Measurements of zeta potential in various rock samples of Aso volcano

Hideaki Hase[1], Tsuneo Ishido[2], Shinichi Takakura[3], Keiko Sato[4], Takeshi Hashimoto[5], Yoshikazu Tanaka[6]

[1] Earth and Planetary Sci., Kyoto Univ., [2] GSJ/AIST, [3] Geological Survey of Japan / AIST, [4] JAMSTEC, IFREE, [5] Inst. Geothem. Sci.., Kyoto Univ., [6] Aso Volcanological Laboratory Kyoto Univ.

Self-potential(SP) electric anomalies are increasingly being observed associated with hydrothermal fields, volcanic activity, and subsurface water flow. It has been widely recognized that anomalies of SP are originated from electrokinetic phenomena such as streaming potential in many cases. Electrokinetic phenomena are induced by the relative motion between fluid and rock(mineral) surface. The rock(mineral) surface in contact with an electrolyte produces electric charge separation at the interface. Such a system is called the electrical double layer. The zeta potential is the electric potential at the slip-plane in the electrical double layer. It is measurable potential in a laboratory experiment, and has been believed as negative in most cases of rock/water systems. SP profile on the ground is strongly influenced by zeta potential of the rocks and soils. Therefore, it is important to measure zeta potentials in areas while SP survey has been conducted.

We measured zeta potential in 32 rock samples from various places of Aso caldera. Samples were ground and sifted out around the radius of 0.5mm. The XRF measurements were conducted on each sample in order to know the major component of mineral elements, because the mineral composition influences zeta potential. We obtained positive zeta potential in 14 samples and negative one in other 18 samples without pH-control during measurements. The samples with positive zeta potential correspond to Mt.Takadake and Mt.Kishima areas where we have detected local positive SP anomalies. The samples with negative zeta potential are distributed on hot spring areas and caldera somma

In case of negative zeta potential, correlation between topographic elevation and SP should be negative. On the contrary Takadake area shows positively correlated topographic effect. That is well corresponded to our experimental result indicating positive zeta potential of Takadake rocks. Zeta potential of rocks has been mostly considered as negative. However, our result suggests that it is sometimes not the case and that we have to be careful with the variation of zeta potential.