alimentary apparatus will afterwards be developed. Near the boundary between the middle and the girdle-like parts this layer entirely ceases, and in the girdle-like part (region of the formation of the arms) and further to the pole of the nutritive vitellus and round the latter we only meet with the cells of the dermo-muscular layer, as has already been stated. Consequently the lower or intestino-fibrous layer of the second germ-lamella, as may easily be seen, originates by transverse division of the originally one-layered second germ-lamella, and therefore in the same way as the latter lamella itself from the cells of the one-layered blastoderm or the upper germ-lamella. The cells of both layers of the middle germ-lamella are always rather smaller, but are more numerous than those of the upper lamella. In form they are generally oval, not unfrequently extended (in the wall of the yelk-sac); their protoplasm is dark, fatty; and the nucleus (or often two) enclosed in each cell can scarcely be detected without reagents. None of the cells of either the second or the upper germ-lamella contain any trace of membranes.

It is not without a purpose that I have dwelt so long on the mode of formation, the individuality, and the distribution of the first two germ-lamellæ, seeing that the only extant memoir treating of this subject (namely that of E. Metschnikoff*) is not quite sactisfactory. In the first place, this naturalist has not recognized the second or inferior lamella ("parenchymatöse") as the middle one; and secondly, he has not referred to its cleavage into the two layers above described, which play so important a part in the formation of the embryonal organism. I regard it as almost unnecessary to add that my wearisome investigations of the development of four different species of Cephalopoda completely contradict the opinion put forward by Kölliker †, according to which both the germ-lamellæ are denied to the Cephalopoda.

[To be continued.]

XIV.—*On the Genus* Rossella (*a Hexactinellid Sponge*), *with the Descriptions of three Species*. By H. J. Carter, F.R.S. &c.

[Plate X.]

In 1872 I published some figures of two forms of sponge-spicule which were found abundantly adhering to fragments of a *Tethya* (*T. antarctica*, C.) that had been dredged up from

* *Loc. cit.* p. 19. † *Loc. cit.* p. 167.

the bottom of the Antarctic Ocean by Sir J. Ross, in 300 and 206 fathoms and in 74½° and 77½° south latitude respectively, which, with other deep-sea specimens obtained at the same time, had been handed over to the British Museum by the Admiralty.

For the sponge from which these spicules were supposed to have been derived I proposed the generic name of "*Rossella*," and for the species "*R. antarctica*" ('Annals,' 1872, vol. ix. p. 414, pl. xxi.). One form of the spicules was regarded as podal or anchoring, and the other as belonging more directly to the body of the sponge.

In the same year another specimen of this genus was obtained by the British Museum from Cebu, one of the Philippine Islands, through Dr. A. B. Meyer ('Annals,' 1872, vol. x. p. 113), and named by Dr. Gray "*Rossella philippensis*" (*ib.* p. 137).

In March 1873 four more specimens of the same sponge were obtained by the British Museum from the same neighbourhood, again through Dr. Meyer; and from their having a different aspect, Dr. Gray proposed for these the name of "*Psetalia globulosa*," stating that they would be described by myself more particularly thereafter ('Annals,' 1873, vol. xi. p. 234).

Subsequently (that is, in the month of June following) I received from Prof. Wyville Thomson the specimen of *R. velata* from which his figure in 'The Depths of the Sea' (p. 418) was taken.

And in the month of March 1874 a glass jar was discovered in the British Museum, containing two small specimens of the veritable *Rossella antarctica*, dredged up by Sir J. Ross in 300 fathoms, 74½° south latitude, no doubt at the same time that the fragments of the *Tethya antarctica* and the spicules above mentioned were obtained.

Thus provided, I have been able to compare all these specimens, and find that they all belong to one genus, viz. *Rossella*, but that the Antarctic, Philippine, and Atlantic deep-sea ones possess peculiarities entitling them to be considered three different species. These peculiarities will appear in the following descriptions respectively, beginning with that of

Rossella antarctica, Carter. Pl. X. fig. 4.

