Resistivity and seismic velocity structure beneath Unzen volcano

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The Unzen volcano in southwest Japan erupted recently on November 17, 1990. It is located at the central part of Shimabara Peninsula, western Kyushu. A number of previous researchers have investigated the resistivity and three dimensional (3-D) seismic structure of Kyushu included the Unzen volcanic area, but the structure of magma beneath the volcano has not been imaged clearly yet.

In this study we have estimated two dimensional (2-D) crustal resitivity structure using magnetotelluric (MT) method with far remote reference technique and 2-D inversion code (Ogawa and Uchida, 1996). The survey line is about east-west direction with 10 observing sites which were set at intervals of 5-25 km centering on the volcano. In consideration of the noise environment of the region, we observed 15 hours/day for five nights at each site. In order to reduce the cultural noise, the remote reference site was set in Kagoshima (about 70km away from the volcano).

In addition to the resitivity structure, we have estimated 3-D P and S-wave velocity structures using a tomographic inversion (Zhao et al., 1992). In this inversion, we used 15,848 P and 8,917 S arrival times from the Japan University Network Earthquake Catalogue (January 1993 to December 1995) published by the Earthquake Research Institute, University of Tokyo.

The results show that a prominent cone-shaped low-velocity anomaly (3-6 %) exists beneath Unzen volcano. This anomaly may represent a magma chamber and geothermal regime that contributed to the recent volcanic eruption. The almost crustal earthquakes are occurred in resistive layer (depth at 5-15 km). The cut-off depth of the crustal earthquakes becomes shallow toward the crater of the Unzen volcano, and it is coincident with the upper boundary of cone-shaped low-velocity zone. These results indicate that the crustal seismogenic layer in volcanic area is contolled by the geothermal regime.