

Seismicity during the formation of a lava dome in the 1990-95 eruption of Unzen Volcano, Japan

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Unzen Volcano began erupting on November 17, 1990. A dacite lava dome emerged in Jigokuato Crater on May 20, 1991 and its growth lasted until early February 1995. During this dome activity, a great number of small earthquakes were observed at seismic stations near the dome, whose hypocenters were concentrated just beneath the dome. However, the details of seismicity during the whole period of dome activity had not been analyzed sufficiently. In this study, we examine the seismic data between May 1991 and February 1995. We mainly analyzed the data from seismograph station FG3 (FG4), which was set up about 500m (700m) SSW of Jigokuato Crater, the site of the dome extrusion.

During May 1991-Oct. 1991 and Feb. 1993-Aug. 1993, the seismicity level changed sharply: earthquakes occurred vigorously for several days or weeks, whereas the seismicity level became much lower when lava extruded smoothly. In contrast, the seismicity level during Nov.1991-Jan.1993 and Sep.1993 -Aug.1994 was generally high, probably due to the endogenous dome growth.

We classified the waveforms of these earthquakes into HF (predominant frequency: 7-10Hz), MF (4-7Hz) and LF (1-4Hz) types by spectral analysis. This classification was newly adopted in this study. The results show that the dominant waveform type had varied as follows: HF (May 1991), LF (Jun.1991 - Aug.1993), MF (Sep.1993 - Oct.1993), and HF (Nov.1993 -Feb.1995). The dominant waveform types between Nov.1991-Jan.1993 and Sep.1993 -Sep.1994 were different although the endogenous dome growth was observed in both periods.

We calculated cross correlation coefficients between a reference event (all events in order) and events occurring within 24 hours from the reference. A correlation window length of 5.5 s from 0.5 s before the onset was used for the calculations. The result shows a large number of multiplets occurred throughout the whole period of dome growth. Swarms with HF events were accompanied by many multiplets; in contrast, swarms with LF events were accompanied by only a small number of multiplets.