General form sac-like, compressed (? *nat.*), with the upper end truncated and open, and the lower one conical and closed (fig. 4, *a*). Aperture elliptical, more or less elongate, corre-

sponding with the long transverse diameter of the body (fig. 5, *a*), leading into a cavity of much the same shape as that of the sponge externally (fig. 4, *e e*). Sessile or fixed by anchoring-spicules. Colour grey. External surface uniformly cribellate and monticular, covered by a thin layer of spicular latticework, and surmounted by three forms of projecting spicules situated respectively on the truncate end, on the body, and on the conical end, as will be more particularly described hereafter. Internal surface, or that of the cavity, uniformly smooth, interrupted by depressions or pits increasing in size towards the lower part. Body or wall constructed of a dense interlacement of large and small spicules, rendered more solid and areolar by the addition of sarcode charged with the minute spicules of the species, and accompanied throughout by the ramifications of the excretory canal-system. Layer of latticework formed of minute, sexradiate, spiniferous spicules, whose horizontal arms, spreading out at right angles to and overlapping each other, form a quadrangular retiform structure held together by the dermal sarcode. Pores situated in the sarcode filling the quadrangular spaces of the latticework. Vents opening into the pit-like depressions on the surface of the cavity. Spicules of three kinds, viz. appendicular, structural, and flesh-spicules. A. Appendicular, of three forms, corresponding with their respective localities:—1. That constituting an erect beard, about a quarter of an inch long, situated round the aperture (fig. 4, *c*), stout, linear, smooth, nearly straight, fusiform, acerate, finely pointed at each end, averaging 10-12ths by 8-1800ths of an inch in its greatest diameters. 2. Anchoring-spicule, which issues from the surface of the body generally, beginning very scantily above in little groups here and there, which increase in number, size, and length towards the lower or conical end, where they attain their maximum size and density (fig. 4, *d d*): stout, smooth, linear, commencing in a finely attenuated end which is fixed in the sarcode of the body, and gradually passing into a thick shaft which is abruptly terminated at the free end by *four* opposite, stout, recurved spines or hooks (fig. 3); average largest size 3 to 4 inches by 5-1800ths of an inch in its greatest diameters, hooks 30 by 5-1800ths of an inch. 3. Crucially headed or veil-spicules, projecting chiefly from the monticules, over every part of the external surface but the aperture, consisting of a shaft whose pointed or inner end is fixed in the sarcode of the body, and whose free or outer one is terminated by four long arms spread out horizontally so as to intercross with those of its neighbours, and thus form a general veil-like covering separated from the body by the length of the shafts between

the body and their heads respectively (fig. 4, *b b*); shaft smooth, or only microtuberculate over the imbedded end; arms more or less flexuous, fine-pointed, parting from the head of the shaft at different angles, covered almost throughout with minute spines, closely approximated, amongst which, here and there, is a much larger spine, curved and inclined outwards or *from* the head of the shaft; average largest size 2 to 3-12ths by 5-1800ths of an inch in the greatest diameters, both for the arms and shaft respectively, the former for the most part longer than the latter. B. Structural spicules (that is, of the body or wall) of three forms, viz.:—4. Nail-like or crucially headed, much like that last described, but with the shaft shorter and the arms longer; the former vertically placed in the wall and the latter spread out horizontally over its external surface, so as to support the lattice-like layer of minute sexradiate spicules imbedded in the dermal sarcode immediately above and the shafts of the veil-spicules beyond; arms more or less curved inwards, so as to render the head of the spicule prominent or monticular, thus characterizing the surface by a number of conical eminences linked together by radiating arms. 5. A long linear spicule, nearly straight, fusiform, often presenting in the middle two or four tubercles corresponding to the ends of the crucial branches of the sexradiate central canal, terminating in spined and more or less inflated extremities, but otherwise smooth; average largest size 3-12ths by 2-1800ths of an inch in its greatest diameters; situated on the inner side of the wall chiefly, where it forms, together with minute sexradiates and flesh-spicules, the surface of the concavity. 6. Sexradiates, of different sizes, with arms of equal length, spined and pointed, chiefly composing the lattice-like structure, which, in the way above stated, covers the whole of the dermal surface with quadrangular interstices from 1-300th to 1-150th of an inch in diameter. C. Flesh-spicules of four rosette-forms, chiefly situated in the surface-layer of the *cavity*:—7. Sexradiate *rosette* with smooth pointed arms of equal length ('Annals,' 1873, vol. xii. pl. xiii. fig. 1). 8. Sexradiate rosette with short arms and double rays (*ib.* fig. 3). 9. Very minute sexradiate rosette with numerous straight capitate rays (Pl. X. fig. 7, *b*). 10. Sexradiate rosette with thick, sparsely spined arms (fig. 6, *a*), whose inflated ends support four or more indistinctly capitate rays (fig. 6, *b c*): rays microspined, thick at first, then becoming finely attenuated and terminating in a hardly perceptible capitate inflation (fig. 6, *d*); rays at first straight and parallel like the prongs of a dinner-fork, becoming more or less divergent towards their extremities (fig. 6); average largest size of the

arm 3½ by 1-6000th of an inch in its greatest diameters, that of the inflation and rays about 7½-6000ths of an inch long (N.B. This is the characteristic rosette of the species). Size of entire specimen 1¾ inch long by 10-12ths of an inch broad, and 7½-12ths of an inch thick; aperture about 7½-12ths of an inch long by 2-12ths wide; margin thick, round; depth of cavity 1½ inch; thickness of wall about 3-12ths of an inch.

