

§ iv. **Uses of Fossils in Geology.**—Apart from their profound interest as records of the progress of organized being upon the earth, fossils serve two main purposes in geological research: (1) to throw light upon former conditions of physical geography, such as the presence of land, rivers, lakes, and seas, in places where they do not now exist, upon changes of climate, and upon the former distribution of plants and animals; and (2) to furnish a guide in geological chronology whereby rocks may be classified according to relative date, and the facts of geological history may be arranged and interpreted as a connected record of the earth's progress.

1. **Changes in Physical Geography.**—A few examples will suffice to show the manifold assistance which fossils furnish to the geologist in the elucidation of ancient geography.

(a) **Former land-surfaces** are revealed by the presence of tree-stumps in their positions of growth, with their roots branching freely in the underlying stratum, which, representing the ancient soil, often contains leaves, fruits, and other sylvan remains, together with traces of the bones of land animals, remains of insects, land-shells, etc. Ancient woodland surfaces of this kind, found between tide-marks, and even below low-water line, round different parts of the British coast, unequivocally prove a subsidence of the land ("Submerged Forests," p. 489). Of more ancient date are the "dirt-beds" of Portland (Book VI. Part III. Section ii. § 2), which, by their layers of soil and tree-stumps, show that woodlands of cycads sprang up over an upraised sea-bottom and were buried beneath the silt of a river or lake. Still further back in geological history come the coal-growths of the Carboniferous period, which, with their "under-clays" or soils, point to wide jungles of terrestrial or aquatic plants, like the modern mangrove-swamps that were successively submerged and covered with sand or silt (Book VI. Part II. Sect. iv. § 1).

(b) **The former existence of lakes** can be satisfactorily