Hydrothermal thermal system developed on the eastern flank of Kusatsu-Shirane volcano, Japan

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For the prediction of a steam explosive eruption, empirical geochemical observations has been carried out. For example prior to the eruption in 1976 at Kusatsu-Shirane volcano Japan, an increase in SO2/H2S ratio has been detected in the fumarolic gases (Ossaka et al., 1980). However, the same change was not observed prior to the eruption in 1982-83. For a reliable prediction of steam explosive eruption, a modeling of hydrothermal system would be effective, because steam explosive eruptions are brought by the explosion of reservoir. In this study we sampled eighteen fumarolic gases on the eastern flank of Kusatsu-Shirane volcano. The chemical and isotopic composition were measured. Also the representative four fumaroles were subjected to the time series observation to see a temporal change in the composition.

In order to explain the chemical and isotopic feature of gases, a gas containing magmatic CO2 and H2S was necessary. The gas could be a vapor phase created by the mixing of high enthalpy magmatic fluid and a low enthalpy local meteoric water. The mixing and the creation of vapor phase would occur at a deep part of volcanic body. The vapor would interact with a local meteoric water at a shallow space resulting in the creation of a secondary vapor phase (Ohwada et al., 2003). A vapor with meteoric origin was added to the secondary vapor. The meteoric vapor contained H2S with non-magatic origin, and contained little CO2. The mixed vapor suffered a H2O vapor condensation. After the condensation the vapor was discharged as fumarolic gas. The meteoric vapor might be created from a water circulating in the shallow space of fumarolic area heated by the volcanic gas flow. The non-magmatic H2S might be a product of hydrolysis of native sulfur deposited under the ground of fumarolic area.