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Migration behavior of naturally occurring radionuclides at the Nopal I uranium deposit, Chihuahua, Mexico

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Abstract

Oxidation of pyrite at the Nopal I uranium deposit, Pena Blanca district, Chihuahua, Mexico has resulted in the formation of Fe-oxides/hydroxides. Anomalous U concentrations (i.e., several hundred to several thousand ppm) measured in goethite, hematite, and amorphous Fe-oxyhydroxides in a major fracture that crosscuts the deposit and the absence of U minerals in the fracture suggest that U was retained during secondary mineral growth or sorbed on mineral surfaces. Mobilization and transport of U away from the deposit is suggested by decreasing U concentrations in fracture-infilling materials and in goethite and hematite with distance from the deposit. Greater than unity $^{234}\text{U}/^{238}\text{U}$ activity ratios measured in fracture-infilling materials indicate relatively recent (<1 Ma) U uptake from fluids that carried excess ^{234}U . Systematic decreases in $^{234}\text{U}/^{238}\text{U}$ activity ratios of fracture materials with distance from the deposit suggest a multistage mobilization process, such as remobilization of U from ^{234}U -enriched infill minerals or differential or diminished transport of U-bearing solutions containing excess ^{234}U .

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