

20 to 30 fathoms (§ 233). The complicated conditions of existence created by the keen struggle for existence at the surface of the sea, give rise to the formation of very numerous pelagic species, especially of Porulosa (SPUMELLARIA and ACANTHARIA). The *abyssal* Radiolaria are very different from those just mentioned; they live at the bottom of the deep-sea, not resting upon nor attached to it, but probably floating at a little distance above it, and are adapted to the conditions of existence which obtain there (§ 235). Here the Osculosa (NASSELLARIA and PHÆODARIA) seem to predominate. The *zonarial* Radiolaria live floating at various depths between the pelagic and abyssal species (§ 234). In their morphological characters they gradually approach the pelagic forms upwards and the abyssal downwards.

The views which have hitherto been held regarding the bathymetrical or vertical distribution of the Radiolaria have been entirely altered by the magnificent discoveries of the Challenger, and especially by the important observations of Sir Wyville Thomson (L. N. 31) and John Murray (L. N. 27). These two distinguished deep-sea explorers have, as the result of their wide experience, been convinced that Radiolaria exist at all depths of the ocean, and that there are large numbers of true deep-sea species which are never found at the surface of the sea nor at slight depths (L. N. 31, vol. i. pp. 236–238; L. N. 27, pp. 523, 525). The result of my ten years' work upon the Challenger Radiolaria, and the comparative study of more than a thousand mountings from all depths, has only been to confirm this opinion, and I am further persuaded that it will some day be possible by the aid of suitable nets (not yet invented) to distinguish different faunistic zones in the various depths of the sea. In this connection may be mentioned the specially interesting fact that the species of Radiolaria of one and the same family present in the different depths characteristic morphological distinctions, which obviously correspond to their different physiological relations in the struggle for existence. Owing to those extensive discoveries, the representation which I gave in my Monograph (1862, L. N. 16, pp. 172–196) of the vertical distribution of the Radiolaria, and of their life in the greatest depths of the sea, has been entirely changed. Compare also Bütschli (L. N. 41, p. 466).

233. *The Pelagic Fauna.*—The surface of the open ocean seems everywhere, at a certain distance from the coast at least, to be peopled by crowds of living Radiolaria. In the tropical zone these pelagic crowds consist of many different species, whilst in the frigid zones, on the other hand, they are made up of many individuals belonging to but few species. Most of these inhabitants of the surface may be regarded as truly pelagic species, which either remain always at the surface or descend only very slightly below it. Probably most Porulosa (both SPUMELLARIA and ACANTHARIA) belong to this group; whilst but few Osculosa occur in it, and fewer PHÆODARIA than NASSELLARIA. In general the pelagic Radiolaria are distinguished from the abyssal by the more delicate and slender structure of their skeletons; the pores of the lattice-shells are larger, the intervening trabeculæ thinner; the armature of spines, spathillæ, anchors, &c., is more various and more highly developed. Numerous forms are to be found among the pelagic