Speciation of natural uranium and thorium in surface waters around a uranium mine (Bistrita Mts., Romania)

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ICP-AES method was used to evaluate the impact of uranium mine dumps on the surface waters from Crucea region (Romania). Speciation modelling indicates that uranyl-carbonate $UO_2(CO_3)_2^{2-}$ and hydroxy uranyl-carbonate $UO_2CO_3(OH)_3^-$ are the main uranium species (see Fig. 1) and that thorium hydroxyl-carbonate $Th(OH)_3CO_3^-$ represents the main thorium species in these waters. Uranium is the most significant trace element in the surface waters nearby the waste rock dumps, sometimes reaching levels op up to 1 mg L^{-1}, well in excess of the Romanian standards limits. A remarkably good correlation exists between dissolved U and the sum of anion concentrations ($NO_3^- + CO_3^{2-} + SO_4^{2-} + Cl^-$) whereas no correlation was found between U and silica, indicating that uranium in these stream waters derived mainly from oxidation of uraniferous bitumen and/or dissolution of carbonates.

The knowledge of uranium concentration in river waters is essential for predicting uranium migration and for the strategies concerning the rehabilitation of contaminated sites. The measurements carried out in the surroundings of a local uranium mine show that the impact of Crucea mine on water quality of Bistrita River is insignificant.

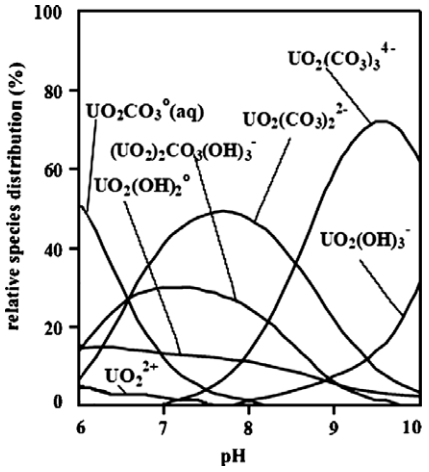

Fig. 1. Speciation of U in the stream waters from Crucea area as a function of pH at 25 °C and 1 bar total pressure for 0.365 mg L^{-1} dissolved U, 0.3 mg $L^{-1}F^-$, 10 mg $L^{-1}Cl^-$, 100 mg L^{-1} SO_4^{2-}, 0.1 mg L^{-1} PO_4^{2-} and $10^{-3.5}$ bar PCO_2.

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U–Pb SHRIMP dating of zircons from the ore-bearing Kharaelakh intrusion (Talnakh district, Russia)

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World-class platinum-group-element (PGE)-Cu–Ni Oktyabr'skoe deposit closely linked to the Kharaelakh ultramafic–mafic intrusion is located in the northwestern corner of the Siberian Craton, Russia. In spite of its significant metallogenic potential, no age constraints for the rocks of the Kharaelakh intrusion are available. Consequently, duration of the ore concentration process responsible to form an economic deposit have never been evaluated quantitatively.

This report presents the first results of uranium–lead dating of 19 grains of zircon, which were extracted using *ppm-mineralogy* technique (NATI Research JSC, St. Petersburg, Russia) from drill core samples of the Kharaelakh intrusion. Rocks investigated include olivine-containing gabbro, olivine gabbro, melanotroctolite and plagioolivinite. Isotope geochemical data (24 analyses) were determined with secondary ion mass spectrometer SHRIMP-II at VSEGEI.

Petrographic inspection revealed two groups of zircon (i.e., ZR-1 and ZR-2). Rare grains of ZR-1 represent colourless corroded *cores*, whereas ZR-2 occur as (1) rims on ZR-1 and (2) single subeuhedral beige crystals. Both zircon groups yield solid mineral inclusions, but only ZR-2 host melt inclusions that predominantly contain glass. Zircons are characterized by a fuzzy cathode luminescence, frequently with a total absence of zoning.

Grains of ZR-1 are characterized by relatively low concentrations of thorium and uranium (411–509 and 393–427 ppm, respectively), whereas contents of Th and U in ZR-2 vary in the range 1758–9510 and 1025–3571, respectively. On the binary Th–U diagram ZR-2 grains (Th/U = 1.92–4.86) are clearly distinct from ZR-1 (Th/U = 1.08–1.23) but overlap with the field of mantle metasomatic derivates (MARID).

A significant time gap represented by two groups of zircon ages (ZR-1, 347 ± 16 Ma and ZR-2, 265 ± 11 Ma) likely represent the timing of magmatic crystallization of two distinct zircon populations. Indeed, geochemical and mineralogical evidences allow to suggest that older zircons may have been formed at high temperatures, whereas younger zircons crystallized more rapidly at relatively lower P–T parameters.

Our new findings are in a good agreement with assumption about the interaction of distinct magmatic sources and a prolonged duration of component fractionation in the magmatic system.

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