

Shallow structure of Aira caldera by the analysis of seismic exploration data

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Seismic velocity structure of Sakurajima volcano and Aira caldera was investigated by a seismic exploration conducted in November, 2008. Seismometers (natural frequency 2Hz) were installed at intervals of 200-300m at Sakurajima volcano and 500m at Aira caldera. Dynamites as sources were detonated at 11 sites at Sakurajima [4 large (200kg) and 7 small (20kg)] and 4 sites (300kg) around Aira caldera. The longest profile line is about 40km.

We applied the differential analysis (Hagiwara, 1938) and the generalized differential analysis (Tajime, 1977) to travel times of P-wave first motions to estimate 2D structure. The structure can be approximated by 2 layers from the travel time curves.

Velocities of the 1st and the 2nd layers are estimated to be 3.1km/s and 4.8km/s, respectively, for profile line S1-S5 which crosses in east-west direction at northern edge of Aira caldera. The top of the 2nd layer reaches the deepest; 2.7km deep beneath location 10km east of S1. The top of the 2nd layer becomes gradually shallower west of the deepest point. It becomes suddenly shallower east and appears at the ground surface near S5.

Velocities of the 1st and the 2nd layers are estimated to be 3.0km/s and 5.1km/s for profile line S1-S8 which traverses the central part of Aira caldera in the direction of northwest-southeast. The depth of the top of the 2nd layer attains the deepest; 3.3km northeast of Sakurajima. It becomes suddenly shallower at northwestern and southeastern side from the point and appears at the ground surface near S8, southeast side.

Velocities of the 1st and the 2nd layers are estimated to be 2.8km/s and 5.2km/s, respectively, for profile line S1-S4 which crosses Minamidake (summit crater of Sakurajima) and southern part of Aira caldera in the direction of northwest-southeast. The deepest point 2.0km deep is located at northwest part of Sakurajima. The top of the 2nd layer becomes shallower in the direction of northwest side of the point and southeast side from near Minamidake and appears at the ground surface near S4.

From the analysis results above, velocities of the 1st and the 2nd layer are about 3.0km/s and 5.0km/s, respectively. The profiles analyzed in this study showed that the top of the 2nd layer becomes deeper in the Aira caldera, especially near the center where low Bouguer anomaly is found (Komazawa et al., 2008). The profile curves of the 2nd layer may correspond to funnel-shaped subbottom structure of the caldera. The depth of the 2nd layer at NW part of Sakurajima coincides with basement depth of caldera estimated from anomaly of gravity.