The use of stable O-H isotope data to evaluate groundwater recharge in Jeju Volcanic Island, Korea

YON-GYUNG RYUH[1] KYOUNG-HO KIM[1] SOO-HYUNG MOON[2] SEONG-TAEK YUN[1]

[1]Dept. of Earth & Environmental Sciences and KU-KIST Green School, Korea University, Seoul, South Korea, *styun@korea.ac.kr

[2]Jeju Province Development Co., Jeju, South Korea

Groundwater aquifers in oceanic islands such as Jeju Island of South Korea are the primary source of water supply and are largely replenished by rainwater infiltration. For sustainable exploitation and management of groundwater, it is crucial to understand recharge characteristics. In this study, groundwater recharge in the Pyoseon watershed of Jeju volcanic island was elucidated by comparing 4-year time-series O and H isotope data of rainwater from seven altitudes with those of groundwater from three deep wells for the production of bottled drinking water. A total of 173 rainwater samples show large variations of isotopic composition; $\delta^{18}O$ values from -15.26 to -2.66‰ and δD values from -112.9 to -1.35‰. Rainwater samples show distinct seasonal and altitudinal changes. In wet season (May-October) the isotopic values plot along the equation $\delta D = 8.12\delta^{18}O + 10.40$, while the precipitation during dry season (November-April) show the regression equation $\delta D = 6.63\delta^{18}O + 12.67$. Rainwater also shows the systematic decrease of isotopic composition with increasing elevation (-1.03‰/100m for $\delta^{18}O$ and -0.11‰/100m for δD). In contrast, groundwater shows unique O and H isotopic compositions with no distinct seasonal change. Hydrochemical characteristics of rainwater are almost identical to those of groundwater. These observations indicate the high flow rates of groundwater without significant water-rock interaction, possibly through highly permeable aquifers. The calculated d-values of groundwater indicated that the groundwater recharge occurs mainly from summer precipitation at high altitudes (~1,460m asl). This study shows a good example of the usefulness of the long-term isotopic study to understand groundwater recharge in volcanic aquifers.