Unzen Volcano : the 1900-1992 eruption

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6. The 1990-1992 Eruption of Unzen Volcano

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Introduction

Unzen volcano abruptly initiated eruption after 198 years of dormancy. At first we worried about disaster caused by debris flows and by the recurrence of collapse of Mt. Mayuyama, which had been associated with the 1792 eruption, killing 15,000 people. Though small debris flows occurred in early stages, we had never expected that the volcanic eruption would proceed to cause intermittent pyroclastic flows which resulted in serious disasters.

One and half years have already passed since the beginning of the eruption until now (12 May 1992). During this period, 43 persons were killed and 11,000 persons from 3,000 families in the maximum number were forced to evacuate. About 7,000 persons are still greatly distressed in living under unfavorable conditions.

Historical eruptions

We have records of two historical eruptions, one in 1663 and the other in 1792. In 1663 the Kujukushima crater opened at the top of the Fugendake Cone, and the Furuyake lava flow extruded from the northeastern upper slope of the Fugendake Cone. The volume of the lava flow was about 5 million m^3. In the next year a debris flow occurred in Akamatsu Valley and killed more than 30 persons.

The 1792 eruption started with ash cloud emission from the Jigokuato Crater opened at the top of the Fugendake Cone. It was followed by extrusion of the Shin'yake lava flow from a vent newly opened on the northeastern upper slope of the Fugendake Cone. The lava volume was about 20 million m^3. After a month from the cessation of lava extrusion, a strong earthquake occurred and then Mt. Mayuyama standing behind the Shimabara City collapsed in a great scale. The resultant debris flow ran into the sea crossing the southern part of the city. This resulted in the generation of tsunami which traveled across the Ariake Bay and hit the opposite shore. 15,000 persons were killed. This has been the largest volcanic disaster in Japan.

Volcanic eruption in 1990-1992

The volcanic activity started with an earthquake swarm beneath the Chijiwa Bay at the western foot of Unzen Volcano in November 1989 (Fig. 6-1). Then the hypocenters moved with time towards the east, and in July 1990 an earthquake swarm occurred beneath the Fugendake cone (Fig. 6-2). At the same time volcanic tremors were also recorded. This was followed by a phreatic eruption both from Kujukushima and Jigokuato craters on 17 November 1990, after 198 years of quiescence.

Although the eruptive activity both in the Kujukushuma and Jigokuato craters had sharply declined with time, the eruption again became active by opening the Byobuiwa crater to the southwest of the Jigokuato crater. From 29 March until the beginning of May intermittent eruptions continued simultaneously from three craters, emitting a large amount of ash cloud. On 15 and 19 May debris flows, of which occurrence we had been afraid of, were caused by light rain falls and ran through the Mizunashi River into the sea. Although parts of them overflowed from the upper stream, they caused no serious disaster because of the river improvement along the down

