

MT survey of geothermal area in southeastern flank of Mt.Ontake

*Junna Kanahiro¹, Toru Mogi¹, Hiroshi Ichihara², Koshun Yamaoka², Mamoru Adachi², Ryo Tanaka¹

1. Hokkaido University, 2. Nagoya University

Mt.Ontake is located at the south end of North Alps Mountains and the elevation is 3067m. Mt.Ontake was considered as an extinct volcano. However, the eruption was suddenly reactivated in 1979 after several thousand years dormancy. Magma hydrothermal eruptions continue to occurred at 1991, 2007 and 2014. Mino belt sedimentary rocks and Nouhi rhyolite distribute as basement rocks. Granitic rocks penetrate the basement. Old and new volcanic products outcrop around Mt. Ontake. The survey area is mainly covered with the volcanic products of old volcanic activities that occurred during about 70 –40 Ma. Residual heat from the old magma activity possibly still remains in this area. Kasaya et al. (2002) estimated a low resistivity zone at directly above the bottom of earthquake source region. It was uplifting to about 4km depth, in the flank of Mt.Ontake. This suggests that the depth of brittle-ductile transition (>300 - 350 degrees) is shallower than averaged depth in Island arcs. Because above two evidences suggest that a geothermal system may exist in this area. The MT survey would contribute to clarify range of the geothermal area.

MT observation was carried out at 35 sites during September and December in 2017. MTU and MTU5A instruments manufactured by Phoenix Co. were used in the observation. Time series of electromagnetic field were recorded for more than two nights in the wide-band MT survey (320 –0.001 Hz) and more than one hour in AMT survey (10000 –1Hz). The recorded data were analyzed and obtained tensor impedances, apparent resistivity and phases by using standard data analysis softwares supplied from the manufactured company. Magnetic field data recorded at Sawauchi, Iwate prefecture and Kubono, Ehime prefecture were used for the remote reference processing. The ModEM three-dimensional inversion scheme (Egbert and Kelbert, 2012) was applied to obtain a resistivity structure.

Topography effects to the MT impedances might be strong because the survey area is located in a flank of the high elevation volcano. In order to verify accuracy of the 3D inversion scheme including the topography, a model including topography was constructed by using DEM data of 10m spacing provided by Geographical Survey Institute in Japan and performed synthetic inversions. As a result, the accuracy was confirmed since the model was reproduced. Then three-dimensional inversion was performed using four components of tensor impedance from the field records. As a result, a preliminary 3-D resistivity structure was delineated that includes three conductive zones in the center, north east and southeast part of the survey area. A resistive zone was also found in the granitic rock exposure area. Especially, the conductive zone in the center is nearly correspond to the conductive zone shown in Kasaya et al. (2002). An investigation of chemical components of hot spring water at the neighbor sites indicated that the water has been placed in an environment with a temperature of 200 degree. Furthermore, the isotope analysis showed that the water contain the components indicating the dehydration from a magma or rising from the deep crust. In conclusion, the conductive area is related to a geothermal system formed in this area.

Keywords: MT, geothermal