Resistivity structure of Kusatsu-Shirane volcano inferred from a magnetotelluric survey

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Kusatsu-Shirane volcano is an active volcano located in the northeastern part of Gunma prefecture. There are some craters on the summit area, one of which is the Yugama crater where lake water shows strongly acidic nature. High seismicity is frequently observed beneath the crater. Several hot springs located in the foot of the volcano discharge abundant hot spring water. For these rasons, there seems to be a highly developed hydrothermal system beneath the volcano.
According to the geochemical studies, fumaroles in the summit area, lake water in the Yugama crater and hot springs in the flank are derived from a two-phase hydrothermal fluid reservoir located beneath the Yugama crater. In contrast, hot springs located in the foot of Mt. Moto-Shirane discharge more primary fluids which are mixtures of high temperature volcanic gases and meteoric water (Ohba et al., 2000). In addition, audio-frequency magnetotelluric (AMT) surveys conducted along an E-W profile of the volcano found a 300m-1000m thick conductive layer beneath the eastern slope. This conductor was interpreted as the smectite-rich layer of Pliocene volcanic rocks that plays a role of low-permeable cap separating the fluid path to the hot spring of the eastern slope and the path to the hot spring of the foot of the volcano (Nurhasan et al., 2006). Another AMT survey conducted around the Bandaiko hot spring revealed the existence of a conductor extending to a deeper part beneath the hot spring (Kanda et al., 2014).
These studies revealed the generating process of various kinds of hot spring water and the shallow structure in the area to some extent. However, a deep structure of the volcano has not been understood yet. We conducted a wideband magnetotelluric (MT) survey across Mt. Moto-Shirane to reveal the pathway of hydrothermal fluid from the deeper part, and the location of heat source, that is, the magma reservoir of the volcano.
The survey was carried out at 12 sites along a 10km long E-W profile from the Manza hot spring area via the summit area of Mt. Moto-Shirane to the Bandaiko hot spring. We inverted the observed data by using the code developed by Ogawa and Uchida (1996) to obtain a 2-D resistivity section. Impedance phase and apparent resistivity were used for the inversion, in which the data showing 3-D features were eliminated in advance.
Obtained resistivity structure was characterized by the following features.
(1) Conductive body extending from the summit area to the deeper part of the western flank
(2) Conductive layer at the shallow part of the eastern flank
(3) Large resistive block at the deeper part of the eastern flank
The conductive layer (2) may correspond to the Pliocene volcanic rocks which were found by the previous AMT survey. Beneath this conductive layer, a resistive block (3) lies. Because the observed data was affected by the artificial electromagnetic signals, we need to examine the data carefully to confirm whether the model is true or not. We will give a presentation on the some results of analysis in a poster session.

Keywords: Resistivity structure, Magnetotellurics, Kusatsu-Shirane Volcano

