Relation between Geothermal Water Flow and Resistivity Structure in the Shallow Part of the Volcano

Shogo Komori[1]; Tsuneomi Kagiyama[2]; Mitsuru Utsugi[3]; Akihiko Terada[4]; Hiroyuki Inoue[4]; Wahyu Srigutomo[5]; Yoshikazu Tanaka[6]; Hideo Hoshizumi[7]

[1] Earth and Planetary Sci.,Kyoto Univ; [2] Graduate School of Science, Kyoto University; [3] Kyoto Univ.; [4] AVL, Kyoto Univ.; [5] Department of Physics, Bandung Institute of Technology; [6] Aso Volcanological Laboratory Kyoto Univ.; [7] GSJ, AIST

It is important to find the geothermal water flow in order to discuss the diffusion and movement of volcanic gas which is released from magma.

As is known, resistivity of geothermal water which contains consentrated ion is 2-3 orders lower than that of pure water.

So geothermal water is thought to produce low resistivity area beneath volcano.Electromagnetic survey of volcano has found low resistivity zone, which has been interpreted not as existence of geothermal water but as hydrothermally-altered impervious layer.However, detailed comparison between resistivity which exists geothermal water flow and that which exists impervious layer has not been done yet.To understand this enables to reveal the effect of geothermal water flow on resistivity structure of volcano.

We conducted AMT,VLF-MT and High Resolution Electrical Resistivity Survey in the northeastern foot of the Unzen Volcano in order to compare shallow resistivity structure with temperature profile of the borehole (USDP-1).These surveys revealed that the low resistivity layer (40 Ohm-m) lies at 40-50m depth and the high resistivity layer (200 Ohm-m) lies below 60m depth. This low resistivity layer corresponds to the high temperature zone (37 degrees C,42m depth) and the high resistivity layer corresponds to the temperature-decreasing zone,respectively.

To examine the factor which decreases resistivity and increases temperature at around 40m depth, we observed the feature of the drillcore samples of USDP-1 precisely. As a result, argillaceous impervious layer was found at 65-100m depth,just beneath the low resistivity and high temperature zone.To quantify permeability of drillcore samples, we measured hydraulic conductivity of those. As a result, argillaceous impervious layer at 65-100m depth is more impervious (10^{-7} cm/sec) than upper layer at 0-50m depth (10^{-5} cm/sec).These suggest that groundwater is maintained shallower than 65m depth and that geothermal water decreases the resistivity of this zone, and also suggest that geothermal water flows laterally.

In this study, following things are found: low resistivity zone corresponds to where geothermal water flows laterally,and high resistivity zone corresponds to where exists argillaceous impervious layer.This argillaceous impervious layer is suggested that has not been altered very much.