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Groundwater Chemistry in a Complex Coastal Aquifer with Diverse Bedrocks and Geologic Structures

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The groundwater chemistry is determined by a number of processes, including water-rock interaction, anthropogenic contamination and seawater intrusion. A better understanding of the groundwater evolution process is often challenging especially when the bedrock aquifer is complex in bedrock composition and geologic structure. In this study, we investigated the influences of rock composition and geologic structure on the chemistry of bedrock groundwater in a coastal aquifer in South Korea. The aquifer geology consists of Cretaceous sedimentary rocks (mainly, siltstone and shale) that were intruded by Cretaceous to Paleo-Tertiary granitoids. Depth-specific groundwater samples (n=1118) were collected from a total of 61 monitoring wells (depth: -269 to 37 m a.s.l.) quarterly from March 2015 to June 2022. Factor analysis of hydrochemical and isotopic data show distinct controls of hydrochemical evolution of groundwater. Groundwater in granitoids is characteristically higher in pH, F and Li, while groundwater in shale with the higher concentrations of SO_4, V and Mo but lower pH and DO. Seawater intrusion characterized by the enrichments of Cl, Na, SO_4, Mg, Sr and B is pervasive near the coastline but is highly controlled by faults. A detailed spatial distribution map of groundwater chemistry was constructed as a result of this study, which will be used for groundwater management.