not often affect the island of Oahu, a depth of 500 fathoms of water, the least depth between the two islands, being sufficient to stop off the vibrations. Milne states that Japan, a country noted for volcanoes, averages, some years, an earthquake a day; and that in two years, in north Japan, 154 out of 387 shook an area of less than 50 miles, and a few of the larger shocks, an area of about 150 miles.

Earthquakes of the second mode of origin may occur in all regions, volcanic or not. They have their origin mostly in the vicinity of mountain regions where old fractures most abound. The vibrations may be begun in a slip of a few inches, or feet, but when there has been a succession of slips, up and up for 10,000 feet and more, as in the faults of the Appalachians, earthquakes of inconceivable violence must have resulted.

Earthquake vibrations have been supposed to be due to wave-like movements in the interior liquid mass of the globe, and Professor A. Perrey of Dijon concluded that the greatest number of earthquakes occurred at the season of the syzygies in each lunar month, synchronous with the tides in the ocean. But if the earth is solid throughout, the facts have another explanation.

The observations of Professor W. H. Niles on the gneiss of a quarry at Monson, Mass., show that even the solid rocks are in some places under a strain; for he states that bendings, sudden fractures, and expansions of the rock often take place; masses, before their ends are detached, become bent upward at middle; and one mass, 354 feet long, 11 wide, and 3 thick, was an inch and a half longer after it was detached than before, showing a strain which was greatest in a direction from north to south — an effect due to compression by the pressure the rocks had been subjected to, and a consequent expansion in a transverse direction. All are familiar with the crackling sounds occurring at intervals in a board floor of a house, arising from change of temperature, especially in winter in a room that is heated only during the day; and with the more common sounds of similar character from the jointed metallic pipe of a stove or furnace, given out after a fire is first made, or during its decline. In each case, there is pressure or tension, accumulating for a while from contraction or expansion, which relieves itself, finally, by a movement or slip at some point, though too slight a one to be perceived; and the action and effects are quite analogous to those connected with the lighter kind of earthquakes.

The earthquake of Lisbon, in 1755, which threw down the greater part of the city, and in six minutes caused the death of 60,000 persons, disturbed an immense area, it being felt at Algiers and Fez as severely as in Spain and Portugal, in the Alps, Great Britain, on the Baltic, and in northern Germany. The effects from sea-waves were of wide extent, but such waves may be propagated across an ocean from the vibrations of a coast region.

An earthquake on the 4th of January, 1843, reported upon by Professor H. D. Rogers (1843), "was felt from the seacoast of Georgia and South Carolina to and beyond the western frontier military posts, and from the latitude of Natchez to that of Iowa, a distance in each direction of about 800 miles; and there are reasons," Professor Rogers adds, "for believing that its actual extent was much greater. Its course was from N.N.W. to S.S.E., and its rate of progress about 2800 to 3000 feet a second, and equable in rate.

The Charleston (S.C.) earthquake of August 31, 1886, which threw down many buildings in the city, was felt from the Carolina coast, Georgia, and central Florida, northward to southern New England, and across New York to Ontario in Canada, and westward to eastern Louisiana, Arkansas, Missouri, and Iowa, an area 800 miles wide by 1000 miles from north to south. Its course was the reverse of that of 1843. It was scarcely appreciable in sea disturbance.