Resistivity structure beneath the fumarolic area of Nasu-Chausu-dake inferred from the DC resistivity survey

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Chausu-dake is an active stratovolcano located in the mid-southern part of the Nasu volcanic group. Its volcanic activity started about 16000 years ago, and six large-scale eruptive activities including the magma ejection and many phreatic explosions were reported. The last one was activity during 1408-1410, and a lava dome was formed in the summit area. Phreatic explosions on July 1st, 1881 formed two craters on the northwestern side and western side of the lava dome. Recently, phreatic explosions occurred in these craters in 1953, 1960, and 1963, and fumarolic fields are formed today.
In this study, we carried out the DC resistivity survey in two fumarolic zones and revealed the detailed subsurface resistivity structure. Of the two resistivity survey lines, we referred to the line crossing the northwestern crater as "line A" (total length: 380m, electrode spacing: 10m) and the other line crossing the western crater as "line B" (total length: 300m, electrode spacing: 10m). Measurements were performed for each line by using the Wenner electrode array and Eltran electrode array which have different sensitivity to subsurface structure each other. The observed data were converted to the apparent resistivity distribution with different electrode spacing, and the 2D resistivity model was inferred using a 2D inversion program based on Sasaki (1981) which solves the non-linear least squares method using finite element meshes. The resistivity structure models obtained by this way were compared with the geological map of Nasu volcano presented by Yamamoto and Ban (1997), and with the resistivity model that was estimated from the AMT data of Aizawa et al.(2009).
As the result, we interpreted high resistivity zones near the surface as the andesitic lava and/or pyroclastic rocks which erupted about 100 thousand years ago, and low resistivity zones corresponded to a hydrothermal fluid and/or the hydrothermally altered zone because the fumarolic gases and the altered rocks were seen at the surface. The resistivity structure model of the line B showed that the low resistivity zone extends to the south of the crater, which is consistent with the 1D model of Aizawa et al.(2009).
In this study, we could interpret only the shallow resistivity structure because the obtained data was of low quality to infer a deep structure. To constrain a deeper and wider subsurface structure and to identify the presence of hydrothermal fluid, we are planning to carry out the AMT survey over the whole area of lava dome.

Keywords: Nasu volcano, fumarolic zone, DC resistivity survey, resistivity structure

