

Three-dimensional resistivity structure of Asama Volcano

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Asama volcano is an andesitic composite volcano located in central Japan. The present active crater locates at the eastern part of the complex. At the west of the crater, there is a horseshoe-shaped caldera, which was formed after the collapse of an old stratovolcano at around 24,000 years ago. In order to reveal the relationship between volcanic activities and subsurface structure, two-dimensional resistivity structure of Asama volcano has already been obtained by Aizawa *et al.* (2008) from the data of dense magnetotelluric survey. However, three-dimensional steep topography around Asama volcano can distort the observed response functions. Therefore, in this study, we performed three-dimensional inversion with the same data set as the previous study. In the inversion, we utilized the scheme proposed by Usui (2015), which enabled us to incorporate precise topography around the mountainous area into the computational mesh with the aid of the unstructured tetrahedral element.

The measurement stations used in the inversion consist of 36 magnetotelluric stations and 37 audio-magnetotelluric stations, and we used full components of the impedance tensor and the vertical magnetic transfer function. Though some stations of them measured only electric fields, the different locations of electric and magnetic fields were taken into account in the inversion algorithm. Galvanic distortion parameters were also estimated as model parameters in addition to subsurface resistivity values.

In the obtained resistivity structure, there is a spherical resistive body at the altitudes from 0.5 to 1.5 km under the collapse caldera. From impedance phases, Aizawa *et al.* (2008) inferred that the resistive body was isolated. By the three-dimensional inversion, we confirmed that the resistive body under the caldera was isolated. We found that hypocenter locates around the isolated resistor under the caldera. Aizawa *et al.* (2008) suggested that this resistive body is old solidified magma and it impedes the ascending magma. The result of our analysis supports the suggestion.

In addition, at the depths deeper than 0 km below sea level, resistivity of the west of the summit was relatively higher than surrounding area. This higher resistivity area is elongated to WNW-ESE direction and locates over the location of dyke intrusions estimated from seismic and geodetic measurements (Takeo *et al.*, 2006). This high resistivity area also corresponds to high P-wave velocity and high-density area revealed by Aoki *et al.* (2010). They suggested that the high velocity is due to the solidification of repeatedly intruded magma. Our result is consistent with this interpretation since the porosity of solidified magma is considered to be low and it can lead to high resistivity in that area. On the other hand, the surrounding conductive area may consist of higher porosity rocks with saline water.

Keywords: magnetotelluric method, volcanic structure, 3-D topography, 3-D inversion, unstructured tetrahedral element