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.

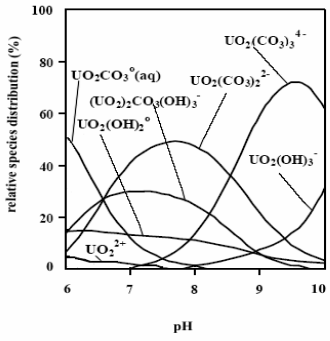

Fig.1. Speciation of U in the stream waters from Crucea area as a function of pH at 25°C and 1 bar total pressure for 0.365-mg·L^{-1} dissolved U, 0.3-mg·L^{-1} F^-, 10-mg·L^{-1} Cl^-, 100-mg·L^{-1} SO_4^{2-}, 0.1-mg·L^{-1} PO_4^{2-} and $10^{-3.5}$ bar P_{CO_2}.