Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC49-P04 Room:Convention Hall Time:May 25 18:15-19:30

Conductivity distribution of the surface layer around volcanic area in central Kyushu

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Kagiyama and Morita (2008) indicated magma degassing is one of the important factors to control magma ascending. Discharge rate of volatiles from magmas through a crater has been estimated by direct observations of CO2 and SO2 gases, such as COSPEC and DOAS, and by geochemical methods. However, discharge rate of volatiles through a volcanic aquifer has not been clarified because of difficulty of obtaining geochemical samples spatially from deeper part of volcanic aquifer. Electrical conductivity of ground strongly depends on the conductivity of pore water, and VLF-MT survey is a powerful tool to clarify the distribution of hydrothermal water in the shallow depth. On this aspect, the authors carried out VLF-MT survey around volcanoes in central Kyushu, Japan.

Aso Caldera: Aso Caldera has acid crater lake in Nakadake Volcano, which is one of the post caldera cones, and has many hot springs within the caldera such as Uchinomaki, Jigoku & Tarutama. Conductivity distribution shows two typical features; caldera floor has almost homogeneous and high conductivity (>10mS/m), while the post caldera cones show wide range. Most cones have lower conductivity (<3mS/m), except active geothermal fields around Naka-dake Craters and western part of post caldera cones (>30mS/m). Just north and south of Naka-dake Craters, high conductivity (3-10mS/m) was identified. This suggests down flow of hydrothermal water from Naka-dake Craters to the flank of post caldera cones. Caldera floor has almost homogeneous conductivity. This feature is explained by the fact that the caldera floor was under the lake until 9 ka and is covered by lake deposit. However, extremely high conductivity (>30mS/m) was found at several areas in the caldera floor. These high conductive zones and Naka-dake are located along the NNW-SSE line. Hydrothermal water may be supplied along this tectonic line.

Kuju volcanic group: Central cones have lower conductivity (<3mS/m), except active geothermal fields around Iwo-yama (>30mS/m). Around volcanic cones, high conductivity zone was identified. This suggests down flow of hydrothermal water from volcanic cones to the flank. On the other hand, another high conductivity zone is identified along the tectonic line; Oita-Kumamoto tectonic line, Yufuin Fault, etc. Hydrothermal water may be supplied along this tectonic line.

Tsurumi&Garan volcanoes (Beppu geothermal area): Many lava domes show low conductivity (<3mS/m), except active geothermal spots in Tsurumi and Garan domes. High conductivity zones are identified along some tectonic faults; E-W trend from Garan crater to Kan'nawa hot spring, along Asamigawa Fault, etc. The area size of high conductive (>30mS/m) zone around northern Beppu hot springs (320MW) is estimated about 4 km2.

These results suggest Geothermal activity dominant volcanoes have wide high conductivity area related with degassing from magma. And VLF-MT survey will be effective method to identify tectonic line around volcanic and geothermal field.

Keywords: Active volcano, Electrical conductivity, Central Kyushu, Geothermal activity