

MT Observation in the Kitakami Mountains

*Masato Fukai¹, Yasuo Ogawa¹, Kuo-Hsuan Tseng¹, Edward Bertrand², Yusuke Kinoshita¹, Masahiro Ichiki³

1. Tokyo Institute of Technology, 2. GNS Science, 3. Tohoku University

Recently, MT observations are actively carried out in the subduction zone around the world to image resistivity structure (e.g. Pommier and Evans, 2017). We can study the distribution and path of the geofluid in the forearc, by imaging the three-dimensional resistivity structure, with the help of the seismic velocity and petrology models. For Northeast Japan, Ichiki et al (2015) analyzes the three-dimensional resistivity of the crust and upper mantle in the Tohoku region from a long-period MT observation. In their research, the MT site spacing was typically set to 20 km for the purpose of imaging the resistivity structure of the mantle wedge. Low resistivity was analyzed in the crust in the forearc side, however the site spacing was large and the frequency band is limited to less than 0.1 seconds, and spatial resolution was not enough to image the detailed structure within the crust. Mishina (2009) conducted broadband MT observation (300 Hz - 1/2000 Hz) along the three lines passing through Mt. Yakushi, Kurikomiyama and Narukoyama. Mishina (2009) and obtained two-dimensional resistivity sections. Sub-vertical conductors, presumably implying fluid path, were analyzed to the east side of the volcanic front for all the three sections. In our study, we carried out MT observations in the southern part of the Kitakami Mountains in order to analyze the fluid distribution in three-dimensions. We used three-dimensional inversion and the results were compared with seismic velocity structures and surface geology. In particular, we succeeded in explaining abnormal phases obtained at many MT sites. Major features of the final model are as follows. (1) Reflecting the geological structure of the shallow structure (depth 1 km), the granite distribution region shows high resistivity (>10,000 ohm). (2) The area of the Paleozoic sedimentary rock shows low resistivity (10 to 100 ohm). (3) In the area with the ophiolite in the northwest of the survey area, there is a remarkable low specific resistance at the depth of 0 km to 25 km. Ophiolite including serpentinite exists on the surface of the earth. The low resistivity may imply serpentinite. The sub-vertical low resistivity of the Kitakami Mountains pointed out by Mishina (2009) was not been analyzed. The sub-vertical low resistivity of Kitakami Mountains can be imaged by two-dimensional modeling to account for abnormal phase data due to current channeling. (4) Regarding the deep crust, in the granite distribution region, high resistivity exists up to a depth of 35 km. A comparison of the seismic velocity structure of the Kitakami Mountains by Ishikawa (2017) with the elastic wave velocity of the minerals suggests that granitic rocks are estimated to be widely distributed in the lower crust of the Kitakami Mountains, This represents the distribution from the bottom of the crust. (5) Low resistivity anomalies (<10 ohm) were analyzed in the deep part of the crust at 5 km-15 km depth in the southeastern part of the study area. Comparing the resistivity model with the two-dimensional seismic velocity section of Kitakami Mountains (Iwasaki et al., 1994), the horizontal positions are consistent between the seismic reflective layer and the electrical conductor. This conductor implies distribution of fluids. The origin of this fluid may be a fluid remaining in the crust, caused by past metamorphism.