Volcanoes stand on lines of fractures in the opening of which their existence began; and subsequently, through geological time, slips up or down may have occurred along such fractures in the earth's uneasy crust, independent of local action, producing earthquakes, and, perhaps, also initiating eruptions. The Mediterranean area is one of the earth's fire regions, from its eastern to its western limit, and its borders are noted for the relative frequency of earthquakes; and these earthquakes, in the majority of cases, are independent of action in the volcanoes of the era. This is true also, according to Milne, of the greater earthquakes of Japan.

The New Zealand Tarawera eruption of 1883, which blew out with explosive violence for a day or two, was followed, three days after it had subsided, by an outbreak in White Island, an active volcano in the Bay of Plenty, and, two months later, by a violent eruption on the island of Ninafou in the Tonga group. The three volcanic regions are on the same island line of the ocean, the northeast or New Zealand line, which is one of the most marked in the Pacific. It may be that this succession of disturbances was due to a slight movement from north to south along the old fracture-plane, through the opening of which the range of islands began its existence.

The central region of an earthquake vibration, which may have considerable breadth or length, or have the course of a long fissure, is called the *epicentrum*. The rock-waves move off from it in all directions, but often most forcibly *in one*. The waves are: (1) *waves of compression*, or condensation, in which the vibrations are *normal* to the origin, or in the direction of the movement of the wave; and (2) waves of distortion, or *transverse* waves. The sounds of earthquakes are attributed by Milne to preliminary tremors preceding the principal shock, which have the more rapid movement required to produce sound.

The amplitude of the wave varies from less than a millimeter to possibly a foot. But destructiveness depends more on rate of vibration than on amplitude. Milne observes that the greater the initial impulse, the greater the speed of propagation; and, as the propagation widens radiately, the velocity of propagation decreases, the period usually becoming larger.

C. Davison (1891) traces several earthquakes of Great Britain to slips along faults. He observes that from the central portions of the slip-area will come, as a rule, the vibrations of largest amplitude and longest period, and from its margin, and especially toward the surface, minute vibrations of a period so short that they may be perceptible only as sound. He thus explains the fact "that the sound-area is not concentric with the disturbed area, and the sound-focus is nearer the surface than the rest of the seismic focus"; and also, "the fact that, in great earthquakes, the sounds are heard only within a comparatively small area immediately around the epicentrum." Liability to slips, and therefore to earthquakes, diminishes with the progress of time.

Kinds of rocks have great effect on the propagation. Milne obtained in Japan, for velocities of propagation, from 200 feet per second to 630 feet; Mallet obtained, for sand, a rate of 825 feet, and for granite, of 1665 feet; Newcomb and Dutton, in the Charleston earthquake, made out a rate of 17,000 feet per second, without any indications of variation in the speed; H. L. Abbott in his observations on explosions at Hallet's Point in 1876,