; but what its connexions internally are I have not been able to determine, although, from analogy, one would be inclined to conjecture that it opened generally by pores and here and there by small holes (the latter probably for the exit of the reproductive bodies) into the cavity of the tubulation. On the other hand, the tubulation opens on the surface through the small and large vents, that is the former directly and the latter after having come from more dilated portions in the centre of the mass; but all appear to be more or less in communication. Spicules of one form only, viz. triradiate, equiarmed, equiangulated; ray about 35 by 3-6000ths, varying in size under this with a few a little larger; densely charging the sarcode throughout, but especially on the surface, which is thus rendered a little more compact than the interior, so as in some specimens to present a cortical structure. Size of largest specimen, of which there are several, about 4 inches in diameter each way, being cubical.

Obs. In this species we cannot help seeing that the parenchymatous structure which intervenes between the contorted tubulation presents a still further step than in *Clathrina laminoclathrata* towards that which reaches its maximum in the Leucones and Teichonellidæ, as will be seen hereafter; at the same time that the dilated portions of the tubulation in the midst of the mass, in communication more particularly with the large vents externally, appear in the aggregate to be tantamount to a single cloacal cavity with general osculum; while the spaces occupied by the parenchyma appear to be the seat of Häckel's "intercanal system," that is, the interspaces between the "radial chambers" in *Grantia ciliata* &c.

In the large specimen of this species, viz. that described, there are also *ova*, but apparently scanty and in a more advanced stage, mixed up with minute crustaceans, which would hardly be there if it were not for the presence of the sponge-ova, for it is at this time that they more particularly invade most destructively the calcareous sponges; hence it is not improbable that some of the ova may be theirs, which prevents my being able to say what the sponge-ova are like. But there is another body also scantily present which is quite new to me, but, being more plentiful in the following species,

viz. *Clathrina ventricosa*, it will be more particularly described there. At first I thought this was a fungoid spore with long tubular tail-like appendage; but its much larger size, absence of septa, and the refractive granules of the interior issuing through the tail seem to be opposed to such a view.

7. *Clathrina ventricosa.*

Individualized. Massive, lobate, sessile generally, or attached by a plurality of attenuated portions of the body, thus resting on such points, or not attached at all, but free and floating, furnished with a large cloaca and contracted mouth, or the same in a group with wide crateriform mouths. Colour white or pinkish brown, the latter probably owing to the proximity of a red-coloured sponge. Texture comparatively firm. Surface-structure consisting of a thick cortex of radiates covered with deep, polygonal, infundibuliform depressions or holes echinated round the inner ends and often diaphragmed there by cribriform sarcode; built up of large radiates, whose intercrossing rays give the polygonal form; almost in juxtaposition, and varying in size under 1-20th in. in diameter; or with the same reduced, probably by friction, to a white, homogeneous-looking, compact, cortical layer, in which the same kind of holes are present, but without the polygonal infundibular form, being simply subcircular and more or less variable in size. Pores in the intervals between the "infundibular depressions." Vents of two kinds, viz. small and numerous and large and single; the former, that is the small kind, at the bottoms of the "infundibular depressions" respectively, varying in size with that of the depressions themselves, echinated &c. at the inner end, as just stated; the latter large and single, bordered by a thin lip of fine structure about 1-16th inch wide; both leading to a large cloaca, whose surface is thickly beset with holes of two kinds, viz. one situated at the bottom of deep, broad, conical depressions, which vary in size, depth, and distance apart, and the other for the most part small, circular, and on the surface; both also communicating with the "hollow spaces" in the general structure of the wall, which will be more particularly mentioned presently; surface of the cloaca pierced generally with pores and sparsely echinated; echinating rays most abundant round the holes leading into the hollow spaces of the wall. Structure of the wall, which in some of the large specimens exceeds an inch in thickness, composed of vermiculated tissue, consisting of tortuously branched and anastomosing tubulation, which may be divided into two kinds, viz. that which is more

