

Hydrogeochemistry of groundwaters in Boeun Area, Korea

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Abstract

We performed a hydrochemical study on a total of 89 bedrock groundwaters collected from preexisting wells (30 to 300 m deep) in the Boeun area. Hydrochemical data showed significant variations in the area, due to varying degrees of anthropogenic pollution. The waters were mostly enriched in Ca and HCO₃ but locally contained significant concentrations of anthropogenic constituents in the general order of Cl > NO₃ > SO₄. In particular, about 11% of the examined wells exceeded the drinking water standard with respect to nitrate. We consider that aquifers in the area are locally highly susceptible to the contamination related to agricultural activities.

Diagrams showing the relationships between the summation of cations (Σ cations) and the concentration of several anions with different origin (natural versus anthropogenic) were used to estimate the relative role of anthropogenic contamination. A good correlation was observed for the relationship between Σ cations and bicarbonate, indicating that water-rock interaction (namely, hydrolysis of silicate minerals) is most important to control the water quality. Thus, we made an assumption that the equivalent of dissolved cations for a water should be equal to the alkalinity, if the chemistry were controlled solely by a set of natural weathering reactions. If we excluded the equivalent quantities of cations and bicarbonate (natural origin) from the acquired data for each sample, the remainder therefore could be considered to reflect the degree of anthropogenic contamination. Finally, we performed a multiple regression approach for hydrochemical data using the Σ cations as a dependent variable and the concentration data of each anion (natural or anthropogenic) as an independent variable. Using this approach, we could estimate the relative roles of anthropogenic and natural processes. Rather than the conventional evaluation scheme based on water quality criteria, this approach will be more useful and reasonable for the evaluation of groundwater quality in a specific region and also can be used for planning appropriate protection and remedial actions.

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