

Evaluation of spring, groundwater and stream water quality for use as a cooling heat source at Iwaki volcano

*Seiichiro Ioka¹, Kazuyoshi Asai², Kazumi Asai²

1. Institute of Regional Innovation, Hirosaki University, 2. Geo Science Laboratory

There is a lack of existing research concerning cooling heat sources that are necessary for geothermal power development at Iwaki volcano. In this study, we evaluate the availability of spring water, groundwater and stream water as a cooling heat source for geothermal power generation. We are mainly concerned with water quality characteristics for geothermal binary power generation, and with scale formation more specifically.

We studied 10 spring water, two groundwater and 18 stream water samples from the Iwaki volcano area. We measured pH, electrical conductivity, water temperature, and flow rate. We conducted analyses for Li^+ , Na^+ , NH_4^+ , K^+ , Mg^{2+} , Ca^{2+} , F^- , Cl^- , Br^- , NO_3^- , SO_4^{2-} , Fe, Mn, Sr, Ba, Cu, B, Si, alkalinity, dissolved organic carbon, $\delta^{18}\text{O}$ and δD in each sample. The evaluation of scale formation was carried out using PHREEQC Interactive Version 3.4.0.12927.

Scale formation was evaluated at an average temperature of 10 °C at the time of water sampling, as well as at a temperature of 15 °C assumed to be applicable to a scenario following utilization of the water as a cooling heat source. The saturation index results for calcite and amorphous silica indicated that all spring water, groundwater and stream water were undersaturated at 10 °C and 15 °C and scale formation was unlikely to occur. However, the saturation index for iron indicated oversaturation at an Fe concentration of 0.005 mg/L or higher, but concentrations of 0.1 mg/L or higher were only detected at two sites. We therefore conclude that these factors are not important provided that those two sites are not used. From the perspective of scale formation, this study indicates that spring water, groundwater and stream water in this area can be effectively utilized as a cooling heat source for geothermal power generation.

Keywords: Iwaki Volcano, water quality, cooling heat source use