

meantime we must all hold tightly to the facts and loosely to the theories. The learner must here content himself with the uncertainty acknowledged by his masters.

XVIII. THE UNSTABLE LAND.

PHENOMENA AND CAUSES OF EARTHQUAKES.

WHEN men feel the earth beneath their feet growing unstable, the most paralyzing sense of insecurity seizes them. The ground supports every thing; to the ground man intrusts his most elaborate and substantial structures, and when it fails him the dismay is complete. Yet the solid earth has not only been shaken by throes which have engulfed cities and populations and mountains, but there is scarcely a moment when its movements or its tremblings may not be felt by the delicate means of research employed by modern science. The stability of the solid earth is instability itself.

The destructive shock lasts but a few minutes, or even seconds. The successive vibrations which devastated Calabria in 1783 were felt during barely two minutes. On the occasion of the destruction of the city of Lisbon, in 1755 and the loss of 60,000 lives, it was the first shock, lasting five or six seconds, which caused the greatest damage. As to extent of damage, Sicily, in 1693, and Calabria, in 1783, have been among the greatest sufferers. Each, according to best estimates, lost a hundred thousand lives. In Syria, Japan, and the Sunda Archipelago, earthquakes are reported to have been attended by still greater fatalities. In the year 526, more than 200,000 people met with death at Antioch and the adjacent towns. The volcanic eruption of Kra-kat'o-a, in August, 1883, was attended by a sea-wave and earthquake which, according to reports, caused the death of twenty thousand persons.

The motions which constitute an earthquake are various. Sometimes they are vertical, either slow or rapid. More generally they are horizontal. In such case, they consist mostly