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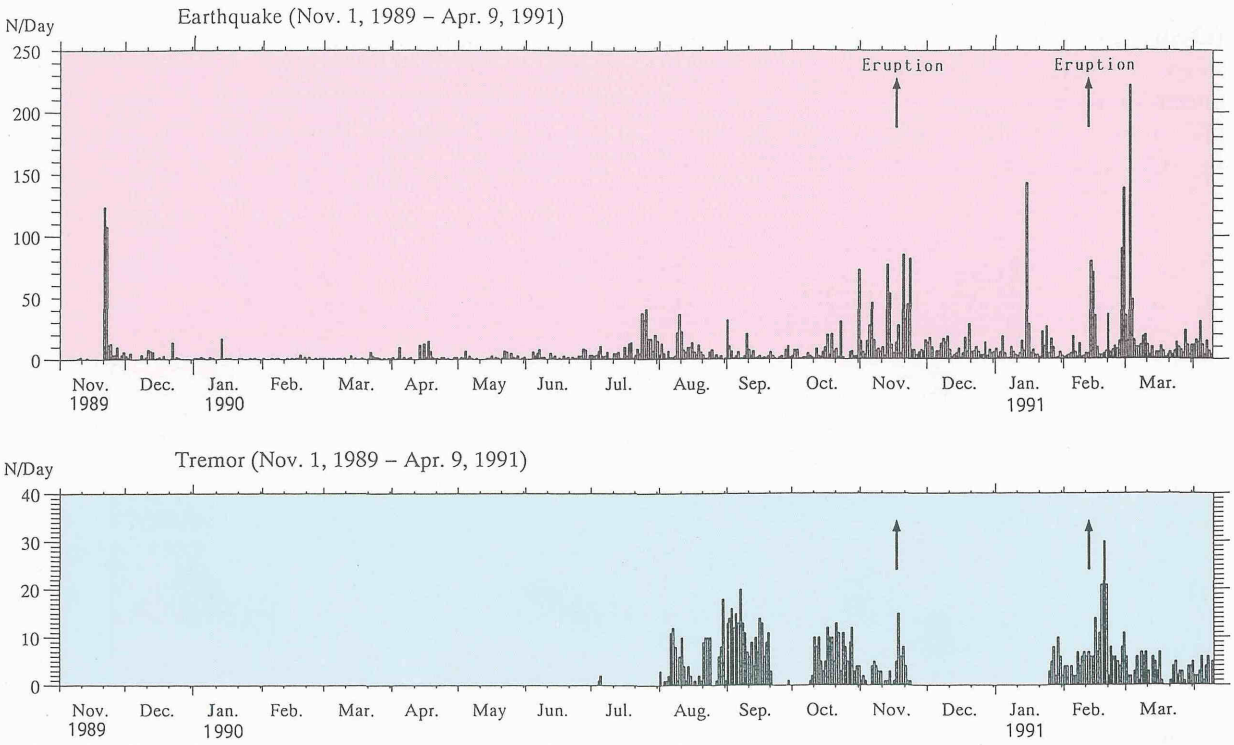

Fig. 6-1. Daily frequency of earthquakes and volcanic tremors from 1 November 1989 to 9 April 1991. The first phreatic eruption took place at the old Jigokuato and Kujukushima craters on 17 November 1990. The second eruption occurred at the newly opened Byobuiwa crater on 12 February 1991.

stream.

From 12 May a number of micro-earthquakes and tremors continued to occur at shallow levels beneath the craters and many cracks in W-E directions were formed around the craters. Then a dacite dome emerged in the Jigokuato crater on 20 May. The lava dome (Dome 1) continued to grow, and then filled up the crater. On 24 May the lava started overflowing and falling down as blocks onto the eastern slope of the Fugendake Cone, resulting in the successive formation of pyroclastic flows. Since the dome continued to grow toward the east and the front of pyroclastic flow reached a distance of about 2.5 km from the crater by 26 May, people living in the Kamikoba village were advised to evacuate. Ash clouds from the pyroclastic flows became high in temperature and trees along the passage were burnt.

On 3 June a landslide collapse of the well-grown lava dome resulted in the formation of a pyroclastic flow which was the greatest in scale among those that had so far occurred. The leading edge of the flow reached a village 3.5 km from the crater, and the ash cloud surge ran more than 4.2 km and reached the Megane bridge. The pyroclastic flow resulted in a terrible disaster. Although the Shimabara City Goverment recommended residents to evacuate in advance, forty persons were killed, three were missing, nine were seriously wounded, and 179 houses were burnt.

On 8 June the flow front of another large-scale pyroclastic flow reached a point close to the Route 57 at a distance of 5.5 km from the crater. The flow burnt 207 houses. No causalities, however, were reported, since the Shimabara City Government set up off-limit quaters and forced the people to evacuate on 7 June.

Since a sliding surface of the collapse cut across the dome right above the vent, pumice eruption was triggered on 8 June. Another eruption on 11 June again resulted in pumice fall, but there was no associated pyroclastic flow event. Pumice blocks of 5 cm across in the maximum size fell around Route 251 at a distance of about 7 km northeast from the crater, breaking front and rear glasses of many cars. A new lava lobe

(Dome 2), which emerged in the horseshoe-shaped crater formed after the dome collapse, continuously grew towards the east and became 600 m in length in two months. During this period, small to medium pyroclastic flows occurred intermittently.

