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IX.—*On Holtenia, a Genus of Vitreous Sponges.* By Wyville Thomson, LL.D., F.R.S., Professor of Natural Sciences in Queen's College, Belfast.

During the deep-sea dredging cruise of H.M.S. 'Lightning' in the autumn of the year 1868, the dredge brought up, on the 6th of September, from a depth of 530 fathoms, in lat. 59° 36′ N. and long. 7° 20′ W., about 20 miles beyond the 100-fathom line of the Coast Survey of Scotland, fine, grey, oozy mud, with forty or fifty entire examples of several species of siliceous sponges. The minimum temperature indicated by several registering thermometers, was 47°·3 Fahr., the surface temperature for the several localities being 52°·5 Fahr.

The mud brought up consisted chiefly of minute amorphous particles of carbonate of lime, with a considerable proportion of living *Globigerinæ* and other Foraminifera, and of the "coccoliths" and "coccospheres," so characteristic of the chalk-mud of the warmer area of the Atlantic. The sponges belong to four genera; one of them was the genus *Hyalonema*, previously represented by the singular glass-rope sponges of Japan and the coast of Portugal, and the other three genera were new to science. One of these latter is the subject of the present paper.

Associated with the sponges were representatives, usually of a small size, of the Mollusca, the Crustacea and Annelides, the Echinodermata, and the Cœlenterata, with numerous large and remarkable Rhizopods. Many of the higher invertebrates were brightly coloured, and had eyes.

Four nearly perfect specimens of the sponge described in the memoir laid before the Royal Society were procured.

Holtenia, n. g.* H. Carpenteri, n. sp.

The body of this sponge is nearly globular or oval. Normal and apparently full-grown species are from 9″ to 1′ 1″ in length, and from 7″ to 9″ wide. The outer wall consists of an open, somewhat irregular, but very elegant network, whose skeleton is made up of large separate siliceous spicules. These spicules are found on the hexradiate stellate type, but usually only five rays are developed, the sixth ray being separated by a tubercle. To form this framework of the external wall, the four secondary branches of the spicule spread on one plane, the surface of the sponge, while the fifth or azygous branch dips down into the sponge-substance.

* The genus is named in compliment to Mr. Holten, Governor of the Faroe Islands, and the species is dedicated to Dr. W. B. Carpenter, V.P.R.S., with whom the author was associated in the conduct of the scientific expedition.

This arrangement of the spicules gives the outer surface of the sponge a distinctly stellate appearance, the centres of the stems being the point of radiation of the secondary branches of the spicules. These quinque-radiate spicules measure about 1″·5 from point to point of the cross-like secondary branches, and the length of the azygous arm is from 7‴·5 to 1″.

Smaller stars, formed by the radiation of smaller spicules of the same class, occupy the spaces between the rays of the larger stars.

The rays of each star bend irregularly, and meet the rays of the spicules forming the neighbouring stars. The rays of the different spicules thus run along for some distance parallel to one another, and are held together by a layer of elastic sarcode, which invests all the spicules and all their branches. Between the rays of the spicules, over the whole surface, the sarcode forms an ultimate and very delicate network, its meshes defining and surrounding minute inhallant pores.

At the top of the sponge there is a larger osculum, about 3″ in diameter, which terminates a cylindrical cavity which passes down vertically into the substance of the sponge to a depth of 5″ 5‴. The walls of this oscular cavity are formed upon the same plan as the external wall of the sponge, and the stars, which are even more conspicuous than those of the outer wall, are due to the same arrangement of spicules of the same form. The ultimate sarcode network is absent between the rays of the stars of the oscular surface.

The sponge-substance, which is about 2″ in thickness between the oscular and outer walls, is formed of a loose vacuolated arrangement of bands and rods of greyish consistent sarcode, containing minute disseminated granules, and groups of granules of horny matter, and endoplasts.

Towards the outer wall of the sponge the sarcode trabeculæ are arranged symmetrically, and at length they resolve themselves into distinct columns, which abut against and support the centres of the stars, leaving wide open anastomosing channels between them. The sarcode of the outer wall, and that of the wall of the oscular cavity, is loaded with minute spicules of two principal forms, quinque-radiate spicules with one ray prolonged and feathered, and minute amphidisci.

Over the lower third of the body of the sponge, fascicles of enormously long delicate siliceous spicules pass out from the sarcode columns of the sponge-body in which they originate, through the outer wall, to be diffused to a distance of not less than half-a-mètre in the mud in which the sponge lives buried; and round the osculum and over the upper third of the sponge, sheaves of shorter, more rigid spicules project, forming a kind of fringe.

I refer all the sponges which were found inhabiting the chalk-

mud to the order Porifera Vitrea, which I have defined in the 'Annals and Magazine of Natural History' for February, 1860. This order is mainly characterized by the great variety and complexity of form of the spicules, which may apparently, with scarcely an exception, be referred to the hexradiate stellate type, a form of spicule which does not appear to occur in any other order of sponges. The genus *Holtenia* is nearly allied to *Hyalonema*, and seems to resemble it in its mode of occurrence. Both genera live imbedded in the soft upper layer of the chalk-mud in which they are supported,—*Holtenia* by a delicate range of siliceous fibres, which spread round it in all directions, increasing its surface without materially increasing its weight; *Hyalonema* by a more consistent coil of spicules, which penetrates the mud vertically and anchors itself in a firmer layer.

It appears to me and to Dr. Carpenter, who have had our attention specially directed to this point as bearing upon the continuity and identity of some portions of the present calcareous deposits of the Atlantic with the cretaceous formation, that the vitreous sponges are more nearly allied to the *Ventriculites* of the chalk than to any recent order of Porifera. We are inclined to ascribe the absence of silica in many ventriculites, and the absence of disseminated silica in the chalk generally, to some process, probably dialytic, subsequent to the deposit of the chalk, by which the silica has been removed and aggregated in amorphous masses, the chalk flints.

The vitreous sponges along with the living Rhizopods and other Protozoa which enter largely into the composition of the upper layer of the chalk-mud, appear to be nourished by the absorption through the external surface of their bodies of the assimilable organic matter which exists in appreciable quantity in all sea-water, and which is derived from the life and death of marine animals and plants, and, in large quantity, from the water of tropical rivers. One principal function of this vast sheet of the lowest type of animal life, which probably extends over the whole of the warmer regions of the sea, may probably be to diminish the loss of organic matter by gradual decomposition, and to aid in maintaining in the ocean the "balance of organic nature."—*Abstract of a paper read before the Royal Society at its last meeting, June 23rd.*