Temporal variation of chemical composition of hot spring waters at Ebinokogen Ioyama Volcano in Kirishima Volcanic Group, Part 2

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Vigorous emanation of hot spring waters and fumarolic gases has been observed at Ebinokogen Ioyama Volcano, since the eruption in April 2018. We have conducted periodic sampling of hot waters emanating from the craters and fumarolic vents since July, 2018, and monitored time variation of their chemical composition which could be related to magmatic and hydrothermal activities. We report time variation of chemical composition.
Water samples were collected from Y2a and Y2b hot springs in South Crater that formed at 50 m south from the Iwoyama crater, from W4 hot spring in West Crater that formed at about 500 m west from the Iwoyama crater, and some small hot springs associated with fumarolic vents in the area between them. During the fluid sampling, water temperature, pH, ORP (oxidation-reduction potential) and EC (electrical conductivity) were measured on site using probes. Chemical composition of major and minor cations was determined by ICP-OES (inductivity coupled plasma optical emission spectrometry) and ICP-MS (inductivity coupled plasma mass spectrometer) and of major anions (Cl, SO_4) was determined by IC (ion chromatography).
Time variation of chemical composition of the hot spring waters basically follows visual variation trend of hydrothermal and fumarolic activities around the craters. Long-term declination of hydrothermal activity after the 2018 eruption is characterized by stepwise drawdown of hot spring water level though some disturbance by seasonal change of rain fall, and classified into Stage I-V. In Stage II (from May 2019) when drawdown of Y2a hot spring water level at South Crater was observed, the water chemistry of Y2a hot spring showed lower Cl/SO_4 ratio and higher B/Cl, As/Cl ratios than in Stage I. In Stage III (from Dec. 2019) when drawdown of W4 hot spring water level at West Crater was observed, the water chemistry of W4 hot spring showed lower Cl/SO_4 ratio and higher B/Cl, As/Cl ratios than Stage I and II. These changes in water chemistry would be attributed to a shift from contribution of single phase fluid in the early stage to contribution of vapor-dominant fluid that experienced subsurface boiling. This model is in accordance to similar change in water chemistry of W4 hot spring observed during Stage IV (from July 2020) when the fumarole and associated hot spring vent appeared on the road nearby the West Crater and Stage V (from Jan. 2021) when the fumarolic activities substantially declined.

Keywords: monitoring of time series change, phase separation

