## Mo, Tl and U isotopes in U-ore deposits: Proxies of redox-driven formation processes

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Since the development of MC-ICPMS, transition metal isotopes have been widely used to characterize redox-driven processes in various processes, from the adsorption on organic and inorganic molecules in soils (Fe chelation on organic acids and siderophores, [1], Tl adsorption on ferromanganese or clay minerals [2]) to the study of sediments deposited during major anoxic events (U and Mo fractionation in black shales vs Mn crusts, [3], [4]).

The objective of this study is to assess the evolution of the isotopic signature of several redox sensitive elements – U ( $\delta^{238}$ U,  $\delta^{234}$ U), Mo ( $\delta^{97}$ Mo) and Tl ( $\epsilon^{205}$ Tl) – in various U-ore deposits to evaluate the effects of temperature, crystal chemistry and Eh on isotopic fractionation. Uranium-ore samples from various deposit types (unconformity related, low temperature vein deposits) and temperature-driven ones (magmatic and volcanic related deposits) were examined.

For deposits reflecting a variety of redox conditions,  $\delta^{97}$ Mo and  $\epsilon^{205}$ Tl cover a wide range of isotopic compositions ( $\delta^{97}$ Mo from -17 to +6‰,  $\epsilon^{205}$ Tl from -17 to +9  $\epsilon$ -units). However, both  $\delta^{97}$ Mo and  $\epsilon^{205}$ Tl show negative and positive correlation, respectively, with  $\delta^{238}$ U, in agreement with the expected variations in fractionation from redox-controlled processes [5]. In contrast, deposits that reflect primarily differences in temperature of formation show no correlation among Mo or Tl isotopes and  $\delta^{238}$ U.

Redox processes, including crystal chemistry to some degree, are thus the main drivers for  $\delta^{97}Mo,\,\epsilon^{205}Tl\,$  and  $\delta^{238}U$  fractionation in U-ore deposits.

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