Successive occurrence of pyroclastic flows resulted in much accumulation of volcanic ash around the volcano, and filled up the upper and middle stream of the Mizunashi River with ash

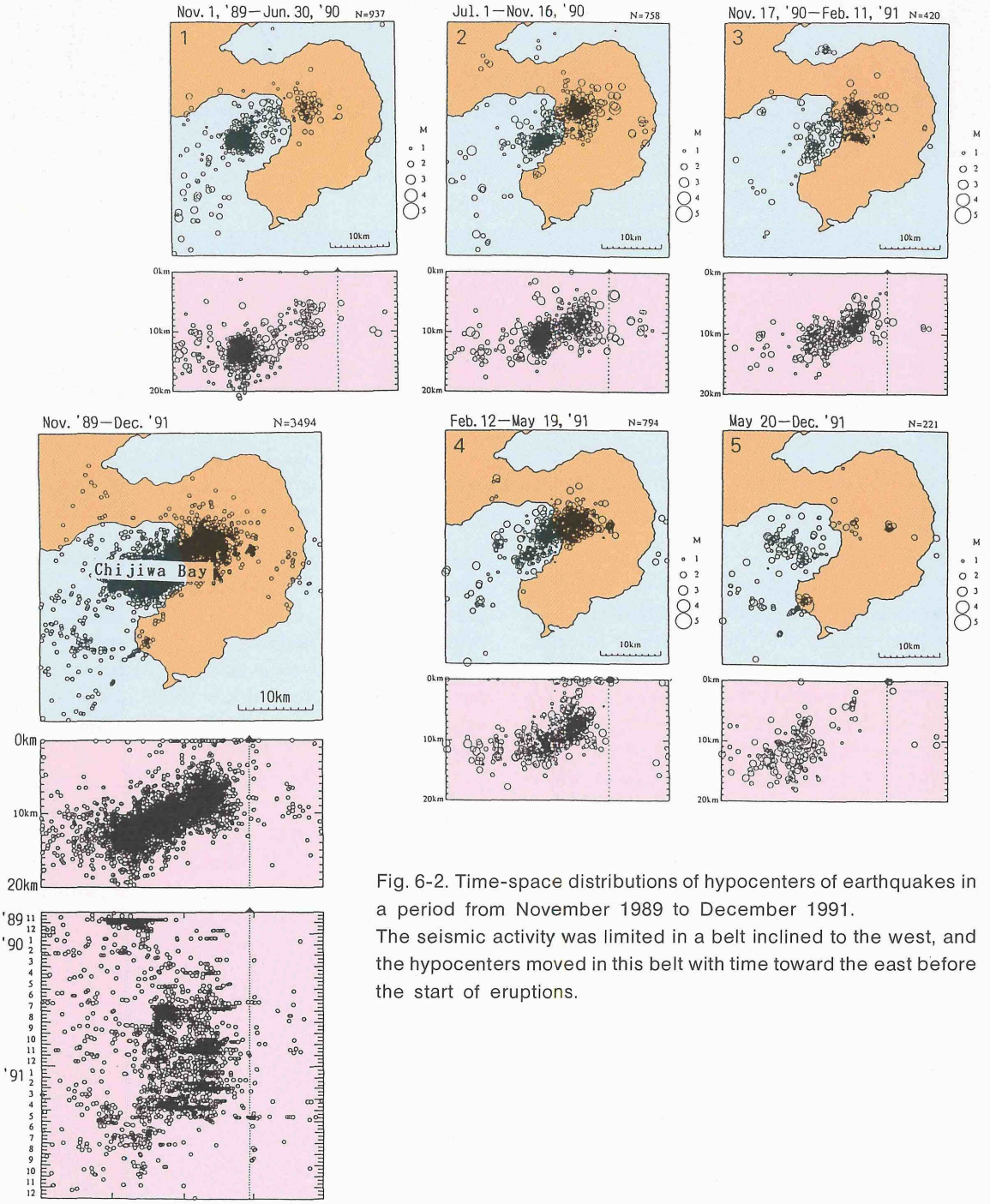

Fig. 6-2. Time-space distributions of hypocenters of earthquakes in a period from November 1989 to December 1991.
The seismic activity was limited in a belt inclined to the west, and the hypocenters moved in this belt with time toward the east before the start of eruptions.

