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Rare-earth element fractionation in uranium ore and its U(VI) alteration minerals

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Abstract

A cation exchange chromatography method employing sulfonated polysterene cation resin (DOWEX AG50-X8) was developed in order to separate rare-earth elements (REEs) from uranium-rich materials. The chemical separation scheme is designed to reduce matrix effects and consequently yield enhanced ionization efficiencies for concentration determinations of REEs without significant fractionation using solution mode- inductively coupled plasma mass spectrometry (ICP-MS) analysis. The method was applied to determine REE abundances in four uraninite (ideally UO_2) samples and their associated U(VI) alteration minerals. In three of the samples analyzed, the concentration of REEs for primary uraninite are higher than those for their corresponding secondary uranium alteration phases. The results for U(VI) alteration minerals of two samples indicate enrichment of the light REEs (LREEs) over the heavy REEs (HREEs). This differential mobilization is attributed to differences in the mineralogical composition of the U(VI) alteration.