Small Scale Heterogeneity beneath Unzen Volcano by Seismic Wave Analysis

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Unzen volcano is one of the active volcanoes in Japan, located in Southwest Japan behind the Ryukyu-Arc. Latest eruption of Unzen volcano began in November 1990, leaving 198 years dormancy. It continued until early 1995, effusion of dacite lava resulted in the formation of lava dome at the summit and frequent generation of Merapi-type pyroclastic flows killed 44 peoples. To detect the volcanic vent used in the last eruption, a seismic reflection survey was conducted with vibratory energy source in December 2001, as a program of Unzen Scientific Drilling Project. A profile of the survey was performed along about 12 km line crossing Unzen graben and passed through 2 km west of the lava dome. The survey line was composed of 201 sweep points along the profile.

In this study, we try to detect scatterer distribution beneath Unzen volcano using vibratory signals observed at seismic stations in Unzen area. According to the reciprocity theorem, the common receiver gather from the vibratory source on the survey line obtained at the station is equivalent to common shot gather obtained at the profile for a source locating at the station. Therefore, we assumed that seismic data observed at the station are data observed in survey line with vibratory sources at the station.

We obtained the image of scatterer distribution beneath Unzen volcano by calculating semblance coefficient with slant stacked waveform, and found strong scattering part at 6 km deep and 5 km west of lava dome. From geodetic data, four pressure sources (A-D) are inferred in Unzen volcano. And shallower three pressure sources are locating very close to the strong scattering parts. Thus we consider the strong scattering part indicates heterogeneity related with magma reservoir.

We also developed a new method to distinguish between scatterer and reflector in the scatterer distribution image. As a result of application of this method to obtained scatterer distribution, we detected two high angle reflectors.