

Emission regions of gaseous elemental mercury around Yugama crater lake at Kusatsu-Shirane volcano, Japan

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Kusatsu-Shirane volcano is one of the most active volcanoes in terms of release of a large amount of heat as volcanic gas and thermal hot waters. In addition to a hot crater lake, locally referred to as Yugama, the Shirane pyroclastic cone exhibits thermal features such as steaming grounds and fumaroles. Because many visitors visit around the Shirane pyroclastic cone for sightseeing, risk evaluations of phreatic eruptions are valuable. Gaseous mercury emissions from ground surface at active volcanoes suggest thermal activities such as shallow hydrothermal system. Mercury contained in geothermal hot water separated from hydrothermal reservoirs as a gas phase and is transported to the surface along relatively high permeable zones. Thus, a spacial distribution of gaseous mercury emission rates from ground surface is one of a clue used to detect fracture zones. Such fracture zones may correspond to areas where explosion vents are formed in future. Furthermore, changes in flux of gaseous mercury may reflect temperature changes in a hydrothermal reservoir although mercury flux from ground surface is affected by environmental factors including air temperature, soil moisture content and organic carbon. Recently, portable apparatuses enabling to measure concentrations of gaseous elementary mercury (GEM) have been developed. To detect fracture zones around the Shirane pyroclastic cone, we applied the portable GEM analyzer which is low power consumption and light weight. On the basis of a simple numerical model which we have developed, we calculated GEM flux from GEM density measured around the soil. As a result, two GEM emission zones, A and B were found at the southern flank of the Shirane pyroclastic cone. The zone A corresponds to a locality of fissure vents formed by phreatic eruptions occurred at the beginning of 20 century. No volcanic vents are observed at ground surface at the zone B while its direction is parallel to an orientation of past fissure vents at the bottom of Yugama crater lake. We believe the zone B is fracture zone which was buried by thick ejecta emitted by following eruptions.

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