Natural actinides in the sediments associated with the Crucea uranium mine (East Carpathians, Romania)

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Between 1962 and 2007, the National Company of Uranium (former Romanian Autonomous Administration for Rare Metals), mined over 1,200,000 tones of pitchblende ore in the East Carpathians. These intensive mining operations have created over 30 solid mining dumps in Crucea-Botusana area (Bistrita Mountains). In this paper we present data from four main tributaries of Bistrita River (i.e. Crucea, Troaca Gavanului, Gavan and Cracul Rau creeks).

The bottom sediment samples collected from mining area show a wide range of total uranium content from 17.20 to 5023.96 $mg \cdot g^{-1}$ with a mean value of 246.81 $mg \cdot g^{-1}$ (dry wt.). Total thorium concentration in sediments collected from Crucea site ranged from 18.70 to 6643.92 $mg \cdot g^{-1}$ with an average of 391.17 $mg \cdot g^{-1}$ (dry wt.). This indicates that the adsorption of the radioactive elements by the sediments is high and variable, influenced by the ore dump – sample relationship. There is a decrease in the concentrations of U and Th in the stream sediments downstream from the Crucea uranium ore.

Strong correlation of uranium with thorium in the sediments (r = 1; $P<0.05$; n = 16) suggests that unspecific co-precipitation dominates over selective adsorption according to valence and ion sizing.

The pollution degree of the bottom sediments shown that U, Th and Pb presents medium and punctual high values, while the rest of the elements presents concentration close to the background values or lowers to them. 71% of uranium from bottom sediments is present as primary fractions and 21% is associated to carbonates. Thorium resulted even more insoluble (94% in primary fractions). In view of the substantial mobility and bioavailability of the fractions, this is not an alarming feature. Lead is always associated mainly with carbonates and organic matter; the insoluble fraction is generally poor. These indicate that the carbonate absorption play an important role for the partitioning of lead. However, if the geochemical conditions it happens to be changes, the surface sediments could act as a future source of actinides and heavy metals to the above water body.

Assessment of metal availability in mining dump soils using chemical extractions (Zlatna area, Romania)

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Past hazardous waste disposal in Romania represents the epitoms of using the environment as a free good. Zlatna, a Romanian copper smelting town, is known as of the top 10 pollution "hot spot" in Romania. The very large tailings dams, which has receive waste slurries from Zlatna copper smelter, and old mining wastes are located close to Ampoi River. The soil structures in the area consist of cambiosoils, luvisoils and regosoils, with a permeability of 3 mm/sec. In situations like this the risk can be assumed to be substantial. The objectives of this study it was: 1) to determine the type and concentration of heavy metals retained in soil fractions; 2) to investigate their potential ecological significance. Information regarding the retention of these metals was required in order to evaluate their availability for release that may occur under environmental conditions and to provide a basis for developing a remediation procedure.

The soils was analysed as follows: (a) Na-EDTA extraction, (b) sequential extraction. Heavy metal contaminated soil was partitioned into fourth available fractions (F), namely exchangeable, carbonate, Fe/Mn oxides, oxidisable oxides and sulfides, according to the form in which the heavy metal bound with soil constituents. The EDTA extractable fraction is considered to be an estimate of the soil-bound metal fraction that can be extracted by plant roots.

The labile fractions measured were: F12 [Cu (2.47%), Co (3.63%), Cr (1.03%), Ni (40.2%), Pb (1.21%, Zn (5.74%) and V (<1%)]; F123 [Cu (5.047%), Co (9.04%), Cr (1.3%), Ni (42.02%), Pb (3.17%, Zn (10.10%) and V (<1%)]; F1234 [Cu (30.99%), Co (26.22%), Cr (49.07%), Ni (59.21%), Pb (20.95%, Zn (42.84%) and V (42.32%)]. Zn, Ni, Cr and V appeared to be less strongly bound to the soils than the rest of the studied metals. The bioavailability of the metals (EDTA extraction) from the soil decrease in the following order: Ni > Co > Zn > Pb > Cu > Cr > V.

Although from our research it resulted that the heavy metals concentrates very little in the exchangeable fraction, the isolation of the mineral fraction of soil rich in metals helps us in the future identification of the links between the bioavailability and the pedogenesis, connections which control the cycle of the heavy metals. Grounded on these results, we were able to prove that the examined tailings can represent an impact on the environment, which constitute an argument in favor of the initiation of a program of remedying the quality of the environment from this mining zone.