Fault-related barriers for uranium transport.

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Conceptual approach to the SNF isolation within the vadose zone of crystalline massifs is based on the assumption that oxidized meteoric water will inevitably destroy assemblages. As a result the most of radionuclides will be leached and transferred in unacceptable concentrations to the environment along hydraulically active discontinuities. This probabilistic scenario does not take into account the fact that different reactive barriers where retention of U(VI) and its reduction again to insoluble U(IV) form could be developed inside the pre-existing fluid conductive discontinuities. These processes were indicated and studied in the vadose zone of the Tulukuevskoe deposit, SE Transbaikalia, Russia, mined by an open pit in welded tuff strata up to the depth of 200 m. The vein-type primary pitchblende mineralization is located within the hydraulically active fault zone and exposed to oxidation and destructive transformation. As the result of hypergen alteration the uranium undergoes to redistribution around the ore body, partial leaching and displacement downstream of redox front along the fault. However, a number of uranium concentrators were indicated inside the fault including: a) oxyhydroxides of Fe, Mn and Ti (hematite, goethite, leucoxene-like aggregates, etc.); b) solid and stable to oxidation organic matter in concentration up to 0.4 mass% (result of interaction between bituminous and U-bearing hydrothermal solutions with formation of hypogene tucholite with U up to 10 mass%); c) aggregates of proto(ferrihydrite) as a result of current microbial activity. Thus, the example of the Tulukuevskoe deposit's vadose zone shows that reactive barriers of high reductive-sorptive ability regarding to actinides can be formed along the fluid conductive fault zones. This phenomenon has to be studied in detail and to be considered during conceptual and numerical filtration-transport modeling as well as in course of the total system performance assessment of SNF underground facilities.