Hab. Ocean-bed.

Loc. Antarctic Sea in 300 fathoms, and lat. 74½° S.

Obs. The hexactinellid character of the spicules of this sponge, together with the free termination of the "anchoring-spicule" in four stout spines or hooks recurved and opposite (Pl. X. fig. 3), characterizes the genus, viz. that of "*Rossella*;" while the erect beard of spicules round the aperture (fig. 4, *c*), and the peculiar form of the flesh-spicule (no. 10, fig. 6), which is by far the most abundant, determine the species, viz. *R. antarctica*. There is no *rosette*-like flesh-spicule that I have yet seen wherein the arms are so distinctly, although so sparsely, spined, and the rays so parallel, so little divergent at their extremities, and so little inflated or capitate. (Altogether, the slightly inflated end of the arm, and the microspined rays which it supports, are a miniature form of the head of the scopiform spicule of *Aphrocallistes beatrix*, 'Annals,' 1873, vol. xii. pl. xv. fig. 2.) It is not improbable that there are other forms of the *rosette* flesh-spicule present in this species besides those described; but if so, I have not seen them, and if there are any, they are of no consequence in a specific point of view after no. 10.

R. antarctica further differs from the two following species, so far as my observations extend, in not possessing the other flesh-spicules or forms of *rosette* which are common to both *R. velata* and *R. philippensis*; while it agrees with *R. velata* in the more or less developed state of *all* the arms of the sex-radiate spicule of the latticework layer on the surface, thus differing from *R. philippensis*, in which for the most part the four *horizontal* arms *alone* are present.

I have described the monticular and latticework layer of the surface in a much more perfect state than it exists in the specimens of *R. antarctica* to which I have alluded, where, from rough usage at some time or other, as in some of the specimens of *R. philippensis*, a great part of the latticework layer has been abraded, thus rendering the cribellate and monticular surface below more evident; but still enough of the former remains here and there to show what the specimen was in its entirety.

From the presence of several minute specimens of this

sponge growing upon little bundles of anchoring-spicules projecting from the surface, it seems probable, if these do not originate in ova which have respectively fixed themselves there for development, that they arise from pullulation or budding.

In my description of *R. antarctica* the spicules are numbered 1 to 10 inclusively, to avoid unnecessary repetition in the following species, which will also be described generally with reference to what has already been stated.

Lastly, by comparing my representation of *R. antarctica* (Pl. X. fig. 4), and its previously delineated spicules (*l. c.*), with Schmidt's representations of his "*Holtenia Pourtalesii*" ('Atlantisch. Spongienfaun.' Taf. i. figs. 1–6), the probability of the latter being a species of *Rossella*, as I have heretofore stated, will appear still greater.

Rossella philippensis, Gray. Pl. X. fig. 1.

General form globular (fig. 2), ovate, or cup-shaped (fig. 1), thus perhaps varying in accordance with the age, development, and wearing of the specimen; presenting a flattened summit in which there is an aperture (fig. 1, *d*), and a conical base which is closed, but rendered irregular by mammiform prolongations of the body, out of each of which issues a hair-like lock of long anchoring-spicules (fig. 1, *c c c c*); mammiform prolongations &c. increasing in size with age, dispersed over the body generally, but largest and most prominent at the lower part. Aperture circular and contracted in the young or globular forms (fig. 2, *b*), elliptical elongate in the ovate, and patulous in the old, worn or cup-like form (fig. 1, *d*); leading into a cavity of much the same shape as that of the sponge externally. Sessile or fixed by the anchoring-spicules. Colour grey. External surface uniformly even, except where interrupted by the mammiform prolongations of the body; cribellate immediately below the latticework layer, surmounted by one form of spicule *only*, which issues, as before stated, in hair-like locks from the summits of the prolongations, and will be more particularly described hereafter. Internal surface, or that of the cavity, uniformly smooth, interrupted by depressions or pits (fig. 1, *e e*), so increasing in size downwards as to occupy the whole of the lower part. Body or wall the same as in the foregoing species. External or dermal surface covered by the same kind of latticework. Pores and vents the same respectively. Spicules of three kinds, viz. appendicular, structural, and flesh-spicules. A. Appendicular, of one form only, viz. the "anchoring" one, no. 2 in the fore-

