

Tracing groundwater-origin nitrogen sources using dual nitrate isotopes in coastal waters off Jeju Island, Korea

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We measured the concentrations of dissolved inorganic nutrients and the dual isotopic composition of nitrate ($\delta^{15}\text{N-NO}_3$ and $\delta^{18}\text{O-NO}_3$) in coastal waters off a volcanic island, Jeju, Korea, to trace the main sources of nutrients. Sampling of seawater and fresh groundwater was conducted in four different coastal areas off Jeju Island: Haengwon, Pyoseon, Ilgwa, and Sagye in May 2020 and 2021. The results showed that the isotopic composition of nitrate was mainly influenced by the mixing between seawater and fresh groundwater in coastal waters off Jeju Island. The bi-plot diagram ($\delta^{15}\text{N-NO}_3$ vs. $\delta^{18}\text{O-NO}_3$) in the coastal seawater and fresh groundwater indicates that fertilizer was the major source of nitrate in Haengwon, while sewage and manure were the major source of nitrate in the other study areas. Thus, our results suggest that this technique using dual nitrate isotopes can successfully identify the sources of nutrients in coastal areas where groundwater discharge is significant.