

IMAGING OF HYDROTHERMAL SYSTEM IN KUSATSU-SHIRANE VOLCANO, JAPAN, USING THREE DIMENSIONAL MAGNETOTELLURIC INVERSION

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A dense magnetotelluric measurement with 85 sites was carried out at Kusatsu Shirane volcano, Japan. The main goal of this study is to delineate the hydrothermal system derived from the three dimensional electromagnetic image. We applied the 3D inversion code of Shiripunvarapon et.al. (2005) to calculate 3D electrical conductivity structure. To overcome the effect of shallow three dimensional structure or galvanic distortion, We have also developed the methodology of modeling by applying phase tensor and induction vector as response functions calculated from the 3d forward modeling. The three-dimensional topography was also taken into account in the 3d forward modeling and two-dimensional inversion results of multiple profiles were used as the initial three-dimensional model. By comparison the results from this different scheme, the final resistivity model shows that there is not significant difference especially in some general features.

The main structure of the conductive zone was found in the center of the model to a depth of 500 m from the surface. This conductor ranging of 1- 5 Ω .m was distributed in the area of measurement. The existence of this conductor is clearly detected by the induction vectors at frequencies 100Hz and 10 Hz, which point toward the center of the model. Based on the drilling data, the clay was found at the depth of 500 m which is the bottom of conductive zone in this model. Below this circular-shape conductive, there is a significantly resistive zone around the crater surrounded by conductive zone. This resistive conduit-like is important features because it is located just beneath circular-shaped clay cap and low earthquakes are sparsely distributed throughout this resistive conduit-like. The loss of high conductivity in this zone implies that the conductive clay cannot exist as the temperature is significantly higher than 200°C. Moreover, the existence of the seismicity in the resistive conduit-like indicated that the trapped free water in the transition zone is the cause of the earthquake generation.

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