IMAGING OF A VAPOR RESERVOIR AT KUSATSU-SHIRANE VOLCANO, JAPAN, BY THREE-DIMENSIONAL MT INVERSION AND MICRO-EARTHQUAKES

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Kusatsu-Shirane volcano is located in central Japan and is historically known for its active phreactic eruptions. The geothermal system underneath the volcano has been investigated by geochemistry and qualitative models have been proposed. Seismic monitoring found the peculiar volcanic tremors, which were explained by vapor-fluid resonance in a crack system under the crater lake (Yugama-Mizugama). However, the whole geothermal system of the volcano has remained unresolved.

We have carried out 49 magnetotelluric measurements and and 36 audio- magnetotelluric measurements at the peak area of Kusatsu-Shirane volcano. This dataset was initially investigated by forward modeling by Nurhasan (2006, PhD thesis) and now this paper presents the inverse modeling results using the code of Shiripunvaraporn et al., (2005). The final model shows a bell-shaped conductive cap which surrounds the crater lake. The cap thins at the north western side where we have geothermal manifestations. The conductor is interpreted as an electrically-conductive and hydrologically-impermeable clay cap made of smectite. Around the crater lake, we have three borehole seismic stations and we can locate earthquakes of magnitude -2. We found that the relocated earthquakes distribute consistently with the resistivity structure. The micro-earthquakes distributed under the bell-shaped conductive cap below the crater lake. The volcanic gas coming from below is trapped by the bell-shaped cap of the smectite and increase of the pore pressure due to gas seem to trigger the micro-earthquakes. Interpretation of the bottom of the conductor (i.e., smectite) as 200 degree C also agrees with the borehole temperature data.

volcano, 3d inversion, micro earthquake

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