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Interpretation of the Hydrothermal System in Kirishima Hot Spring Village, Southern Kyushu, Japan

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It is very important to understand hydrothermal systems for sustainable utilizing of hot springs. However, in Japan, most of the large hot springs are located in national parks. Therefore, explorations such as geochemical, geophysical or boring surveys to interpret the hydrothermal systems had not been conducted enough. For this reason, hydrothermal systems of some hot springs in Japan have not been made clear even now.
We constructed a conceptual model to interpret the hydrothermal system of Kirishima Hot Spring Village in Kirishima national park, southern part of Kyushu, Japan. There are many hot springs in Kirishima Hot Spring Village, such as Maruo, Hayashida, and Myoban hot spring areas. Kirishima Hot Spring Village is located in southwestern part of Kirishima volcanoes, like Onami-ike volcano, and the altitude of Maruo area is about 600 m and that of Hayashida and Myoban areas is about 800 m.
In order to interpret the hydrothermal system in Kirishima Hot Spring Village, we need to understand three important factors which are heat source, hot spring water, and subsurface structure. In January 2011, Shinmoe-dake volcano of Kirishima volcanoes made a large scale eruption. Then, the pressure source of Kirishima volcanoes is expected to be located in about 2 km west of Onami-ike volcano and its estimated altitude is about -7 km (Kobayashi et al., 2011). We used this pressure source for our conceptual model as a heat source. Secondary, we tried to clarify the fluid of Kirishima Hot Spring Village by considering the chemical compositions of hot spring water. In addition, we made a Na-K-Mg diagram to estimate the reservoir temperature and find that spring water has reached equilibrium or not. As a result, we supposed that hot spring water of Maruo area is magmatic, and that of Hayashida and Myoban area is consisted of sulfate and meteoric water. Thirdly, we used gravity data, which is the result from previous study and our field survey, to make a residual Bouguer anomaly map and a vertical derivative map for understanding subsurface structure. These maps indicate that there are many faults in subsurface of Kirishima Hot Spring Village.
Integrating the result from previous studies, our discussions, and gravity survey, we constructed a conceptual model of hydrothermal system in Kirishima Hot Spring Village. This conceptual model represents that the reservoir of Maruo, Hayashida, and Myoban areas is a presumed fault and attendant cracks. It also represents the formation process of the hot spring water.