Evaluation of Uranium Entrapment by Apatite crystallization in hydrothermal fluid.

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The knowledge of behavior of radionuclides in natural waters is a key factor in assessing contamination risks resulting from accidents in nuclear power plants or waste repositiory sites. Although mobility of radionuclides in water-rock systems have been extensively studied at ambient conditions, their behavior at elevated temperatures is largely unknown. This gap of knowledge is especially important while evaluating uptake of nuclides by minerals. At low temperatures, the main considered uptake mechanism is adsorption on mineral surfaces. However, at elevated temperatures (typical for waste disposal containers heated by radioactive decay), mineral dissolution and crystallization could cause entrapment of nuclides in mineral crystal lattices, representing the more stable and safer way of immobilization compared to adsorption. We intend to present data on uranium (U) entrapment by apatite grown at hydrothermal conditions. Phosphates have high affinity in incorporating actinide elements at ambient conditions [1]. Apatite is a common phosphate mineral, which is stable at hydrothermal conditions. In our study, brushite was precipitated at room temperature [2] and further transformed to apatite at hydrothermal conditons. Brushite powder was placed into a Teflon-lined stainless steel autoclave with a 0.5 M NaCl solution, doped with aliquotes of 1000 ppm U standard solution to make total concentrations of 10, 25, 50 and 100 ppm. The experiments were loaded into a furnace at 200°C for 32 days. Experimental products (crystals and fluids) will be analyzed for U with inductively coupled plasma optical emission spectroscopy (ICP-OES). We anticipate presenting U apparent partition coefficients for apatites as a function of U concentration in fluid.

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