Note on the Eruption of the Unsen-dake in the 4th year of Kansei (1792).

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The eruptions in the 4th year of Kansei (1792) of the Unsen-dake which stands on the peninsula of Shimabara, in the province of Hizen (Kyushu) extended over a period of nearly 4 months. They were preceded, for several weeks, by a number of small shocks, which caused some landslips from mountain slopes; the first eruption having taken place on Feb. 10, 1792, at midnight, near the top of the Fuken-san (1478 m above the sea level), one of the highest peaks of the vicinity of the Tomaes Bay, the greatest amount of disturbance having occurred there.

The greatest vertical dislocation of 18 feet occurred in the Mino-Owari earthquake, while the greatest horizontal shear occurred in the San Francisco earthquake. The latter has shown a vertical displacement of only 1 or 2 feet, while the former was accompanied by a large horizontal shear of about 18 feet. In the Formosa earthquake, whose magnitude was much smaller than the other two, the vertical and the horizontal displacements of the ground were each of a moderate scale, the maximum amounts being 6 and 8 feet respectively.

The maximum vibratory motion in the Mino-Owari earthquake showed a tendency of being directed from the central point towards each end; while, in the two other earthquakes, the same motion was, as far as can be ascertained, directed from one end towards the centre.

Again, the direction of the maximum (vibratory) motion was, in the Formosa earthquake, the same as that of the shear of the depressed ground. In the two other earthquakes, however, the reverse was the case. These differences are probably due to the diversity in the manner of action of the force along the fault plane which finally produced the dislocations.
mountain. Subsequently there were several eruptions from different neighbouring places, attended by numerous detonations and earthquake shocks. Of the latter, those on April 21st and 22nd (March 1st and 2nd, Lunar Calendar) were the strongest, causing in the town of Shimabara some damage to buildings and cracks of the ground about 1 inch in width. The final catastrophe occurred at about 6 o'clock in the evening of May 21st, (April 1st, Lunar Calendar), when two violent earthquake shocks took place, and the entire southern slope of the Mae-yama (876 m above sea level), which is opposite the town of Shimabara, slid down, producing an immense avalanche of rocks and earth. The latter quickly descended into the sea, of Ariake, which separates the Peninsula from the province of Higo, causing a considerable change in the topography of the harbour. Amongst others, three small islands were wiped out of existence, and several dozen others newly created. Simultaneously with the landslip, great sea waves were formed, which rolled in along the shore and attained at some places a height of 20 to 30 feet, causing devastations among 17 villages along the eastern coast of the peninsula for a distance of 77 km. The number of the casualties on this side of the Ariaké sea amounted to 9745 persons killed and 707 persons wounded, besides 496 cattle and horses. The sea waves produced also a considerable amount of damage on the eastern shores of the Ariaké sea, namely, in the counties of Akita, Udo, and Tamana, of the province of Higo, where the total number of persons killed amounted to 5,100. Along the coasts of the Amakusa Islands, 343 people were drowned. Earthquake shocks continued to happen for the next two months.

The local earthquakes which accompanied or preceded the eruptions of the Unsen-daké were not very destructive, but much severer than is usually the case with volcanic explosions. In these latter cases, as with the recent outbursts of Japanese volcanoes, namely, Bandai-san (1888), Azuma-san (1893), Adataro-san (1900), and Torishima (1902), the phenomenon is purely that of a steam explosion, and the volcanic force is mainly spent in blowing and projecting mountain masses, only a small amount of the energy being transformed into earthquake vibrations. On the other hand, in eruptions like those of the Unsen-daké, which were attended by no gigantic explosion, the subterranean volcanic energy would be in a great measure spent in causing mechanical vibrations, resulting in comparatively severe earthquake shocks.

The cause of the great Shimabara sea waves seems to have been
the disturbances of the waters by the enormous quantity of rock and earth masses thrown into the latter. Thus the volume of the debris was roughly 0.55 cubic Km, or equivalent to an area of 550 square Km, with a thickness of 1 metre. Such an area is nearly equal to that of the Ariake sea, which is an inland body of water included between the two provinces of Hizen and Higo, and the volume of the debris thrown suddenly into the sea seems to be sufficient to produce an initial displacement of the surrounding water masses, the disturbances thereby created being propagated to the different parts of the shores, where tidal waves were formed.

The great landslips from the Mae-yama was evidently the effect of the local but violent earthquake shocks.

Instances exactly similar to the Unsen-dake eruptions are not rare. Thus, the eruptions in 1868 of Mauna Loa, in the Island of Hawaii, began on March 27 of that year. On April 2, there took place a severe earthquake shock, which did some damage to buildings in the vicinity, causing at the same time, a landslip of an enormous quantity of soft clay from the head of a ravine called Kapapala at the south-eastern flank of the mountain. This produced a mud stream, half a mile in width and about 30 ft in depth at the centre, which descended into the sea in the interval of only a few minutes, over a distance of 3 miles. The result was the immediate formation of large sea waves, which rolled in along the shore of Kau district, attaining a height of 40 to 50 feet.

The sea-waves attending the great eruptions of Krakatoa in 1883 were also probably caused in a measure by the ejection of the rock masses into the surrounding sea waters.*

* See the *Kiō Guigō*, Vol. II, No. 29.