

Seismic experiment for surveying the volcanic conduit of Unzen Volcano, using controlled sources

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In the Unzen Scientific Drilling Project, the conduit drilling is planned from 2002 to 2004. The location and extent of the conduit is one of the most necessary information to determine trajectories of the drilling.

In order to reveal the subsurface structure of Unzen Volcano, a seismic experiment was conducted at using artificial sources in 1995. Tomography analysis using the 1995 experiment data shows that a low velocity region exists at the sea level beneath the summit caldera. This low- V_p region probably represents the extent of the hydrothermal system sustained around the conduit. However the resolution of tomography is not sufficient to detect the conduit. On the other hand, we detected crustal reflectors using the seismic data from the 1995 experiment. Some of the reflectors were located in the vicinity of the pressure sources inferred from the ground deformation in the 1990-95 eruption. The distribution of these reflectors probably corresponds to the magma reservoirs and/or the ascent path of magma beneath the volcano. Although geophone intervals were too long to detect the conduit because of the refraction experiment, these results suggest that the reflection experiment with dense geophone distribution can reveal the fine structure such as the conduit or dike intrusion.

In order to detect the conduit of Unzen Volcano, the seismic reflection and fan-shooting experiments were carried out using vibratory energy sources (VIBROSEIS) in December 2001. About 580 receivers, each receiver consists of 9 geophones, were deployed at intervals of 25 m along N-S survey line (Line-1) and branch line (Line-1A) on the western flank of the volcano. The Line-1 is crossing over the supposed conduit which obliquely descends westward from the lava dome. In the reflection experiment, three VIBROSEIS vehicles vibrated at about 280 source points on the Line-1 at intervals of 25 - 100 m. For the observation of scattered waves by the conduit, we also deployed a 3-dimensional seismic array at the flank drilling site (USDP-1). In the fan-shooting experiment, 5 sources were located on the eastern foot of the volcano, and their signals were recorded at geophones on the Line-1 and Line-1A. Because the source energy of the VIBROSEIS is not enough to penetrate the volcanic edifice, 3-100 sweeps of the vibration signals were stacked to improve the S/N ratio of the data.

These experiments were successfully conducted, and the data processing is now ongoing. Several later phases, which are considered to be reflected waves by the structure discontinuity beneath the volcano, are recognized in the seismograms obtained in this experiment.