

Water quality and stable isotope for springs in the Kirishima volcanic area

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Kirishima is located at north part of Kyushu and extended from the northeast at Kagoshima prefecture to the southwest at Miyazaki prefecture. Kirishima is a one of most active volcanoes in Japan. Kirishima consists of more than 15 volcanic mountains, for example, Karakuni mountain, Shinmoe mountain, Kurino mountain and Takachiho mountain. The annual precipitation amount around Kirishima is very large (more than 2,000 mm), and precipitation amount is especially large from June to August. It is estimated that the amount of groundwater recharge in Kirishima is large. The purpose of this study is to make clear the characteristics of water quality and stable isotopes in groundwater and spring water, and estimated the groundwater flow in Kirishima volcano. The observation was carried out at July 19 to 21 in 2011 and December 3 to 5 in 2011. The water samples were sampled at 24 points in July and at 30 points in December.

As a result of field survey, EC (electric conductivity) and pH values of spring water are almost same between July and December. In many points, however, the groundwater discharge in December is relatively smaller than that in July. It is considered that the groundwater discharge is influenced by the precipitation amount which is large in summer period. The water temperature is slightly high in July. Water temperature may be influenced by air temperature. The EC value of hot spring is very high (1,255uS/cm), and relatively high at southeast in Kirishima. The water quality type is mainly Ca- HCO₃ and Na- HCO₃ in spring water. For the hot spring, the water quality type is (Na+Mg)- HCO₃. Thus the spring water which is located at southeast in Kirishima also show the (Na+Mg)- HCO₃ type, it is estimated that the hot spring is mixed in the spring water at southeast in Kirishima. The NO₃⁻ concentration is contained in several sites.

Stable isotopes of oxygen ($d^{18}\text{O}$) and hydrogen ($d\text{D}$) in spring water which is located at high elevation are relatively light. The altitude effect thus exists in Kirishima volcano site. The local meteoric water line at Kirishima is $d\text{D} = 5.59 d^{18}\text{O} - 5.92$ ($r^2=0.769$) in July and $d\text{D} = 4.13 d^{18}\text{O} - 16.81$ ($r^2=0.548$) in December. These local meteoric water line are different to the Craig's meteoric water line. As a result of $d^{13}\text{C}$ and water quality, the volcanic CO₂ gas is mixed the groundwater or spring water for the area which is extended from northeast to southeast at Kirishima. In future, the detailed groundwater flow can be clarified by using the result of groundwater residence time.

Keywords: Kirishima volcanic area, spring water, water quality, stable isotope, groundwater flow