

it is only a century since measurements of height have been taken in sufficient number and with sufficient accuracy to afford secure data for comparison. For geological processes a hundred years is a period of as small significance as a single second in the history of mankind.

It is easier to determine variations of level at sea-coasts, but even there it is often doubtful whether a change of relative level is due to displacements of the land or of the ocean; and the observer has to be careful not to mistake for secular movements any of the effects of sedimentation in heightening the land, or of marine erosion and subaerial denudation in breaking down the coast. The occurrence of submerged forests and beds of peat, old roads and other human structures on the sea-floor are among the more secure evidences of a depression of the land or uprise of the water. On the other hand, remains of harbour and pier constructions, and fragments of vessels found at a height above the existing sea-level, or at some distance inland, give evidence of a secular movement of land-elevation or retreat of the sea within historic ages. Former coast-lines and terraces can sometimes be identified many hundred feet above the present surface of the ocean. The exposure of delta deposits is usually regarded as a sign of land elevation, whereas long narrow fiords occurring as the continuation of river-valleys towards the sea, are regarded as proofs that a coast is undergoing subsidence.

The oldest direct observations on relative changes of level were made in Scandinavia. Hjärne observed in 1702 that the Swedish coasts were frequently extended in consequence of a retreat of the sea, and Celsius and Linnæus afterwards made investigations on the rate of retreat by means of boundaries and marks on the rocks at Gefle and Kalmar. Celsius in 1743 read his memorable paper at the Swedish Academy of Science, in which he argued that the volume of water in the ocean was diminishing. He calculated the sinking of the ocean surface-level at forty-five inches in a century. Linnæus supported the views of Celsius, but Bishop Browallius (1756), E. D. Runeberg, and the Danish scientist, Jessen (1763), opposed them. E. D. Runeberg argued that the changes on the Swedish coast were due to elevation of the land in consequence of earthquakes.

The Scottish mathematician, Professor Playfair, in 1802