

We have, therefore, in the life-history of *Myzostoma*, as detailed by Wheeler, a remarkable confirmation of Smith's theory of secondary hermaphroditism, and a further case in which it appears to supply a complete interpretation of facts hitherto lacking an explanation.

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LV.—On the Affinities of *Astrosclera willeyana*, Lister. By R. KIRKPATRICK.

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[Plate XI.]

AMONG some sponges collected by Dr. C. W. Andrews, F.R.S., off Christmas Island, and presented to the Natural History Museum by Sir John Murray, were four small examples of *Astrosclera willeyana*, Lister. The specimens had been detached from a block of coral rock brought up from a depth of 46 fathoms, and had been put into alcohol. The largest example, which is mushroom-shaped, is 12 mm. high, 8 mm. in diameter at the base of the round stem, and 14 mm. in diameter across the convex head. The rounded upper surface is smooth and shows a reticulate pattern with irregularly meandrine or rounded meshes about a millimetre in diameter. Several stellate oscular areas are scattered over the surface. In a vertical section of the sponge the strands of the network are seen to be the edges of walls or lamellæ composed of loosely aggregated spherules, which amalgamate lower down to form solid masses.

A second columnar specimen, 12 mm. high, was decalcified and stained. A third example formed a small cylindrical nodule, and a fourth an irregular disk 7 mm. in diameter and 2-3 mm. thick.

Vertical longitudinal sections of the decalcified specimen showed a tubular network with numerous elongated longitudinal strands hanging down from a surface layer (of ectosome), and joined by fewer and shorter more or less transverse tubular bars.

The walls of the tubes were beset with siliceous spined acanthostyles set at a very acute angle and evidently pointing in the direction of exhalant currents. The spicules beneath the ectosome were vertically dressed.

The gaps in the tubular network, *i. e.* the meshes left after decalcification, were filled, in the complete state, with spherules of aragonite, separate in the upper part of the sponge, but fused into solid walls and masses in the lower.

All four specimens have the siliceous acanthostyles. One specimen has in addition centrotriænes, spined microxeas, and spirasters belonging to a species of *Triptolemus*, a Tetractinellid Theneid sponge, which seems to have a boring habit. The flagellated chambers are fairly well preserved. In some double-stained sections not thoroughly decalcified the aragonite spherules took the stain, the deeper stained central part of each spherule looking like a nucleus. Numerous embryos are present, especially below the ectosome.

In 1900 J. J. Lister published a memoir on *Astrosclera* in Willey's 'Zoological Results,' part iv. Four of the specimens he described came from 35 fathoms off Lifu; a fifth from 100 fathoms off Funafuti was sent to him from the British Museum.

He considered these organisms to be very aberrant calcareous sponges which appeared to show affinities with some of the Pharetronidæ. Recently I wrote to Mr. Lister asking for the loan of his preparations, all of which he very kindly sent to me.

In one of the longitudinal sections of a complete specimen showing hard and soft tissues I found on the outer edge of the section a number of vertically dressed acanthostyles, but the tissues of the canals were devoid of these spicules.

On decalcifying a fragment of the old and dead Funafuti specimen I found remains of much macerated acanthostyles, often reduced to a thin shell, but still recognizable as acanthostyles.

Mr. Lister had had imperfect material to work with, and could hardly have come to any other conclusion than the one he adopted.

My own views concerning this sponge are as follows:—*Astrosclera willeyana* is a siliceous Ectyonine sponge related to *Hymerhaphia*. Originally it was a small thin incrusting sponge with a skeleton constructed of separate vertical columns of acanthostyles with one spicule to each column. It acquired the habit common among its Ectyonine congeners of selecting special kinds of particles from its surroundings, which here include numerous aragonite-forming algæ corals,

&c.* *Aulena crassa* (Carter), with its main skeletal construction almost identical with that of *Astrosclera*, selects minute particles of siliceous or quartz sand. *Astrosclera* selects the more tractable spherules of an aragonitic sand. An artificial aragonitic sand made after Meigen's recipe (Bericht nat. Gesell. Freiburg, xiii. p. 9) resembles the supposed scleres of *Astrosclera*. Little masses of these spherules, each one of which is a radiating aggregate, make not a bad imitation of fragments of *Astrosclera* skeleton, for the artificial spherules vary in size and become polyhedral with mutual pressure.

