

be sure to form in favorable places. On the emergence, these deposits remain to mark progress. Beach-like deposits are readily made by rivers and on lake-shores.

### WORK IN THE OCEAN'S ABYSSAL DEPTHS.

The bottom of the ocean, down to about 15,000 feet, has its abundant life, and besides is ever receiving relics in great profusion from the pelagic life of the waters, and thus it may over large portions be making limestones and flint-beds; but it is poor in other geological work. It feels the movement of the tidal wave, and also that of the polar flow toward the equator, each under the ocean's heavy pressure. But these are infinitesimal sources of force, and have, therefore, no sensible, mechanical effects, either in the way of transportation or abrasion. The near convergence of ridges that could bring the waters passing between them into a working condition does not exist.

There are hence no means of producing a stratified or bedded structure in the abyssal deposits, excepting earthquake vibrations, the results of which would be local, and variations, with the passing ages, in the pelagic or abyssal life of the waters, causing variations in the showers of Diatoms or of shells of Rhizopods, or in the growth of Sponges and other species over the bottom. The wide-spread contributions of volcanic ashes from volcanoes, especially the oceanic, drop to the bottom and rest there, undergoing only such chemical changes as may go on at the temperature.

Tidal or current scour is limited to relatively shallow depths or unusual conditions. Mellard Reade mentions cases of probable tidal scour at bottom in channels between islands on the coast of Scotland. But the depths do not exceed 800 feet. He also reports (1885) that, according to Sir James Anderson, the undercurrent out of the Mediterranean near Gibraltar moves the water to its bottom, and that at 500 fathoms the wire of the electric cable was ground like the edge of a razor, so that they had to abandon it and lay a new cable well inshore. This is confirmed by Captain Nares, who reports that he could get no specimen of the bottom probably because of a "perfect swirl at that depth."

The great oceanic currents carry on little transportation and corrosion of detritus, on account of their distance from the land. The Labrador current, with its westward tendency (page 46), acting against the submerged border of the continent, may have produced some results in past time, if not doing so now. But its chief geological work has been the transportation of icebergs, and that has not yet ceased. It has been supposed that the course of the steep outer slope of the submerged Atlantic border has been determined by the oceanic currents; but it is far more probable that the position of the slope has directed the courses of the currents. The Gulf Stream along the Florida Straits and toward Cape Hatteras has a velocity sufficient for abrading action; but the stream does not carry its surface velocity to the bottom,