particularly defined by a cortex and *filled* with parenchymatous structure, and that which is *empty* or hollow, to which I have just alluded; the former in communication with the surface, the cloaca, and the hollow spaces by *pores* situated in these parts respectively, together with small holes, but much larger than the pores, in the cortex here and there, also opening into the hollow spaces. Hollow spaces or intervals communicating externally through the infundibular holes of the surface and internally with the cloaca through the holes in the surface of this cavity. Structure of the parenchyma cancellous, traversed by branched canal-systems which respectively open into the hollow spaces through the "small holes" in the cortex just mentioned; canals more or less echinated by the fourth ray of quadriradiates. Hollow spaces more or less smooth or sparsely echinated, like the cloaca. Spicules of two kinds, viz. triradiate and quadriradiate, both apparently equally abundant:—1, triradiate of two sizes, viz. large and small, the former equiradiate and equiangled, a little raised in the centre; rays stout, irregular in their outline, becoming suddenly much diminished a little way from the end, about 52 by 13-6000ths in their greatest dimensions; the latter or smaller similar, but with the ray more regular in form, about 35 by 4-6000ths; both forms variable in size between the measurements given. 2, quadriradiate, the same as the smaller triradiate in size, but with the fourth ray in addition curved and somewhat shorter. The large triradiates appear to be confined to the surface, where they are occasionally provided with a fourth arm, and the quadriradiates, mixed with the triradiates, to the interior generally, the former perhaps most abounding on those surfaces which are most echinated. Size varying with that of the specimen, of which there are upwards of a dozen, extending from that of a small bean to one nearly 6 inches in its longest diameter. The largest of all is the free or floating specimen, which is subovoid, 3 inches high, that is placing the large mouth upwards (for there are several small ones about the body, each provided with a lip), and $5\frac{3}{4} \times 4\frac{2}{3}$ horizontally in its greatest diameters; the large mouth is 3 by $\frac{1}{2}$ inch in its greatest diameters, and the cloacal cavity much larger; wall averaging an inch thick. The rounded form combined with a compact, white, even, homogeneous-looking structure on the surface indicates that this specimen has for some time been free and floating; its parenchyma is abundantly charged with reproductive bodies. The next largest specimen was attached by several attenuated portions of the body, and, having been much less exposed to friction, presents a much more perfect state of the

surface. In form this specimen is more globular, being about 4 inches high by $\frac{3}{4}$ in diameter, but consisting of two individuals joined together, has two large subcircular vents, each about an inch in diameter, leading to two cloacæ below of much larger dimensions; while the specimen with crateriform vents, each of which is an inch in diameter, leading into cloacæ a little deeper, consists of a group of several such individuals joined together and sessile generally.

Obs. This is by far the largest and most abundant in specimens of all Mr. Wilson's calcareous sponges, and it is somewhat remarkable that, like the floating Auloplegma-form of *Clathrina tripodifera*, it should be abundantly charged with reproductive bodies. But for the asconoid or tubular structure of this species, the amount of parenchyma is so great that it closely resembles Häckel's *Leucaltis floridana* in this respect (*op. cit.* Taf. xxvi.); and in some specimens the canals and spaces in the parenchymatous structure are so thickly echinated by the fourth ray of the quadriradiates that, on the other hand, they look like the echinated tubes of *Clathrina tripodifera*, while here, as in the latter, they are easily distinguished, especially in the sections of the dried portions, by their *yellow side*, owing to the presence of the dried sarcode and its contents lining in particular this part, while that of the "hollow spaces" is smooth and more or less white. Are the "hollow spaces" here analogous to the "intervals" in *Clathrina tripodifera*, which in the latter have been shown to be identical with Häckel's "intercanal system;" while here they are apparently as evidently analogous to the "radial chambers" of *Grantia ciliata* &c., through which they may be homologized with the excretory canal-system in *Teichonella prolifera*? I must leave others to make the adjustment.

In some of the specimens which are altogether solid the small infundibular vents on the surface are supplemented by several larger ones, which, not leading to a *single* large cloaca, are in this respect like those of *Clathrina primordialis*, that is, connected with several dilated portions in the midst of the structure internally, which in the aggregate amount to a large single cloaca; but they differ from those in *Clathrina primordialis* in being all provided with a *lip*.