The primarily separate spherules would gradually amalgamate to form walls, which would permit of the choanosome growing into folds; the lumen of the latter would gradually contract owing to the encroaching laminæ. The vertical acanthostyles in the tubular folds would tend to assume more and more an oblique position. The thin sponge crust became a disk, and the disk a column.

The character of forming a skeleton of aragonite has evidently been an eminently successful one for the little *Hymerhophia*-like sponge, for examples have been recorded from widely distant localities, viz. from 10 to 20 degrees south of the Equator and from longitudes 105° E., 166° E., and 175° W., from depths of 35–100 fathoms on coral rock. But apparently there have been penalties and drawbacks associated with this strange success, for the sponge has become subject to the attacks of boring organisms.

The tubular and honeycomb style of architecture is not uncommon among the Ectyonine relatives of *Astrosclera*. *Aulena* (*Holopsamma*) *crassa* (Carter), for instance, presents a very similar appearance to *Astrosclera* both on the surface and in section (see Lendenfeld, 'Mon. Horny Sponges,' pl. viii. figs. 1, 2); here the echinating styles are smooth.

I shall not attempt to give an account of the histology and cytology of *Astrosclera* at present, because the specimens, precious though they be, are not sufficiently well preserved. I shall be dredging off Christmas Island this autumn, and if I am fortunate enough to procure more specimens of this wonderful sponge I shall fix them at the moment of capture and in accordance with the best methods.

In the true siliceo-calcareous sponge *Merlia normani* ('Annals,' Feb. 1910, p. 288) the skeleton of calcite, which is formed by an epithelium on the external surface, partly supports the sponge, but chiefly shelters masses of archæo-

* For lists of calcitic and aragonitic organisms see Meigen, Centralb. für Mineralogie, 1901, p. 577, and Ber. nat. Gesellsch. Freiburg i. B. 1903, xiii. p. 51.

cytes. *Astrosclera* is, in my opinion, a purely siliceous sponge, and does not secrete aragonite.

Summary.—*Astrosclera willeyana*, Lister, is an Ectyonine sponge with a supplementary skeleton formed of foreign particles of aragonite, the latter being at first discrete, and later welded into concrete walls and blocks.

EXPLANATION OF PLATE XI.

Astrosclera willeyana, Lister.

Figs. 1-3. Specimens, nearly nat. size.

Fig. 4. Surface of specimen 3, $\times 10$.

Fig. 5. Longitudinal vertical section of soft tissues of a decalcified specimen, $\times 7$.

Fig. 6. The same, $\times 16$, showing acanthostyles in the walls of the choanosome and below the ectosome. This figure should have shown embryos.

Fig. 7. The same, $\times 65$.

Fig. 8. Acanthostyle from Christmas Island specimen, $\times 700$.

Fig. 9. Ditto from Lifu specimen, $\times 700$.

Fig. 10. Aragonite spherules, nearly but not wholly decalcified, with remains of radiating lines of particles deeply stained, the whole apparently imbedded in cell-like masses of protoplasm (? remnants of ground substance); no nuclei visible. $\times 1000$.

LVI.—*New Mammals from the E. Indian Archipelago.*

By OLDFIELD THOMAS.

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Pteropus liops, sp. n.

Very similar externally to *Pt. temminckii*, and agreeing with it in size, quality and distribution of fur, and general colour, but differing in the following details:—Face (including cheeks and chin) uniformly pale brown, without any tendency to the formation of eye-rings; in *temminckii* the face generally is whitish, the cheeks especially, while there are perceptible brown eye-rings carried forward anteriorly nearly to the nose, and contrasting with the narrow median buffy-whitish frontal line between them. Under surface, from sternum backwards, dark broccoli-brown, the hairs of this part being in *temminckii* broadly tipped with pale buffy.

Skull with the orbits markedly smaller than in *temminckii*.

Forearm of type 102 mm.

Hab. Buru Island.

Type. Subadult female. Original number 892. Collected August, 1909, by Mr. W. Stalker.



Kirkpatrick, Randolph. 1910. "On the affinities of *Atsrosclera willeyana*, Lister." *The Annals and magazine of natural history; zoology, botany, and geology* 5, 380–383.

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