

pact mass. The organic remains on the bottom of the sea often retain for a long time some of their sarcodic substance, and we are inclined to think that this exercises upon the phosphate an attraction which might be considered as a feeble echo of that exercised by living matter. This view might be supported by recalling the frequent incrustations of phosphates and its concretionary development upon the remains of plants and animals; at the same time it must be pointed out that phosphate of lime is sometimes formed around inert matters to which no affinity would appear to carry it. A solid body of any kind appears to serve as a nucleus, though phosphatic nodules are by preference formed around organic centres, but whatever the nature of the nucleus, once the first layer of the concretionary substance is deposited it no longer remains inert, acting in its turn as a centre of attraction and grouping round it, just as the solvents furnish material, all the molecules of the same nature which are found within its radius of attraction.

Recalling now the various particulars stated in the preceding general descriptions, we may give a resumé of the facts upon which we rely for the interpretation of the mode of formation of the phosphatic nodules dredged to the south of the Cape of Good Hope. It may be said that the phosphate of lime accumulates in marine muds in the form of remains of organisms which secreted this body during life, the analyses of oceanic deposits usually showing the presence of a notable quantity of phosphate of lime. It is upon the debris of organisms that the solvent action of the sea-water impregnating the sedimentary pulp is exercised; we know that nearly all the bones of fishes, Crustacean carapaces, and other organic structures containing phosphates, have been removed in solution. After having been dissolved, the phosphate, existing in a state analogous to that of colloidal bodies, is deposited at first in the interiors of Rhizopod shells lying isolated in the muddy matter and still lined with organic material. This filling up of the Foraminifera shells is seen perfectly in microscopic sections of the nodules, which show also that the concretionary substance, having filled the empty spaces, continues to be attracted around these centres and infiltrates into the muddy mass, enclosing all the impurities and binding together several centres whose agglomeration forms the nodule. This concretionary process is accompanied by an after-growth more or less complete of phosphate upon the calcite. In other cases mineral particles are taken as a centre of concretion, as shown in the nodules from the Green Sand; in this case organic matter does not apparently play the same role in determining the formation of the nodule.¹ On the decay of fish bones, and indeed of all animal structures, ammoniacal salts are formed, and at the same time phosphoric acid in combination with lime is dissolved in sea-water, the natural result being the formation of ammoniacal or alkaline phosphates, which react upon any structural form of carbonate of lime, such as shells, Corals, &c., the phosphoric acid in combination with the alkaline bodies combining with the lime of the Coral or shell to form phosphate of

¹ See Irvine and Anderson, "On the Action of Metallic (and other) Salts on Carbonate of Lime," *Proc. Roy. Soc. Edin.*, vol. xvii. pp. 52-54, 1891.