

Schematic Model on the Correlation Mismatch of Uranium and Radon in Granite Aquifer, Korea

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The high levels of radionuclide in groundwater suggest the need for appropriate management even for the naturally occurring hazardous materials. Radionuclide contamination such as uranium (U) and radon (Rn) in groundwater has become a hot issue for the environmental communities and authorities of Korea. The spatial distribution pattern of U and Rn groundwater show preferential localization to the Mesozoic granite area and poor correlation between U and Rn even though Rn is a daughter nuclide of U. Mesozoic granite are divided into Jurassic granite (Jgr) and Cretaceous granite (Cgr) which are the representative igneous rocks of Korea. Both U and Rn concentrations of groundwater are high in the Jgr, while only Rn concentration of groundwater is high in Cgr. The solubility of radionuclide trapped in accessory mineral is depend on geochemical conditions such as pH-Eh, alkalinity and saturation index. Considering the similar geochemical conditions in both granite aquifers, this discrepancy is found to be the results of the difference in U-host minerals and their solubility in the two granite aquifers. The schematic model represent the major U-host mineral and reason for high and/or low U and Rn concentration levels in Cgr and Jgr aquifer. The U-bearing mineral might act as a source of U and Rn in groundwater if they were sufficiently soluble to allow the liberation of U from the lattice of accessory mineral. Zircon and monazite is the major U-bearing mineral in Cgr and they cannot be a source of dissolved U in groundwater owing to their insoluble character in surficial condition. Uraninite is the main U-host mineral in Jgr and it is also insoluble, but unlike zircon and monazite, it can be oxidized to the more soluble uranyl ion or its aqueous complexes through water-rock interactions. Rn gas can be independently accumulated in groundwater despite its significantly low concentrations of dissolved U if there are enough U-host minerals especially in the fractured or highly weathered zone of granite bodies. The solubility contrast depending on the U-host minerals is the geological cause for the disagreement in the concentration of U and Rn in the granite aquifer, Korea.