

The animals generally of the ocean are little liable to extermination from changes of climate over the land; and hence *some* marine invertebrate species of the early Tertiary, *many* of the later, and *all* of the Quaternary, have continued on until now, while, as regards terrestrial animal life, there were in this interval many successive faunas.

*The lowest species of life are the best rock-makers;* namely, Corals, Crinoids, Rhizopods, Diatoms, Millepores, Bryozoans, Brachiopods, Mollusks; for the reason that the structures of only the simplest kinds can consist mostly of stone and still perform all their functions. Multiplication of bulk for bulk is more rapid with the minute and simple species than with the higher kinds; for all animals grow principally by the multiplication of cells; and when single cells or minute groups of them, as in the Rhizopods, are independent animals, the increase may still be the same in rate per cubic foot, or even much more rapid, on account of the simplicity of structure.

While, therefore, we may conclude that we have, in known fossils, a fair though incomplete representation of the *marine* life of the globe, we know very little of its *terrestrial* life,—enough to assure us of its general course of progress, but not enough for any estimate of the number of living species over the land; or for safe deductions as to lines of succession.

Geology may have within reach of study fossils representing a twentieth of its marine life; but it has not more than a thousandth of its terrestrial life.

*Some examples of marine accumulation.* — (1) Beds of oysters, along with other living species, exist in the shallow seas, as off the coast of North America, but in waters too deep for disturbance by the waves. Sands or earth encroach upon them through the marine currents, but not to the destruction of the species. Afterward, through some geological change, beds of detritus are washed over them, exterminating the oysters and perhaps other species also. This is one case; and in it the fossils are unbroken. (2) In another place, the relics of the life of the coast, the shells, Corals, Crustaceans, etc., live so near the sea level as to be within reach of the waves, and hence they may be dislodged at times of heavy storms, and may become ground into fragments and sand; or they may be contributed to under-water banks, and some of the shells may be scarcely worn, and therefore good fossils. (3) In another case, the worn fragments, coarse and fine, may be washed up a beach and ground fine or coarse by wave action. (4) Again, the species may live over seashore flats which are so shallow that the triturating waves act gently, and all relics thereby become ground to mud, and not one is left to make a distinguishable fossil. (5) Again, where barriers off a seacoast exclude the salt water with its marine life, not a sea-relic of any kind may be put into the accumulating seashore beds until some change of conditions removes the barrier.

### 3. Methods of Fossilization.

In the simplest kind of fossilization there is merely a burial of the relic in earth or accumulating detritus, where it undergoes no change. Examples