

Boron Content and Isotopic Composition of Uraninite and U(VI) Alteration Minerals for Nuclear Forensics Applications

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A first-time investigation of the B content of uraninite and associated alteration minerals has been investigated for samples originating from 18 uranium deposits of varying geochemical origins. Boron concentrations were determined using solution mode-inductively coupled plasma mass spectrometry (SM-ICP-MS), and found to be highly variable, ranging from ~0.5 to ~170 ppm. Correlations between B contents in pristine (unaltered) uraninite and alteration phases (U(VI) minerals) were observed, with higher concentrations in primary uraninite compared to the associated secondary minerals in intrusive, unconformity, sandstone, and metamorphite type U deposits. Tabular sandstone-type U deposits showed less variability in B content between primary uraninite and secondary uranium minerals. $\delta^{11}\text{B}$ values for uraninite and alteration phases were explored using multicollector (MC)-ICP-MS for the purposes of monitoring isotopic fractionation during supergene processes, developing advanced models of U geochemical cycling, and determining the applicability of B concentrations and isotope systematics as nuclear forensic indicators.