

Geophysical exploration by using self-potential and zeta potential of rocks

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Self-potential (SP) anomalies were observed on active volcanoes and geothermal areas. The SP is mainly formed by streaming potential associated with groundwater flow in porous media. Electric charge of the streaming potential is generally positive, so that a positive SP anomaly at the upper part of volcano can be interpreted as a sign of hydrothermal upwelling. Therefore, the interpretation of SP anomalies is important for detecting hydrothermal circulation and is also used for evaluation of volcanic activities.

Recently, SP numerical simulations have been conducted (e.g., Ishido and Pritchett, 1999; Hase et al., 2005), which allow to discuss a quantitative interpretation of flow directions and fluxes of groundwater. Hase et al. (2003) has conducted several zeta potential experiments of volcanic rocks and clarified that the zeta potentials of rocks have variety values in area-by-area. This result implies that groundwater flow by only gravity force can cause a characteristic SP anomaly because of the zeta potential variety influenced by heterogeneous structure.

A characteristic SP anomaly was observed on Kaimondake volcano despite there is no indication of geothermal activities (Kanda et al., 2004). Zeta potential experiments of rock samples from the volcano were conducted by Hase et al. (2004). The result of zeta potential shows negative in all samples, however the zeta potentials were different by each rock stratum in the volcano. In this study, we will discuss a new geophysical exploration by using SP and zeta potential of rocks.