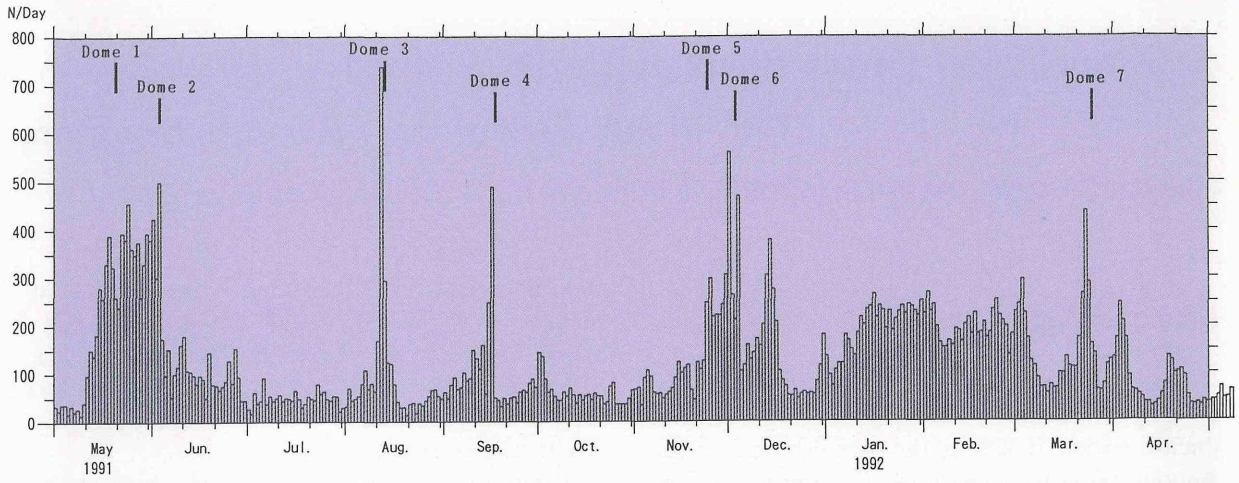

Fig. 6-3. Daily frequency of shocks which include earthquakes, volcanic tremors and others such as those generated by rockfalls and pyroclastic flows. Shocks always increased in daily number before the emergence of a new lava dome.

and lava blocks. The 30 June debris flow flowed down through the southern part of the city into the sea, opening a new wide channel off the midstream of the Mizunashi River. This debris flow destroyed 137 houses along the new channel. No casualties, however, were reported, since the debris flow occurred in the off-limit quarters and the people had already evacuated.

On 14 August a new dome (Dome 3) started growing near the top of the cone. It continuously grew and extended towards east onto the Dome 2. Intermittent collapses of the dome front onto the northeastern slope resulted in the successive formation of pyroclastic flows in the Oshigadani Valley which burnt out trees on the Taruki mound. On 15 September another landslide dome-collapse, the largest among those that had so far occurred, resulted in the formation of a pyrolcastic flow. The main flow dashed along the Oshigadani Valley and then veered left into the Mizunashi River at the Kamikoba village. The leading edge ran about 5.5 km from the crater. Ash cloud surge, however, ran straight forward from a junction of the valley with the river and burnt 193 houses.

A new dome (Dome 4) started growing in the crater which formed after the large-scale collapse of Dome 3, and extended northeastward. At a length of about 500 m, however, a daily rate of the dome growth was declined in the middle of November.

From late November, earthquakes started to occur in swarm. On 24 November the growth of Dome 5 was recorded. Dome 5 extended over Dome 2 toward the south. This resulted in the successive collapses of the southeastern side of the dome. As a result, some of middle-size pyroclastic flows flowed down into the Akamatsu Valley.

On 13 December, a new lava lobe (Dome 6) started growing in a crater formed after a small collapse of the southeastern side of Dome 5. Dome 5 continued to grow and small pyroclastic flows occurred successively on the east and southeastern side of the cone. From February, collapses of the southeastern side of the Dome 6 resulted in the successive formation of pyroclastic flows in the Akamatsu Valley.

On 25 March, a new dome (Dome 7) started growing. Pyroclastic flows successively flowed down also toward the Akamatsu Valley. In the middle of April, the domes still continue to grow, and dome collapses and resultant pyroclastic flows continue to occur, suggesting the supply of magma still remains at high rates. Up to this time, seven lava domes have been formed. Preceding the emergence of each dome, swarm of shocks has occured (Fig. 6-3).