

ment of the nodule is well seen. One of these nodules, about 4 cm. in diameter, had attached to it two Ascidians and a Brachiopod (see Fig. 34), so that a portion of the nodule probably projected above the mud when at the bottom.

A great many nodules belonging to the third, flattened, mammillated, or irregular variety were present. They vary greatly in size, contour, and internal structure, some resembling the first, others the second, varieties above described. Those resembling the



FIG. 34.—Manganese Nodule with two Tunicates (*Styela squamosa* and *Styela bythia*) and a Brachiopod attached. Station 100, 2600 fathoms, Southern Indian Ocean.

first variety are mammillated on the exterior, while the interior is friable, sometimes mottled, or with ill-defined black and whitish bands, but not concentric. Those resembling the second variety are less mammillated, are generally compact throughout, with fine concentric layers, and, when cut in section and rubbed with a chamois leather, give a fine black shining submetallic surface. Sometimes they have a volcanic fragment, or a fragment of bone, for a nucleus, and then the external form of the nodule resembles closely the shape of the enclosed fragment. Frequently the nucleus appears to be pseudo-

morphosed by manganese, especially when it consisted of carbonate or phosphate of lime. Sharks' teeth and earbones of Cetaceans also give a form to the nodules when forming the nuclei.

Two or three nodules, or fragments of nodules, merit a special reference. They appear to be fragments of the spherical variety, and we have every reason to believe that the nodules of which they once formed part were broken while yet at the bottom of the sea. The structure and angular form, as well as the radial and concentric fractures, of one piece, leave no doubt that it once formed part of a large spherical nodule. The surfaces of the broken part are covered with fine rugosities, indicating a deposition of manganese over the fragment after its separation from the original nodule, and upon these same surfaces of fracture two Brachiopods and a Hydroid have subsequently attached themselves. Another and smaller fragment, with concentric structure, in which a portion of the palagonitic nucleus is still to be observed, is wedge-shaped, and has been formed by a fracture following the direction of the rays of the original nodule. That the nodule had been broken while yet at the bottom of the sea is proved by the fact that the fragment is entirely surrounded by a new concentric deposit of manganese about 0.5 mm. in thickness. This fragment must then be regarded as having been separated from the original nodule at the bottom, and to have subsequently become the nucleus of a new nodule.

About twelve of the nodules contained nuclei of basic volcanic glass or of palagonite. In some the unaltered glass was surrounded by coloured bands of palagonite or altered material, similar to the specimen represented in Pl. XIX. fig. 3 from Station 293. In