

and other places show that from atmospheric disturbances the level of the sea may be lowered as much as 1 foot 8 inches.²⁴⁹

In a wide deep ocean, tidal elevation probably produces no perceptible geological change. It passes at a great speed; in the Atlantic, its rate is 500 geographical miles an hour. But as this is merely the passing of an oscillation whereby the particles of water are gently raised up and let down again, there can hardly be any appreciable effect upon the deep ocean-bottom. When, however, the tidal wave enters a narrow and shallow sea, it has to accommodate itself to a smaller channel, and encounters more and more the friction of the bottom. Hence, while its rate of motion is dimin-



Fig. 161.—Section of a Beach defined by High- and Low-water Mark.

ished, its height and force are increased. It is in shallow water, and along the shores of the land, that the tides acquire their main geological importance. They there show themselves in an alternate advance upon and retreat from the coast. Their upper limit has received the name of *high-water mark*, their lower that of *low-water mark*, the littoral space between being termed the *beach* (Fig. 161). If the coast is precipitous, a beach can only occur in shelving bays and creeks, since elsewhere the tides will rise and fall against a face of rock, as they do on the piers of a port.

²⁴⁹ Haschert, *Deutsche Rundschau für Geographie*, July, 1887. *Bull. Amer. Geograph. Soc.* xix. 1887, p. 314. J. de Pulligny, *Assoc. Franç.* 1891, ii. p. 287.