Spatial Distribution Of Uranium In Groundwater Of Korea

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Uranium is the most ubiquitous element among naturally occurring radioactive materials (NORMs) in environmental system because of its abundance in the Earth crust and long half-life ($t_{1/2}$≈4.5×10^9 years). Although the specific radioactivity of natural uranium in groundwater is extremely low, chronic exposure results in kidney problems and potential toxicity in bones. This study was conducted on a nationwide scale for 9 years through 2006–2014 to determine the spatial distribution of uranium in groundwater, and to evaluate geological relationship with uranium occurrence. The great uranium concentrations were found in the midland of South Korea. The bedrock geology mainly comprises plutonic and meta-sedimentary rocks. Granite, granitic gneiss and black shales could act as source rocks for the uranium component in the groundwater. The Spearman's correlation coefficients showed moderate relationship between the uranium and other ions of F, Na, Ca, HCO_3, and SO_4. Additionally, Ca-HCO_3 were predominant type for the investigated groundwater samples. These results suggested that the uranium component could be associated with dissolution of secondary minerals such as feldspar, gypsum, and micas into groundwater. Estimated aqueous species of uranium are uranyl carbonate complexes under neutral and oxidizing conditions as a typical groundwater circumstance in Korea. In particular, the calcium contents facilitates the formation of calcium-uranyl carbonate complexes that increase the uranium mobility in the groundwater environments. Therefore, the uranium contents in groundwater must be continuously monitored and properly reduced for the drinking purpose, especially, at the midland of Korea.