

—like pumice and glassy lapilli, almost always profoundly altered—are perhaps the most frequent nuclei, then follow teeth of sharks and other fish, otoliths, bones of Cetaceans, siliceous and calcareous Sponges, and even agglomerations of the deposits in which casts of Foraminifera can be recognised.

Not only the external form and the presence of nuclei, but also the internal structure, indicate the concretionary nature of the nodules; the sections, in fact, show that the nodules are built up of successive concentric zones. The inner zones follow closely the form of the nucleus, while those towards the exterior are more regular and have more ample curves. Some zones are darker than others, and in these the manganese is more abundant than in the intervening ones, which have a large admixture of earthy and clayey materials. The zones vary in thickness in different specimens; sometimes they are thinnest in the central, and sometimes in the outer, layers. This zonary structure is well exhibited when the nodules are demanganised; the clayey and earthy skeletons that remain after this treatment resemble strikingly all the varieties of urinary calculi. The empty spaces in these skeletons show the positions occupied by the eliminated manganese in the nodules, and it may be seen that the dendrites had passed across the earthy and clayey zones.

The concretionary arrangement of the nodules is likewise clearly exhibited by the facility with which the successive zones may be separated into concentric shells or scales following the earthy layers. In some of the more compact and purer nodules, and in spaces free from foreign substances, a distinct fibro-radiate disposition may also be observed, recalling the structure of pyrolusite, and there is nearly always a tendency to a fracture following the radii of the nodule. Some of the nodules, indeed, have broken up in this fashion while still at the bottom of the sea, and the separate fragments or wedges of the original nodule have become the centres or nuclei around which new concentric layers have been deposited.

*Microscopic Characters.*—The microscopic characters of the manganese concreted in the nodules do not present any peculiarities to allow of a specific determination of the mineral. Like all the oxides of manganese, it appears, in the thin slices of the nodules, as absolutely opaque: a black mass sometimes with a brownish tint. There is no trace of internal structure nor of crystalline form, if we except some small patches in a few of the denser nodules, whose crypto-crystalline appearance has been compared to pyrolusite. When mixed with the clayey matters of the deposits the manganese is often seen as minute roundish grains with a black opaque centre and a brownish coloured border. But generally the red-brown or chocolate pigment of the deposit is indefinite, and the oxides of iron and manganese occur with very vague contours. In the nodules the manganese appears to be amorphous, but as we have said it assumes a dendritic arrangement which can be well seen under the microscope. All the details of this structure, and the form of the manganese in the nodules, are represented by the figures on Pls. XXVIII. and