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Hydrothermal system around the active crater of Aso volcano inferred from a three-dimensional resistivity structure

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This paper presents a three-dimensional (3-D) electrical resistivity model around the active crater of Aso volcano using the audio-frequency magnetotelluric (AMT) data obtained during 2004-2005. The AMT data were collected at 43 locations on an approximately 300-m grid in and around the Nakadake crater, the summit of the central cone complex, and were already interpreted by two-dimensional models (Kanda et al., 2008).

Over the past 80 years, all of the volcanic events within Aso volcano have originated from the 1st crater of Nakadake. The volcanic activity of Aso has showed a cyclic activity pattern: a crater lake is formed at a quiet period and a Strombolian eruption occurs at an active period. From November 2014, Strombolian eruptions have been observed at the 1st crater, which is considered to be a part of a similar activity cycle. This cyclicity of the volcanic activity implies that a specific structure that acts to accumulate the energy required to trigger eruptions develops at approximately the same location beneath the 1st crater. The objective of this study is to reveal such specific subsurface structure.

As a result of 3-D inversion using the code of Siripunvaraporn and Egbert (2009), we have obtained the following features in the 3-D resistivity model. A highly conductive zone is present at depths between 100 and 300 m beneath the 1st crater, but unexpectedly the resistivity of the shallow subsurface around the Nakadake crater is not low in general. The low resistivity zone widely distributed at a depth around sea-level which was found in the previous studies is seen only beneath the northern half of the Nakadke crater including the 1st crater. We will discuss these features in connection with the variation sources inferred from other geophysical studies.

Keywords: Aso volcano, resistivity structure, active crater, audio-frequency magnetotellurics, hydrothermal system