Self-potential and AMT measurements in Izu-Oshima Volcano

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Izu-Oshima is one of the most active volcanoes in Japan. During the latest eruption in 1986-87, various phenomena indicating interaction between magma and ground water were observed as magma ascended and descended. In order to enhance prediction of volcanic activities in future eruptions, it is important to clarify background structure of magmatic activities and to understand physical and chemical processes of magma-groundwater interaction.

To understand distribution and flow of the ground water in a calm period, we conducted a self-potential mapping around a caldera and AMT measurements along ENE-SWS survey line crossing a central cone Mt. Mihara in March, 2006. We also started continuous self-potential measurements in order to understand background variations.

Local high and low electrical potential anomalies were observed within the caldera. The difference of the potential reaches up to 500 mV. At northern flank of Kengamine and western flank of Mihara-Shinzan, the potentials are high. These locations coincide with fumarole and anomalous ground temperature areas. On the other hand, low anomalies were observed at regions where lava flows cover the surface.

The most prominent feature of the two-dimensional electrical resistivity model revealed by the AMT measurements is a layered structure of upper resistive and lower conductive layers approximately divided at sea level. The lower conductive layer gets shallower beneath the caldera area. This feature has already been revealed by previous studies and has been interpreted that the sea water invaded into the volcanic edifice gets shallower beneath the caldera. Furthermore, at boreholes inside the caldera and NE shore of the island, a basement layer underling Oshima volcano is found at depths of several hundred meters below sea level. The layer contains clay minerals such as montmorillonite and can be one of factors of the conductive layer. We also detected local conductive regions at about 400 m above sea level beneath Mt. Mihara. These regions are just beneath the high electrical potential anomalies mentioned above. Probably the conductors play important roles to consider the cause of the high electrical potential as well as to reveal subsurface condition beneath the fumaroles and ground temperature anomalies at the ground surface.

The continuous self-potential measurement system was installed from flank of Mt. Mihara to the caldera floor in March, 2006. The system was expanded outside of the caldera in October, 2006. The observed data show 1) long term variation (probably annual variation), 2) variation by precipitation, and 3) daily variation. We have not fixed whether the variations are caused by natural phenomena or by artificial facts such as drift of electrodes currently, and will continue consideration of the reasons.