vances, and rises in consequence of the diminishing depth. At the breaking, or the collapse, of the wave, the waters are thrown forward, and dash, for the most part, up the shore, while the trough part of the wave flows off as the "undertow," followed down the beach by the returning water of the collapsed wave.

Some features of the movement are well illustrated in Hawaiian surf-riding. The Hawaiian, swimming out with his plank, plunges beneath the first billow and rises beyond it; then dives beneath another, and another, until he has passed one of the great billows. This he mounts, and, if rightly placed on it, rides to the beach with great speed. Should his plank not keep the right angle on the crest of the billow, the surf of the following wave will overtake him; but this he would avoid by diving beneath it and swimming out farther for a fresh start.

The work done by the wave-and-current agency includes abrasion of the most violent kind, as well as the gentlest, and transportation and deposition as extensive as coast lines and shallow sea-borders or seas. It is the agency that preserves to the continents the detritus of the discharging rivers, inasmuch as waves work landward; yet it has aid in this in the fact that sediment drops in salt water in one fifteenth of the time required in fresh. On the borders of the Gulf of Mexico, according to A. Agassiz, river sediments do not extend out beyond the 100-fathom line, for at this depth there is always the usual sea-bottom life. Along the Atlantic border there are sediments in deeper water, but this is because icebergs or icefloes have dropped there loads of gravel and sand. This agency also makes impossible the transportation of material from one continental land to another. If the fabled Atlantis were at the surface over the Dolphin shoal (page 19), the waves and currents would work about it and for it, and allow of no contributions to any outside land, and least of all to America — the continent supposed to have needed help.

2. *Work of denudation.* — The waves bring to bear the violence of a cataract upon whatever is within their reach, — a cataract that girts all the continents and oceanic islands. In stormy seas, they have the force of a Niagara, but with far greater effects; for Niagara falls into a watery abyss, while, in the case of the waves, the rocks are made bare anew for each successive plunge. They work by impact, and with enormous force. They have also great abrading power added to impact, through the load of debris they take up and transport. Stevenson, in his experiments at Skerryvore (west of Scotland), found the average force of the waves for the five summer months to be 611 pounds per square foot, and for the six winter months, 2086 pounds. He mentions that the Bell Rock Lighthouse, 112 feet high, is sometimes buried in spray from ground-swells when there is no wind, and that on November 20, 1827, the spray was thrown to a height of 117 feet, — equivalent to a pressure of nearly three tons per square foot. During a westerly gale in March, 1845, his dynamometer registered a pressure of 6083 pounds per square foot, which gives for the velocity per second, by the formula, $\sqrt{\frac{Pg}{64}}$ (P being