

Stable isotope geochemistry of CO₂-rich groundwater in Chungbuk Province, Korea

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It has been known that carbon dioxide (CO₂) in CO₂-rich groundwater in Korea mainly comes from a mantle. We investigated elemental and stable isotope (carbon and lithium) geochemistry in the CO₂-rich groundwater in order to evaluate the origin of CO₂ and other geochemical processes. The CO₂-rich water shows high pCO₂ up to 1.34 atm and low pH down to 4.6, while the surrounding groundwater has much low pCO₂ down to 5,827 μatm and high pH up to 7.3. The former has average δ¹³C_{DIC} value of -7.5‰ (n=6) and the latter average δ¹³C_{DIC} value of -18.1‰ (n=4), indicating that CO₂ comes mainly from a mantle and soil, respectively. Furthermore, δ⁷Li values of CO₂-rich water range from 3.8‰ to 7.7‰, while those of the surrounding groundwater from 10.3‰ to 14.5‰. This result suggests that congruent dissolution occurs in the CO₂-rich groundwater, in well consistent with the PHREEQC results. Overall, this study shows that high CO₂ derived from a mantle promotes a water-rock interaction, resulting in congruent dissolution and therefore little Li isotope fractionation.