

generalization," adding, "the Silurian system, therefore, may be regarded as representing a long early period, in which no vertebrated animals had been called into existence."

It is certainly a fact well worthy of our attention, that as yet no remains of fish are on record as coming from any stratum older than the base of the "Upper Ludlow." (See above, p. 432.) When we reflect on the number of Mollusks, Echinoderms, Corals, Trilobites, and other fossils already obtained from Silurian strata below "the Ludlow," we may well ask, whether any other set of fossiliferous formations were ever studied with equal diligence and over so vast an area without yielding some ichthyolites.

Nevertheless, we must be permitted to hesitate before we accept, even on such evidence, so sweeping a conclusion, as that the globe, for ages after it was habitable by all the great classes of invertebrata, remained wholly untenanted by vertebrate animals. In the first place, we must remember that we have detected no insects, or land-shells, or freshwater pulmoniferous mollusks, or terrestrial crustaceans, or plants (except furoids), in rocks below the Upper Silurian. Their absence may admit of explanation, by supposing all the deposits of that era hitherto examined to have been formed in seas far from land or beyond the influence of rivers. Here and there indeed a shallow-water, or even a littoral deposit may have been met with, as in North Wales, for example, and North America; but, speaking generally, the Silurian deposits, as at present known, have certainly a more pelagic character than any other equally important formations.

It is a curious fact, and not perhaps a mere fortuitous coincidence, that the only stratum which has yielded the remains of land-plants is also the only one which has afforded the bones of fish. Bone-beds in general, such as that of the Lias near Bristol, those of the Trias near Stuttgart, of the Carboniferous Limestone near Bristol and Armagh, and lastly that of the "Upper Ludlow," are remarkable for containing teeth and bones, much rolled and implying transportation from a distance. The association of the spores of Lycopodiaceæ (see p. 432) with the Ludlow fish-bones shows that plants had been washed from some dry land, then existing, and had been drifted into a common submarine receptacle with the bones. More usually, however, the "Upper Ludlow," like the "Lower Silurian," is devoid of plants and equally destitute of ichthyolites.

It has been suggested that Cephalopoda were so abundant in the Silurian period that they may have discharged the functions of fish; to which we may reply that both classes coexisted in the Upper Silurian period, and both of them swarmed together in the Carboniferous and Liassic Seas, as they do now in certain parts of the ocean. We may also suggest that we are too imperfectly acquainted with the distribution of scattered bones and teeth, or the skeletons of dead fish on the floor of the existing ocean, to have a right to theorize with confidence on the absence of such relics over wide spaces at former eras.