going description, but much larger and longer, increasing in size towards the lower part, where they are 6 inches in length. B. Structural, the same as in the foregoing species, but with *no* spines on the shaft or arms of the crucially headed one. C. Flesh-spicules of eight forms (see 'Annals,' 1873, vol. xii. pl. xiii.), viz. figs. 1, 2, 3, 4, 5, 6, 8, and 12 inclusively, only that figs. 2, 3, and 4 in *R. philippensis* are subspinous in all their parts. Size of the largest specimen, which is cup-shaped (fig. 1), 2 inches high, and $2\frac{5}{12}$ inches by $1\frac{7}{12}$ inch wide at the orifice; cup 1 inch deep, with thick rounded margin. Longest hair-like locks of anchoring-spicules 6 inches. Size of ovo-globular specimen $1\frac{1}{2}$ by $1\frac{1}{2}$ inch in its greatest diameters. Size of the three other specimens, which are younger, globular, and linked together by the hair-like locks of the largest (as in figs. 1 & 2,*f*), different, probably in accordance with their ages respectively.

Hab. Marine.

Loc. Cebu, Philippine Islands.

Obs. The hexactinellid character of the spicules of this sponge, coupled with its four-hooked anchoring-spicule (no. 2) as described in the last species, at once proves it to be a *Rossella*; and the absence of the crucially headed veil-spicule from the surface of the body generally (that is, the absence of the "veil"), whose presence is so characteristic of *R. antarctica* and *R. velata*, further proves it to be the *R. philippensis* of Dr. Gray. To this we might add the much greater development in size and length of the groups of anchoring-spicules, the absence of spines on the arms of the large crucially headed structural spicules of the body, and the absence, for the most part, of the outer and inner arm of the latticework sexradiate spicule of the surface, thus leaving the four *horizontal* ones alone developed; while the absence of the erect fringe of spicules around the aperture, whose presence is so characteristic of *R. antarctica*, further distinguishes it from that species.

It is not improbable that the "cup-like form" above described and figured (Pl. X. fig. 1) has had its cavity and shape worn down, and has become modified generally into its present condition from a younger and more globular form with contracted aperture, somewhat like fig. 2; while, so far as these changes go, there may be similar differences between the older and younger forms also of *R. antarctica*; but although such may be thus anticipated, I am not, from the few specimens from which I have had to write my descriptions, able to make the statement with certainty.

In studying the Spongida it will be found that the general form so often varies, that alone it is not to be depended on as

a specific distinction, any more than the same complement of spicules is always accompanied by the same form of sponge: thus, two sponges may be almost undistinguishable in their general forms, and yet, after all, be totally different in the forms of their spicules respectively. Hence the necessity of examining *every* specimen of sponge *microscopically* before we decide on its specific characters.

As in *R. antarctica*, so here we have younger specimens of *R. philippensis* (fig. 2) growing upon the hair-like locks of the older ones (fig. 1, *f*), but much larger in dimensions, similar to those noticed in the concluding part of my description, which suggested to Dr. Gray the name of "*Psetalia globulosa*" (*l. c.*). But whether originating in ova or pullulation I am, as above stated with reference to the minute ones on *R. antarctica*, unable to determine.

Lastly, it might be observed generally that although the hooked extremities of the anchoring-spicules have been for the most part torn off, there are many among them, especially coming from the upper part of the sponge, which naturally have never had any, but have always been fine-pointed.

Rossella velata, Wyville Thomson ('The Depths of the Sea,' p. 418).

