

water-action, if of sedimentary origin. The shallow-water origin of beds is so generally true that thick formations in almost all cases are proof that a slow subsidence, equal in amount to the thickness, was going on over the area during the deposition; and also that without such a subsidence the making of thick strata or formations has rarely taken place.

Such evidences of actual change of level are good, and have profound significance. Geology has thus proved that:—

1. Unequal changes have been in progress simultaneously in different parts of the same continent.

2. The changes in level have usually gone forward with extreme slowness—by the few inches or feet a century, though sometimes also by abrupt displacements. The former are termed *secular* changes, the latter *paroxysmal*.

Another class of facts is represented by the following from Illinois:—

A section of the coal formation of Illinois, described by Worthen, contains 16 coal-beds, large and small, *separated by* fragmental beds and limestones containing *abundant remains of marine life*. The coal-beds indicate eras of *emerged* land, the marine fossils, intervening eras of *submergence*, and their number shows that at least sixteen alternations between the two conditions there took place in the Carboniferous period. Facts make it certain that the great Interior Sea of the continent communicated at that time freely with the ocean to the south. The same region thus went up and down, changing the dry land outline and the sea depths; and the changes went on with extreme slowness, for coal-beds, as well as the much thicker marine beds, were slow in accumulation. Facts of similar import are afforded by all the successive formations, from the Cambrian upward, and alike on all the continents. In explanation of such changes it may be questioned whether subsidences over the sea-bottom may not have produced some or all of these oscillations in level. As far as evidence can be obtained, the changes were independent of movements in the ocean; for the coal-beds of Illinois and those of Ohio and Pennsylvania do not show that uniformity of parallelism which this hypothesis requires.

Further: *changes of level are now in progress*, both of the slow *secular* kind and of the sudden or *paroxysmal*. The following sketch represents a case in which a Roman temple has passed through a time of partial submergence below the level of the Mediterranean. The temple is that of Jupiter Serapis at Pozzuoli. It was originally 134 feet long by 115 wide; and the roof was supported by 46 columns, each 42 feet high, and five feet in diameter. Three of the columns are now standing, and they bear evidence of submergence for a considerable time to half their height. The lower twelve feet are smooth; for nine feet above this, they are penetrated by lithodorous or stone-boring shells, remains of which (a species now living in the Mediterranean) were found in the holes. The columns, when submerged, were consequently buried in the mud of the bottom for 12 feet, and were then surrounded by water nine feet deep. The pavement of the temple is now under water. Five feet below