

Three-dimensional velocity structures in the region between Hakone volcano and Tanzawa Mountains, central Japan

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Hakone volcano is located in the northern boundary zone of the Izu-Mariana volcanic arc in central Japan, where the Izu Peninsula on the Philippine-sea plate has been colliding into the Japan island arc. There has been fumarolic activity around the Owakudani area, and many intense swarm activities have occurred in the caldera of Hakone Volcano. Previous studies (e.g. Oki and Hirano, 1970; Yukutake et al., 2011) interpreted that the hydro thermal fluid derived from a deep-seated magma beneath Hakone volcano contributes to the occurrence of swarm earthquake. However, there is no evidence to show existence of the hydro thermal fluid and a deep-seated magma. To understand the mechanism of swarm earthquake occurrence and tectonic process around Izu-collision zone, we tried to estimate three-dimensional velocity structure in and around Hakone volcano, by using tomographic inversion of seismic wave velocity.

We used the data of 52 temporary stations installed in and around the caldera of Hakone volcano. We also used the data obtained by the permanent seismic station installed by Hot Springs Research Institute of Kanagawa prefecture, Earthquake Research Institute, National Research Institute for Earth Science and Disaster Prevention, and Japan Meteorological Agency. The double-difference tomography method (Zhang and Thurber, 2003) was applied to the present analysis.

Under Hakone volcano, low V_p and low V_s anomaly regions were estimated in the depth range from 6 km to 15 km. Within the low velocity zone, V_p/V_s is high (1.9) in the 10-15km depth, while that at the 6 km depth is relatively low (1.6). This result suggests that the deep-seated magma body is located in the high V_p/V_s region, and the low V_p/V_s region reflects the hydro thermal fluid or volatiles from the magma body. High V_p and high V_s regions were estimated under Tanzawa Mountains. The high velocity zone corresponds to a plutonic body of tonalite or hornblende gabbro. A low-velocity wedge was estimated between Tanzawa Mountains and Hakone volcano that corresponds to trough-filled deposits.

Keywords: Three-dimensional velocity structures, Hakone volcano, Tanzawa Mountains