Hydrothermal circulation process related to phreatic eruption of Iwo-Yama at Kirishima volcanoes

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A phreatic eruption occurred on a south crater of Iwo-yama, Kirishima active volcano, on April 19, 2018, and active hydrothermal activities including fumarole and high temperature water outflow have continued until now. We analyzed major chemical compositions of waters sampled on the 12th and 13th October 2018 in order to clarify the hydrothermal systems beneath the Iwo-yama related to the phreatic eruption. Water temperature, pH, ORP, and EC were measured *in situ* using electrodes. Na^+ and K^+ were quantified using an atomic absorption spectrophotometer, and Si, As, Al^{3+}, Mn^{2+}, and Fe^{2+} were analyzed by ICP-MS. Ca^{2+} and Mg^{2+} were quantified by EDTA titration, while those of some samples by ICP-MS. Alkalinity was analyzed by neutralization titration. F^-, Cl^-, Br^-, NO_3^-, PO_4^{3-} and SO_4^{2-} were analyzed by ion chromatography. Hydrogen and oxygen isotope ratios of waters were analyzed by cavity ring down spectrophotometry.
The temperature and pH of erupting hot waters in the south and west craters were 70~ 97 ℃ and 1.3 ~ 2.1, respectively. The temperature and pH of low temperature springs in the northeastern wetland out of the craters were about 20 ℃ and 2.2 ~ 5.2. Cl^- and SO_4^{2-} concentrations ranged within 1000 ~ 8000 ppm and 2,000 to 10,000 ppm for hot waters and 3 ~ 300 ppm and 10 to 1100 ppm for low temperature spring waters. Positively linear relationship indicated the same origin of between concentrations of Cl^- and SO_4^{2-}. The d^2H and $d^{18}O$ of the highest Cl^- and SO_4^{2-} concentrated water were -18 ‰and -4.0 ‰, indicating high contribution of magmatic water. Strongly acidic water was formed by oxidation of magmatic components due to mixing of meteoric water in the groundwater aquifer. The all analyzed waters can be explained simple mixing of the above high temperature water with local meteoric water. It is notable that up to about 3000 ppb As was confirmed in the hot water.
The silica geothermometer indicated the highest temperature of 262 ˚C for the hot water containing the highest Cl^- concentration, suggesting the aquifer temperature is higher than that. The formation of high temperature water in the groundwater aquifer must be related to the phreatic eruption.

Keywords: geothermometer, hydrogen and oxygen isotope

