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Hydrogeochemistry and related hydrodynamic conditions of springs in limestone area

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Hydrogeologic and hydrochemical features of the ground water system in limestone and karst area is very complicated due to the occurrence of conduit flow along solution cavities. As an effort to test the applicability of hydrogeochemical and environmental isotopic data to understand the ground water flow, we have examined 30 samples of spring water from Yeongweol area. Surface water (N = 6) and well ground water (N = 15) were also examined. Sampling was undertaken during May/June (dry period) and July (rainy period) of 1999. Environmental isotope data ($\delta^{18}O$, δD, tritium content) of spring waters indicate the recent age (after 1960's) of the groundwater recharge from meteoric waters.

The chemistry of spring waters is mainly controlled by dissolution of limestone. Based on the occurrence and hydrogeochemical data, spring waters are classified into two groups (type I and type II). This grouping agrees well with the result of cluster analysis. Type I spring waters (N = 8) generally have lower concentrations of Mg, Na and K than type II water (N = 22) and are hydrochemically similar with shallow well waters. Type II spring waters are chemically similar to deep well waters, but some of them show a remarkable change in the discharge rate and chemistry during high rainfall period. By combining with thermodynamic calculation of geochemical parameters such as P_{CO2} and saturation index (S.I.) of calcite/dolomite, our hydrogeochemical data indicate the hydrodynamic conditions as follows: type I waters represent the shallower-depth infiltration of meteoric water under partially open system and are generally undersaturated with respect to calcite and dolomite, whereas type II waters undergo higher degrees of water/rock interaction during deeper circulation and attain saturation state with respect to calcite and dolomite. Hydrodynamic conditions of type II spring waters are likely changed temporally with rainfall events, from the domination of diffused flow during dry period to the domination of conduit flow during rainy period. Our present study suggests that hydrogeochemical survey should be conducted as an important procedure in ground water engineering because hydrogeochemical data are very useful to elucidate the hydrodynamic and hydrogeologic conditions of ground water system.

Keywords: spring, limestone aquifer, hydrogeochemistry, hydrodynamics