Constraints on the Hydrothermal system beneath the Northern fumarolic area from the dense resistivity survey and isotopic ratio of hot spring water.

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Kusatsu-Shirane volcano is the andesitic to dacitic Quaternary active volcano located in the northwestern part of Gunma prefecture. The volcanic activity started about 600 thousand years ago and repeated eruptions intermittently. The current stage of eruptive activity started from eruption of Heibeike lava about 16000 years ago, and in recent years phreatic eruptions around the Yugama crater have been repeated. In the northern flank of Shirane pyroclastic cone, a geothermal area exists (called Kitagawa-funki). During the elevated volcanic activity in 2014, increase in fumarolic temperature was observed. In this study, to reveal the subsurface resistivity structure beneath the fumarolic area, a high-density electrical resistivity survey was conducted with three survey lines along which Hashimoto et al. (2004) performed a similar survey in the 4th Joint Observation of Kusatsu-Shirane Volcano. The survey lines were 490-550 m in length and each electrode interval was set to 10 m. The measurement was performed in October 2017 using the Wenner and Eltran electrode arrays. For the analysis, we used the program of Sasaki (1981) and we gave an interpretation in comparison with the geological map of Kusatsu-Shirane volcano. As a result, it was considered that the low resistivity zone beneath the fumarolic area corresponds to hydrothermally altered rocks or hydrothermal fluids, while the high resistivity area corresponds to Kagusa lava and Shirane lava. These are consistent with the result of Hashimoto et al. (2004) in the portions shallower than 50 m, indicating that the underground structure has hardly changed due to the activities of 2014.

The water isotopic ratios of hot-springs in the northern fumarolic area and of crater lakes of Yugama and Mizugama were also measured. The measurement results were consistent with the model of hydrothermal system proposed by Ohba et al. (2000), but problems to be solved such as the relationship with Yugama crater remained. In this study, good quality data on the deep structure was not obtained and therefore only the interpretation of the shallow structure was made. In order to estimate a deeper and more extensive underground structure, it is necessary to carry out an electrical resistivity survey with a longer survey line, and/or an AMT observation. For the interpretation of the water isotopic ratios, it is necessary to perform a temperature analysis and the composition analysis such as Cl concentration.

Keywords: Hydrothermal system, electrical resistivity survey, isotopic ratio of water

