

and in exposed places up to 100 feet or more above high-water mark, lies the zone within which the sea does its work of abrasion. To this zone, even where the breakers are heaviest, a greater extreme vertical range can hardly be assigned than 300 feet, and in most cases it probably falls far short of that extent.

The mechanical work of erosion by the sea is done in six ways.

(i.) The enormous force of the breakers suffices to tear off fragments of the solid rocks.

Abundant examples are furnished by the precipitous shores of Caithness, and of the Orkney and Shetland Islands. It sometimes happens that demonstration of the height to which the effective force of breakers may reach is furnished at lighthouses built on exposed parts of the coast. Thus, at Unst, the most northerly point of Shetland, walls were overthrown and a door was broken open at a height of 196 feet above the sea. At the Bishop Rock lighthouse, on the west of England, a bell weighing 3 cwt. was wrenched off at a level of 100 feet above high-water mark.²⁷⁰ Some of the most remarkable instances of the power of breakers have been observed by Mr. Stevenson among the islands of the Shetland group. On the Bound Skerry he found that blocks of rock, up to 9½ tons in weight, had been washed together at a height of nearly 60 feet above the sea; that blocks weighing from 6 to 13½ tons had been actually quarried out of their original bed, at a height of from 70 to 75 feet; and that a block of nearly 8 tons had been driven before the waves, at the level of 20 feet above the sea, over very rough ground, to a distance of 73 feet. He likewise records the moving of a 50-ton block by the waves at Barrahead, in the Hebrides.²⁷¹ At Plymouth, also, blocks of several tons in weight have been known to be washed about the breakwater like pebbles.²⁷²

²⁷⁰ T. Stevenson, *op. cit.* p. 31. D. A. Stevenson, *Min. Proc. Inst. Civ. Engin.* xlvi. 1876, p. 7.

²⁷¹ T. Stevenson, *op. cit.* pp. 21-37.

²⁷² The student will bear in mind that the relative weight of bodies is greatly