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Interpretation of self-potential anomalies on a tranquil volcano using zeta potential variation

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Self-potential (SP) anomalies were observed on many 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 discus 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.

Characteristic SP anomalies were observed on Kaimondake volcano despite there is no indication of volcanic activities. In order to clarify the mechanism of the anomaly, we collected rock samples from the volcano and conducted zeta potential experiments. The result of the experiments show that the all samples indicate negative zeta potentials, however the values have much variation from sample to sample. In this study, we try to calculate 3D numerical SP simulation in consideration of the zeta potential variations and will discuss the mechanism of the SP generation of the volcano.