General form ovoid, hollow; truncate and open at the upper, closed at the lower end. Aperture subcircular, slightly widening inwards from a thin margin to a cavity of much the same shape as the sponge itself externally. Sessile or fixed by anchoring-spicules. Colour brownish grey. External surface uniformly net-like and monticular, resting on a widely cancellated structure below, and covered by the latticework spicular layer above, which is again surmounted by three forms of appendicular spicules, whose relative positions and forms will be described hereafter. Internal surface or that of the cavity, the structure of the body or wall, and that of the latticework layer the same as in both the foregoing species. Pores and vents respectively the same in form and situation. Monticules of the surface round or boss-like, looking like so many stelliform eminences regularly linked together by interradiating lines. Spicules of three kinds, viz. appendicular, structural, and flesh-spicules. A. Appendicular of three forms, viz. 1, pointed at each extremity, and 2, four-hooked at the free end (like nos. 1 and 2 in *R. antarctica* respectively), associated, scantily scattered over the upper part of the body in small groups issuing from the summits of the boss-like eminences, becoming more numerous towards the lower part, where they attain

their maximum size, length, and density—average length 3¼ inches: 3. crucially headed, like no. 3 in *R. antarctica* and similarly situated (that is, issuing from the summits of the monticular or boss-like eminences), but larger and more numerous, averaging in the length of the shaft 7-12ths, and in that of the arms 6-12ths of an inch respectively. B. Structural spicules of the body and latticework layer, the same as in *R. antarctica*. C. Flesh-spicules, the same as those in *R. philippensis*. Size of entire specimen $2\frac{8}{12}$ by 2 inches in its greatest diameters; aperture 8-12ths of an inch wide; cavity 1½ inch deep.

Hab. Marine.

Loc. Atlantic Ocean-bed, north-west of the Shetland Islands.

Obs. The specimen of *R. velata* from which the above description has been taken is that figured by Prof. Thomson in his 'Depths of the Sea' (p. 418). It came to me dry and not labelled; but in a jar numbered "65," received also at the same time, there are, among other sponges, three fragments of *R. velata*, which, according to the position of the station which is indicated by this no. (viz. about 80 miles north-west of the Shetland Islands), must have been dredged up in 345 fathoms. Nothing, however, can give a better idea of the sponge, except seeing it, than the representation to which I have alluded; and therefore it will not be here repeated.

R. velata differs from *R. antarctica* in the absence of the erect fringe of spicules round the aperture, and, of course, in not possessing that form of *rosette* or flesh-spicule which is peculiar to the latter. It differs from *R. philippensis* in possessing the covering of veil-spicules, whose crucially armed heads form by intercrossing with each other an external envelope common to both *R. antarctica* and *R. velata*, as well as in the absence of the peculiar form of *rosette* in *R. antarctica*.

From *R. philippensis* it also differs in possessing the stelliform boss-like surface, and in the absence of the mammiform prolongations of the body with the large hair-like locks of anchoring-spicules that issue from them respectively, which are equally absent in *R. antarctica* (Pl. X. figs. 1 & 4); lastly, in having for the most part the outer and inner arm of the sexradiate spicule of the latticework dermal layer developed as in *R. antarctica*, together with a profusion of veil-like spicules, with probably other minor differences, which being merely in degree do not merit further mention here, although generally they indicate, from their delicate nature when compared with the other species, the quiet habitat in which *R. velata* has been developed.

General Observations.

The essential differences between the species of *Rossella* above described are as follows:—

R. antarctica differs from the other two in possessing an erect fringe of stout spicules round the aperture and the peculiar form of *rosette* flesh-spicule above described.

R. philippensis differs from *R. antarctica* and *R. velata* in *not* possessing the monticular or boss-like surface, together with the veil-like covering of crucially headed spicules, but in lieu thereof probably the mammiform prolongations of the body with the large hair-like locks of anchoring-spicules issuing from them respectively.

R. velata differs from *R. antarctica* in not having the form of *rosette* peculiar to the latter, and from *R. philippensis* in possessing the veil-like covering of crucially headed spicules.

EXPLANATION OF PLATE X.

Fig. 1. *Rossella philippensis*, Gray, old individual, natural size; cup-like and much worn: *a*, body; *b b b*, mammiform prolongations of the body; *c c c c*, hair-like locks of long anchoring-spicules issuing from the prolongations; *d*, cavity or cup-like excavation of the body; *e e*, pit-like depressions on the surface of the same; *f*, hair-like lock of spicules on which a young individual of the same species has become developed.

Fig. 2. The same, young specimen which has become developed on the hair-like lock of fig. 1, *f*, natural size: *a*, body; *b*, aperture; *c c*, mammiform prolongations of the body supporting the hair-like locks of spicules respectively.

Fig. 3. Form of free end of the anchoring-spicule characteristic of the genus *Rossella*.

