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The electrical resistivity structure of Aso volcano inferred from broadband MT surveys

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Aso volcano is a Quaternary active volcano located in the northeast of Kumamoto prefecture, central Kyushu, Japan. It had formed the huge caldera through the four large pyroclastic eruptions until 90ka, since then it has been in active mainly at the central cones.

Electrical resistivity structures of active volcanoes provide us the useful information for understanding mechanisms of current and past activity, and for foreseeing future activity. Therefore there are many previous works to estimate resistivity structure also at Aso volcano, for example, Takakura et al. (2000) and Utsugi et al. (2009) show the NE-SW cross-section diagram by broadband magnetotelluric(MT) survey. However, It's insufficient to conclude what kind of substances and the state are reflected because of the shallow exploration depth, down to only 5km below sea level. Because a seismic low velocity zone and a sill-like pressure variation source are expected at approximately 6km(Sudo and Kong, 2001) and 15km(GSI, 2004) respectively, we should fill the gaps in exploration depth so that we can compare resistivity data with other data and estimate the subsurface structure accurately. Additionally, there are many poorly-understood themes for Aso volcano, for example the shape of caldera floor and its formation process, subsurface structure related to large pyroclastic eruptions, complicated tectonics in caldera and so on. It's important to reveal the deeper resistivity structure for understanding them, thus we carried out broadband MT observations.

There are nine observation points, of these, seven arranged along a line of Utsugi et al. (2009) cover craters of Mt.Naka-dake, the low velocity zone and the sill-like pressure variation source. Other two arranged along a line of Takakura et al. (2000) lie directly on the low velocity zone. We invested one or two months for each point, and succeeded in obtaining data up to 1000[s] with low noise at the former seven. Then two-dimensional inversions(TM-mode) were applied to NE-SW profiles also with data of previous works. As a result, we revealed the resistivity structure down to 15km below sea level for the first time, and found three features as follows.

(1) A high resistivity body continuing to deep part

There is a region of Hundreds of ohm meter(ohm-m) continuing to about 15km below sea level with 5km width at the central part of caldera. Its strike seems to correspond to Oita-Kumamoto Tectonic Line(OKTL), hence it could be a large intrusion along OKTL.

(2) A low resistivity body at southern caldera

There is a region up to 100[ohm-m] centered at about 9km below sea level from southern slope of central cones to Nango-dani. In light of information of seismic velocity, magnetization and so on, it might be a low density region such as tuff body or some kind of hot region.

(3) A non-conductive magma chamber

There is no low resistivity region centered at Kusasenri, the seismic low velocity zone expected a magma chamber corresponds to relatively high resistivity region instead. Although molten rock is generally considered highly conductive, actual magma chambers so structurally and materially complicated that it might not show low resistivity.

Keywords: Aso volcano, broadband MT survey