The large "free and floating" specimen of this species is plentifully charged with ova about 1-333rd in. in diameter, from which the germinal vesicle has in most instances disappeared, and in some of which the first line of segmentation seems to be visible. But the body to which I have just alluded as being scanty in *Clathrina primordialis* is here as

abundant as the ova, if not more so. It is a long elliptical cell, more or less slightly curved and more or less round at the free end, which sometimes appears to be flattened for a minute distance and sometimes doubly papillated, but the latter very indistinctly, and therefore not satisfactorily determinable; this at the other end opens widely into a long caudal tubular appendage, which becomes somewhat contracted in the middle, to expand again into a suctorial or trumpet-shaped form at its free extremity. In size the total length is about 33-6000ths inch, of which $12 \times$ 6-6000ths go to the cell or head and 21-6000ths to the tail, which is about 1-6000th in. in diameter at the extremity. The cell presents a large refractive nucleus at the free end, and the rest is filled with equally refractive spherical granules of about half the size of the nucleus, which can be traced as they issue through the tail, and sometimes form a heap at the end, where they have exuded. What this body is I am unable to conceive, unless it is a parasite which, like the minute Crustacea, infests the specimen.

Besides the large ova and these bodies &c. there are also small cells from 3 to 6-6000ths in. in diameter, sometimes nucleated, but always filled with spherical refractive granules like those of the yelk in the ova. Are these the spermatozoid cysts or cells? They, like the ova, are mixed up with the spongozoa, which are only about $1\frac{1}{2}$-6000th or 1-4000th in. in diameter—measurements which could not have been made here or in the other instances had not the greater part of these sponges been, as they still remain, in an excellent state of preservation for this purpose.

8. *Clathrina latitubulata* (provisional, incertæ sedis).

Agglomerated. Composed of a comparatively large, more or less contorted and anastomosing tube about $\frac{1}{6}$ in. in diameter, swollen or dilated at short distances into rounded forms, which give it an irregularly knotted appearance, on each of which knots or prominent parts there is a single vent or none at all. Colour sponge-brown when fresh, whitish outside when dry. Surface even, composed of large radiate spicules interunited by more or less defined areas of cribriform sarcode. Pores large, represented by the cribrate areas. Vents single, naked, on the prominent parts of the lobes or dilated portions. Structure consisting of a very thin wall, most of which is cortex or surface-structure, not averaging more than $\frac{1}{19}$ in. in thickness, composed of two or more layers of large and small radiates, held together by the sarcode of the

surface, but more particularly by a comparatively thick layer of the same substance internally; continuous over one part and cribrated with large holes in another, opposite to corresponding holes in the cortex, rendered more or less polygonal by the intercrossing of the arms of the large radiates, and through which the cribriform areas of the surface can be seen. Spicules of two kinds, viz. triradiate and quadriradiate:—1, triradiates of different sizes, mostly regular in form and mostly large; ray 90 by 15-6000ths: 2, quadriradiates of two sizes, viz. very minute and very large; the former numerous, sagittal in shape, averaging only 10 by 1-6000th in the shaft, with arms respectively about half this length, and the latter, which tends more to a regular form and is scant, with arms 150 by 21-6000ths. No. 1 is chiefly confined to the cortex, the minute form of no. 2 to the sarcodic lining of the interior, with the large form here and there in the interior of the cortex. Size of specimen, which altogether is irregularly oblong, about $1\frac{1}{4} \times \frac{3}{4} \times \frac{1}{2}$ inch.

Obs. The structure of this species, if not abnormal, is very uncommon, on account of the general form in combination with such a thin wall; not less so the layer of sarcode over the inner surface, which is charged with the minute quadriradiates confusedly distributed throughout its substance, hence indicative of an abnormal condition. In general form, that is in outward appearance, it is very much like Polèjaeff's *Heteropegma nodus gordii* ('Challenger' Reports, 1883, Calcarea, p. 45, pl. i. fig. 7, and pl. iv. fig. 1), which also came from Australia, viz. from off "Cape York" at the N.E. angle, since that from the Bermudas appears to have been too much injured for illustration, but when anatomically examined proves to be totally different, as may be seen by the descriptions respectively.

[To be continued.]

XLVIII.—*On a Species of* Echinocardium *from the Channel Islands.* By F. Jeffrey Bell, M.A.

Some weeks ago I received from Mr. Finlay of the Watt Museum at Greenock, an exceedingly fine specimen of *Echinocardium*, which he asked me to determine for that institution. A very superficial examination of the object showed me that it was altogether unlike any specimen in the British Museum, and that it could not be readily assigned to any described