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ENVIRONMENTAL ISOTOPIC AND GEOCHEMICAL STUDIES OF CO_2-RICH WATER IN THE KANGWON PROVINCE

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Environmental isotopic (^{18}O, ^{2}H, ^{3}H, ^{13}C, ^{34}S and $^{87}Sr/^{86}Sr$) and geochemical studies on CO_2-rich waters in the Kangwon Province were carried out to elucidate the origin, residence time, water-rock interaction and mixing process of CO_2-rich water. The CO_2-rich waters can be divided to three types based on chemical compositions: Na-HCO_3, Ca-Na-HCO_3 and Ca-HCO_3 types. The dissolution process of plagioclase is important in water/granite interactions and its solubility change according to reaction temperature, which played an important role in the determination of chemical compositions. The application of various chemical geothermometries shows that the calculated reservoir temperature of Na-HCO_3 type (about 150℃) is higher than those of Ca-HCO_3 type. $\delta\,^{18}O$ and δ D data indicate that CO_2-rich waters were derived from local meteoric water. It also that each type of CO_2-rich water has distinct isotopic composition and Na-HCO_3 type water (-10.8 to 12.1‰, $\delta\,^{18}O$) is lighter than other type waters. Tritium contents close to zero are observed the Na-HCO_3 type water, confirming a long resident time and the possibility of a CO_2 inflow into the aquifer at great depth. These isotope data also show that the Ca-HCO_3 type water has undergone mixing process with superficial water during ascending at depth, whereas Na-HCO_3 type water was less mixed with younger waters. The carbon isotope data (-8.8 to +0.8‰, $\delta\,^{13}C$) indicate that dissolved carbon in the CO_2-rich waters was possibly derived from deep seated CO_2 gas. The high $\delta\,^{34}S$ values (up to +38.1‰) of dissolved sulfates suggest that sulfate reduction by microbial activity had occurred at depth. Strontium isotopic data ($^{87}Sr/^{86}Sr$) of CO_2-rich water also show distinctive ratios, indicating they are controlled by reaction with local host rock.