

Hydrochemical and isotopic characteristics of CO₂-rich water and groundwater from spa areas in granitic aquifers in the north central part of South Korea

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This study looked into groundwater and surface water in spa resort areas of the north central region of South Korea to understand flow and geochemical processes controlling the occurrence of CO₂-rich water. The CO₂-rich water and deep groundwater were collected from the wells with the total depth of 500 to 1000 meters. Temperature and pH of samples were in the range of 21 to 29 °C and 6.02 to 6.53, respectively. Measured concentration of dissolved CO₂ was as high as 410 to 960 mg/L.

Bedrocks of the site are Precambrian gneiss and Cretaceous granite and gold and molybdenum mines were operated 40 years ago. There are four commercial wells of CO₂-rich water near the lithologic boundary with lineaments in the southeastern direction. The CO₂-rich water at the intersection of the lithologic boundaries is in reducing conditions with higher concentration of H₂S, which is different from other wells. The non-CO₂ rich waters of the study site are Ca-HCO₃ type and change to Na-HCO₃ type with the increase in well depth. Groundwater in the study area can be classified as three groups of CO₂-rich water, shallow and deep groundwater based on hydrochemical and isotopic characteristics.

δ¹⁸O and δD of deep groundwater showed depleted values indicating contribution of higher altitude recharge and surface waters showed evaporation effect in summer. The δ¹³C values of CO₂-rich water were heavier than -8‰, indicating deep-seated sources of carbon. Moreover, the 3H values of deep groundwater were mostly below 1 TU implying long residence time.

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