Uranium transfer around volcanic-associated uranium deposit.

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Only about 60% of the annual consumption in the nuclear fuel cycle is provided by primary uranium production at present. Hence, a strong demand for additional exploration of additional uranium resources is identified in many countries. Hence, a large potential exists for unconventional uranium deposits such as mobilization areas in the surroundings of known deposits. Besides environmental aspects a deep understanding concerning the migration and accumulation behaviour of uranium isotopes and related elements is necessary. As an example we will present data of the Tulukuevskoe deposit, SE Transbaikalia, Russia. Here, primary UO_2 mineralization is mined from the Tulukuevsky open pit (TOP). The pitchblende is subject of secondary remobilization and transformations within the vadose zone of the deposit. Seven years of field and laboratory studies indicated that a uranium speciation dominated by carbonate complexes and gradually shifted from the $UO_2(CO_3)_3^{4-}$ to the $UO_2(CO_3)_2^{2-}$ species field with enhanced formation of uranylcarbonates [1]. Three remobilization areas varying in their mineral-chemical composition, transport parameters and the oxidizing degree of the welded tuffs are conceptualized. Sensitivity to the sequential variations in hydrochemistry and isotopic composition of fractured and meteoric waters is considered in the context of spatial-temporal development of the redox front. Identification and exploration of the redox front and of primary and secondary uranium enrichments is facilitated by the µ-energy dispersive x-ray fluorescence (EDXRF) technique that allows the high resolution *in-situ* determination of a number of elements simultaneously at the microscopic scale of typically 100 µm [2]. This method is fast and useful in order to localise primary uranium minerals as well as mobilised and secondary uranium-bearing phases. The results of the study are interesting also as an analogue of destruction of deep repository of nuclear waste.

[1] Petrov V.A. et al. IAEA, **CN-128**: 260-264. (2005)

[2] Rammlmair, D. et al. in *Handbook of Practical X-Ray Fluorescence Analysis* (eds. Beckhoff, B., Kanngießer, B., Langhoff, N., Wedell, R. & Wolff, H.) 640-687 (Springer, Heidelberg, 2006).