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Resistivity structure around the Aira caldera

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The Aira caldera is located in southern Kyushu and was formed by the catastrophic eruptions of the Aira volcano approximately 29,000 years ago. Sakurajima is a post-caldera volcano and started to grow in the southwestern part of the caldera after 3,000 years of the Aira eruptions. It repeats explosive eruptions more than eight hundred times per year in recent three years. Since co-eruptive depression of the ground around the Kagoshima Bay was observed after the 1914 eruption of Sakurajima volcano (Omori, 1916), the source of magma supply to Sakurajima is presumed to be located at a depth of 10km beneath the Aira caldera (Mogi, 1958).The objective of this study is to clarify the corresponding electrical resistivity structure to the assumed magma reservoir and to the supply paths to Sakurajima volcano.

We have conducted the magnetotelluric (MT) measurement mainly along two traverse lines in the direction of WNW-ESE crossing the Aira caldera since 2009. The MT data at 39 sites in total, including 16 seafloor sites, were obtained for the last four years. For the seafloor observation, the electromagnetic field was recorded for about two to three weeks with a sampling interval of 8 Hz using several OBEMs (Ocean Bottom Electro-Magnetometers). For the land observation, the MTU-5 systems of Phoenix Geophysics Ltd. were used to measure the EM field with the frequency range of 0.001-320 Hz. We performed a 2-D analysis along two lines across the Aira caldera. The strike direction for 2-D analysis was estimated from the individual impedance data obtained on land by using a decomposition technique (Groom and Bailey, 1989).

As results of the 2-D inversion (Ogawa and Uchida, 1996) applied to the TM-mode data set, a high conductive region of less than 10 ohm-m was found in the southern profile beneath eastern Aira caldera at depths greater than 7-8 km. This conductor appears to extend upward, but it is not clear because of shortage of the higher frequency data obtained by OBEMs. Location of the conductor seen in the resistivity model is roughly in agreement with the location of depression source inferred from the geodetic data (Eto and Nakamura, 1986). This indicates that the conductive zone is possibly the structure relevant to the magma reservoir.

Keywords: magma reservoir, Sakurajima volcano, resistivity structure, Aira caldera, OBEM