

# Relationship between changes in electrical conductivity and polythionates contents in Yugama, an active crater lake of Kusatsu-Shirane volcano

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Kusatsu-Shirane volcano, Japan, has an active crater lake named Yugama. During the calm period of the volcano, the major constituents of dissolved anions in Yugama are chloride and sulfate. When the volcanic activity becomes active, polythionates appear as dissolved sulfur species in addition to sulfate. It is suggested that the content of polythionates and polythionate/sulfate ratio in Yugama change according to the state of the volcanic activity, and the change in the content ratio must be connected to the compositional change of the volcanic gas supplied, more specifically, the change of the  $\text{SO}_2/\text{H}_2\text{S}$  ratio supplied from subaqueous vents of the lake [1]. Regarding the geochemical monitoring of the Kusatsu-Shirane volcano, the content and content ratio of dissolved sulfur species in Yugama is a good indicator of the volcanic activity state. However, analysis of sulfur species cannot be performed on-site, and it is necessary to combine routine sampling with chemical analysis in a laboratory for monitoring.

Considering the chemistry of sulfur species in Yugama water, the formation and decomposition of polythionates will bring about changes in the redox state of the lake water and the dissolved contents of electrolytes. In that case, changes in the composition of the dissolved sulfur species could be grasped by monitoring the ORP and electrical conductivity (EC) of the lake water that can be measured with sensors electrochemically on-site without chemical analysis. In this study, we discussed the possibility of the geochemical monitoring of active crater lakes using ORP and EC sensors.

We measured ORP, EC, and dissolved anions contents in preserved Yugama water collected between 2014 and 2018, which includes the active period of the Kusatsu-Shirane volcano. As a result, the EC value correlated with the polythionates/sulfate and polythionates/chloride content ratios and not with the sulfate/chloride content ratio. On the other hand, the ORP value does not correlate clearly with the content ratio related to dissolved sulfur species. The change in EC of Yugama water may imply that in polythionates content, although further evaluation is needed.

[1] Takano (1987), *Science*, **235**, 1633-1635.