

Anatomy of Active Volcanic Edifice at the Kusatsu-Shirane Volcano, Japan, by Magnetotellurics: Hydrothermal Implications for Volcanic Unrests

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We aimed to perform three-dimensional imaging of the underlying geothermal system to a depth of 2km using magnetotellurics (MT). We deployed 91 MT sites focusing around the peak area of 2km x 2km with typical spacings of 200m. The full tensor impedances and the magnetic transfer functions were inverted, using an unstructured tetrahedral finite element code to include the topographic effect. The final model showed (1) impermeable clay cap as the near surface conductor, (2) brine reservoir as a deep conductor at a depth of 1.5 km from the surface, and (3) a vertical conductor connecting the deep conductor to the clay cap associated with the seismicity, which implies a fluid/gas path. The past magnetization/demagnetization sources and the inflation source of the 2014 unrest are located just below the clay-cap, consistent with the clay capped geothermal model.

Keywords: Phreatic eruption, volcanic unrest, Magnetotelluric method, clay cap, brine