

with variations in the earth's rotatory force, and consequently in the length of day and night, or with any incongruity between the earth's centre of gravity and the centre of form.

Professor Penck agrees with Suess in the leading principle that secular variations are due, not to crust-movements, but to fluctuations of sea-level. He doubts, however, the possibility of the equilibrium between land and water being disturbed by general variations of the earth's gravity. He traces all changes of level in maritime tracts of land to local re-distribution of rock-material and consequent local alteration in the attractive force exerted by the land upon the water-surface. Re-distribution may be produced by crust-folding, by the denudation of adjoining continental areas by the sedimentation of organic and inorganic deposits on the sea-floor, and most of all, in Professor Penck's opinion, by the piling-up of colossal masses of ice in particular regions. The American geologist, Mr. Upham, has arrived, on independent grounds, at similar conceptions of variation in the sea-level, although he at the same time believes in the actual upheaval of land areas.

The whole question is again discussed by Suess in the second volume of his work, *Das Antlitz der Erde*. This volume describes and compares the coast-line of the Atlantic and Pacific Oceans, passes in review the distribution of the oceans in all past geological epochs, and gives a complete account of all relative changes of level between land and water within historic time. The many sources of error and the insufficiency of data are noted; and the several causes which might have influenced the surface of the ocean are carefully elucidated. Professor Suess adheres firmly to his view that secular movements of elevation of land have been without significance in determining the grander forms of the earth's surface, and take place at the present day very exceptionally, and only as local phenomena. He depicts a shrinking crust or lithosphere, which as it contracts carries with it the immense body of water on its surface. According to Suess, episodal crust-subsidences have determined the form and position of the ocean-basins at different epochs of the earth's history, and have been accompanied by the corresponding widely-extended negative movements of the ocean. The existing oceans represent areas whose subsidence may have occurred in various ages, and whose boundaries are marked by lines of crust-fracture. Bearing in view the vast extent and the uniformity of those