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3D electrical resistivity modeling of the Onikobe caldera -Implications for volcanoes and earthquake activity

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The Onikobe caldera is an oval topographic depression of 7.5km x 10km. In its southern part, there are active geothermal fields in east-west directions and the most active geothermal manifestation Katayama-Jigoku is in its southeastern end. Around the area, many crustal earthquakes occur, such as Iwate-Miyagi Nairiku Earthquake(Mw 6.9). The objective of this study is to image the resistivity structure in three dimensions in order to relate the distribution of fluids to volcanoes and earthquakes.

MT survey of 30 sites was conducted in 2009 in and around the Onikobe caldera. Three-dimensional inversion (WSINV3DMT) was applied to the dataset using the full impedance components. The results of the inversions are as follows. A low resistivity body with north-south strike was found at 20km depth in the western part of the caldera. The conductor extends upward, but it starts to branch laterally at 15km depth. One minor branch goes to 3km depth under the Mukaimachi caldera, which is located to the south-west of Onikobe caldera. Another major conductive branch reaches 2km depth below the surface of Katayama-Jigoku. The latter conductor has an east-west strike, which reflects the regional direction of tectonic compression. The resistivity of such crustal anomaly is between 1 and 10 ohmm. Using the Hashin-Strikman model, where conductive fluid shells cover the resistive rock matrix, the conductors will have fluid content as 1-7%, if we assume typical saline crustal fluids. Earthquakes occur at resistive zone above conductive body. This suggests the triggering of earthquake by fluids.

Keywords: maganetotelluric, inland ?earthquake, geofluid