

Hydrogeochemical process of nitrate contamination in groundwater in the western part of Jeju volcanic island, Korea

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Groundwater is the sole-source of water supply for about 660 thousand residents in Jeju volcanic island. Since the early 1990s, nitrate contamination in groundwater has become an environmental issue in the western part of Jeju due to agricultural and livestock activities. To provide a systematic measure for groundwater management, this study objects to understand the processes of nitrate contamination in the western part of Jeju through periodic monitoring and hydrogeochemical analysis.

Groundwater has been sampled every quarter since Sep. 2016, and the study area gradually expanded to upstream area while tracking the sources. Since July 2017, five multi-depth monitoring wells were installed to determine the vertical movement characteristics of surface contaminants. Anions (Cl, NO₃, SO₄, HCO₃), cations (Na, K, Ca, Mg, Fe, Mn) and stable isotopes ($\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{15}\text{N-NO}_3$, $\delta^{18}\text{O-NO}_3$) were analyzed in groundwater samples.

Based on the monitoring results, 50% of deep groundwater samples (about 100m in depth) appears to be contaminated by nitrate, mainly from fertilizers. Nitrate gets into the pumping wells through the walls of poorly grouted wells and by the inflow of groundwater recharged from the upgradient areas. The nitrate-contaminated and uncontaminated groundwaters showed clear differences in hydrogeochemical characteristics, indicating different flow paths. In future study, discrete-depth monitoring of groundwater will be carried to identify source areas of nitrate.