雌阿寒岳北麓におけるMT法比抵抗構造探査
Magnetotelluric survey on the northern foot of Meakandake volcano

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We performed a broadband MT survey in the northern part of Mt. Meakandake in August and September in 2018. Mt. Meakandake is one of the active volcanoes in the southwestern part of Akan caldera in eastern Hokkaido. Recently, a remarkable ground inflation has been reported on the northeastern foot of Meakandake. We planned a magnetotelluric survey to investigate the electrical structure across the deformation source. In this study, we describe the features of our MT data and show the 1–D models as a preliminary modeling.

The Geospatial Information Authority of Japan (2018) reported a remarkable crustal inflation on the basis of the GNSS observation and InSAR analysis from late 2016 through 2017. They modeled the deformation as an opening of the sill–like crack (about 11 km long and 2 km wide) at a depth of about 6 km on the northeastern foot of Meakandake. As the estimated deformation source was large, we considered that it might be imaged as a low resistivity anomaly, if it was related to magma or hydrothermal system. Investigating the subsurface structure across such an extensive inflation source will also contribute to understanding the magma plumbing system of the Akan area. Around Meakandake, a MT survey was previously conducted in the eastern area as a part of the Geothermal Development Promotion Survey (NEDO, 1992). More recently, an AMT survey was performed across the summit along a NE–SW direction as a part of volcano study of Meakandake (Takahashi et al., 2018). However, because of the limited sounding depths, the electrical structure near the above–mentioned deformation source has not been clarified yet.

Therefore, in this study, we newly deployed twelve broadband–MT sites along a NW-SE trending survey line across the longer side of the inflation source on the northern to eastern foot of the volcano. We used four set of the MTU–5/5A system (Phoenix Geophysics) for the campaign. We acquired the time series of the electric field in two components and the magnetic field in three components for 3 to 7 days for each site. In calculating the response functions, we used the SSMT2000 software and applied the remote reference processing using the magnetic field data Sawauchi in Iwate Prefecture that was provided by Nittetsu Mining Consultants Co., Ltd.

Contrary to our first expectation, the induction vectors and phase tensors suggested an electrical regional strike of N60ºW, which was almost parallel to the survey line. Thus, in this study, we sought a provisional 1–D modelling instead of the 2–D analysis in an unpreferable direction. We estimated 1–D resistivity structures using the Occam’s inversion (Constable et al., 1987), in which we used the ssq impedance (Szarka and Menvielle, 1997; Rung-Arunwan et al., 2016) as the input data. In this inversion, we only used a frequency range, in which the responses showed approximately a 1–D feature.

The inverted 1–D models exhibited a distinct low resistivity layer (1–10 Ωm, hereinafter called, C1) at depths around a few hundred meters at all sites. In addition, at the sites in the SE half of the survey line, another low resistivity layer of approximately 10 Ωm (hereinafter called, C2) was found at a depth around

2–4 km.

According to the NEDO (1992)’s borehole logs that were drilled at about 1 km east of our survey line, the low resistivity layer C1, which is common to all the sites, is likely to correspond with the volcanic tuff layers in the Miocene indicating weak alteration with montmorillonite and/or chlorite. Meanwhile, the deeper low-resistivity layer C2 is recognized only at the locations near the above-mentioned inflation source. In addition, C2 is shallower at the sites near the inflation source. For this reason, we suspect that C2 has some relation to the inflation source, although their depths are different. We note that the interpretations are tentative since they are based on the 1-D modeling, and further evaluation is needed through a 3-D modeling in the future.

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