

exhibit very primitive structural relations. The occurrence of fossil Polycystina in the Carboniferous formation of England has been incidentally mentioned by W. J. Sollas:—"In the carboniferous beds of North Wales pseudomorphs of Radiolaria in calcite occur, along with minute quartz crystals" (Ann. and Mag. Nat. Hist., 1880, ser. 5, vol. vi. p. 439); and in the siliceous slate-beds of Saxony Rothpletz has shown the existence of a few Sphæroidea (Zeitschr. d. Deutsch. Geol. Gesellsch., 1800, p. 447).

245. *Abundance of Radiolaria in the Various Rocks.*—The relative quantity of well-preserved or at all events recognisable Radiolaria in the different rocks is very variable. In this respect three different degrees may be distinguished, which may be called shortly "pure, mixed, and poor" Radiolarian formations. The *pure* Radiolarian rocks consist for the greater part (usually much more than half, sometimes even more than three-quarters) of closely compacted often calcined masses of siliceous Polycystine shells. To this category belong the pure Miocene Polycystine marls of Barbados (§ 246), the Tertiary Polycystine clay of the Nicobar Islands (§ 247), and the Polycystine quartz of the Jura (§ 248). All these pure Radiolarian rocks may be regarded as fossil Radiolarian ooze (§ 237), and are certainly of deep-sea origin, having probably been deposited at depths greater than 2000 fathoms. Their palæontological character also is in favour of this view, for the abyssal *Osculosa* (§ 235) are more abundant and richer in species than the pelagic *Porulosa* (§ 233). The elevation of this deep-sea layer above the surface of the sea appears to have taken place but seldom; it has only been observed on a large scale at Barbados and in the Nicobar Islands. The *mixed* Radiolarian rocks are much more common; they were probably deposited at much less depths, or perhaps are not true deep-sea formations at all. The siliceous shells of Polycystina always constitute less than half (sometimes less than one-tenth) of their mass, and are less prominent than other siliceous remains (Diatoms), or calcareous remains (Foraminifera), or in some cases than the mineral constituents (pumice, &c.). To this group belong many of the above-mentioned Tertiary marls and clays (especially the Mediterranean Tripoli), also many flints, cherts, and other quartzites from Mesozoic strata (especially from the Jura), and probably also some palæozoic quartzites. The marine ooze from which they have originated may have been deposited at very various, even at slight, depths of the ocean. Formations *poor* in Radiolaria, which contain only a few species of SPUMELLARIA and NASSELLARIA mingled with other fossil remains and mineral particles, occur in all formations and are probably very widely distributed. Further careful examination of thin sections (especially of coprolites) will yield here a rich harvest of new forms. Both the mixed and the pure Radiolarian formations may be divided according to their petrographic characters into three groups, which, however, are connected by intermediate varieties—(1) soft, chalky marl (§ 246), (2) plastic clay (§ 247), and (3) hard, flinty quartz (§ 248).