

Seismicity associated with the emergence of a dacite lava dome in May 1991 at Unzen Volcano, Japan

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During the 1990-95 eruption of Unzen Volcano, seismicity near the crater intensified in conjunction with the emergence and associated growth of a dacite lava dome. One week before the emergence, seismicity had started to increase gradually, and was accompanied by ground deformation on the upper flank of volcanic edifice. These phenomena became a sign of impending lava extrusion. In this study, we investigated the characteristics of seismic activity associated with the emergence of a dacite lava dome in May 1991. We mainly analyzed the data from seismograph station FG3, which was set up about 500m SSW of Jigokuato Crater, the site of the dome extrusion.

The daily number of earthquakes had been increasing since May 12. Yamashina and Shimizu (1999) inferred from an analysis of crustal deformation data that the dome emerged on May 19, but the number of earthquakes had begun decreasing on May 18, about one day before the dome emergence. Other outstanding peaks were found on May 22. The most significant feature of the seismic activity in this period was the occurrence of HF-type events.

We define an earthquake group as a time series of earthquakes whose waveforms are similar or vary only slightly over time (Umakoshi et al., 2002). Such groups are thought to be generated by continuous migration of hypocenters and/or continuous changes of source mechanism. We grouped the earthquakes using the method developed by Umakoshi et al.(2002), and we identified 30 groups for May 12-30. About 43% of all events belonged to one of these groups.

In many groups, the number increased first. After reaching the peak level, it decreased gradually until it disappeared. Many groups had been activated on May 17, the day exhibiting the highest level of seismicity. Intense activity of two groups was responsible for the increased number of earthquakes on May 22. Also, it appears that the seismic activity of May 12 to 13 consisted of the emergence of two short-lived earthquake groups.

Waveforms of all major groups observed on May 17 are of the HF type, whereas the waveforms of two groups observed on May 22, are of the LF type. This suggests that the source mechanism in the intense seismicity of May 22 was different from that of the highest seismicity of May 17.