

the depth of water, and in the deeper zones of warm latitudes species are noticed which are inhabitants of the littoral zones of the highest latitudes. Forbes also showed that all sea-bottoms are not equally fit for the development of life, for in all the zones he found areas less peopled than others, these barren areas being mostly formed of sand, and inhabited only by creatures whose remains were not likely to be met with in a fossil condition. Thus might be explained the rarity of fossils in certain sandy beds. On the other hand, beds or banks of marine animals are of definite thickness, each species being best developed at a certain depth. A species may die out through the accumulations produced by its own organic remains reaching a height at which the animal cannot exist; other species may then come and settle on the top, but were the bottom of the sea to sink the first species might return, and in the space intervening between such *dying out and return* sand and ooze might have been deposited. This might explain, in certain cases, the alternation of layers with and without fossils, and these facts show how a change in the level may exert a great influence on the structure of the layers.

The general conclusion arrived at by Forbes, and shared by Lovén, may be expressed thus:—The greater the number of bathymetrical zones in which a species exists in the same region, that is, the more frequently it is found at varying depths along the same coast, the wider the area over which it will be found to exist. This proposition was a necessary consequence of the conclusion arrived at in 1842 by de Verneuil and d'Archiac from their study of transition beds; they say—"If we consider the development of organisms in those ancient periods, horizontally, geographically, or in space, it will be seen that those species found at a great many spots and in countries lying far apart, are almost invariably those which lived during the formation of several successive systems."<sup>1</sup> This quotation shows that the mode of distribution of marine Mollusca, both vertically and horizontally, had been recognised from the study of the fossil fauna of the globe.

FORBES AND  
LOVÉN ON BATHY-  
METRICAL DIS-  
TRIBUTION.

In 1846 Forbes published an important work on the connections between the present flora and fauna of the British Isles, and the changes which have modified the extent of ground occupied by them in former times, particularly during the glacial period.<sup>2</sup> These labours had considerable influence on geological studies. The facts as then understood indicated that the greater number of marine animals, especially Polyps, Echinoderms, and Mollusca, live or are best developed at a certain depth, and led to the following conclusions:—Supposing a marine basin on which sedimentary layers are deposited; in the centre the layers are perhaps thousands of feet below the surface, while near the shore, the bottom gradually rising, the layers will be found nearer and nearer the surface. Under these circumstances it was thought impossible that the same species of animals should be found in equal numbers over the whole extent of the layers; it was naturally supposed that animal life would disappear in the layers formed in the centre of the basin, or that different

<sup>1</sup> *Bull. Soc. géol. France*, sér. i. tom. xiii. p. 260, 1842.

<sup>2</sup> *Mem. Geol. Survey*, vol. i. p. 336, 1846.