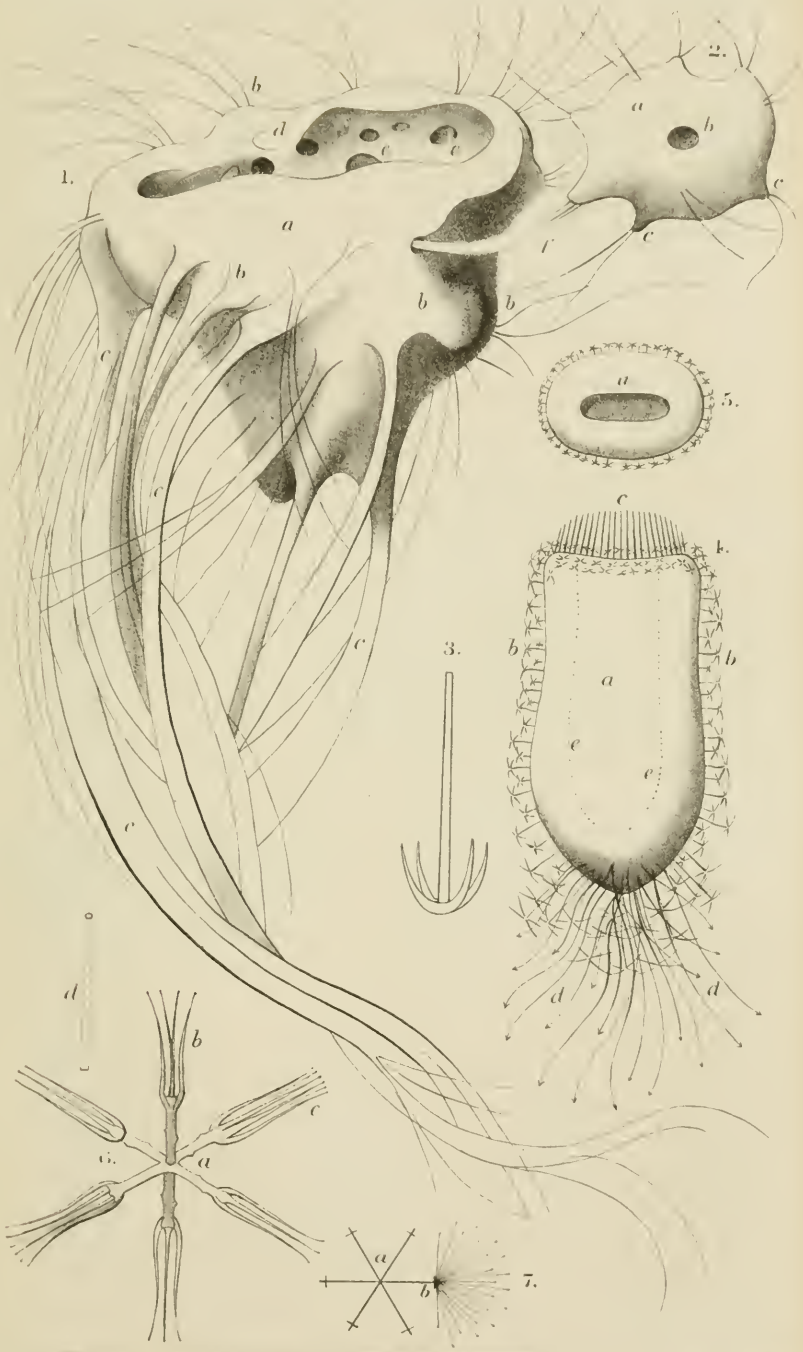
Fig. 4. *Rossella antarctica*, Carter, natural size, from the largest of two specimens dredged up by Sir J. Ross in 74½° south latitude: *a*, body; *b b*, external or veil-like covering composed of crucially headed spicules; *c*, erect fringe of spicules round the aperture; *d d*, anchoring-spicules of the lower extremity; *e e*, dotted line indicating the shape of the cavity.

Fig. 5. The same, apertural end: *a*, aperture.

Fig. 6. Form of *rosette* or flesh-spicule peculiar to *R. antarctica*: *a*, arms subspined; *b*, four-rayed head; *c*, six-rayed head; *d*, end of a single ray, more magnified, to show that it is capitate and micro-spined over the shaft.

Fig. 7. *R. antarctica*, "pappiform rosette," magnified to the same scale as the foregoing, viz. 1-12th to 1-6000th of an inch, to show their sizes relatively: *a*, arms of the rosette; *b*, head of one arm with rays.

N.B. For convenience only one head of rays has here been inserted.



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