Geochemical characterization of uranium mill tailings

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In France, uranium mines were exploited between 1945 and 2001, leading to the production of 76,000 t of U and 50 Mt of mill tailings stored on 16 storage sites. Studies are being performed to determine the long term behaviour of these storage sites, focusing on the mobility of U and ^{226}Ra.

Following previous work [1] on mill taillings issued from dynamic treatment, coring and sampling were performed in four storage sites, including heap leaching tailings. All the tailings studied come from sulphuric acid treatment of granitic ore. Radio-geochemical variations were assessed through analyses on 10 to 20 samples for each site. Focus was put on the mobility of U and ^{226}Ra by characterizing their granulometric distribution and performing sequential leachings. Concurrently, water-rock interactions were constrained by pore water sampling on one site.

Samples issued from each site feature strong similarities, typical of a mix of tailings and water treatment sludges. Three main mineralogical families are identified: “inherited minerals”, intially present in the granitic rock (quartz, micas, K-feldspars, ancillary minerals such as sulfides and oxides), “refractory” U-bearing minerals (uraninite, coffinite) and newly formed minerals. The latter are clay minerals and Fe^{III} oxy-hydroxides (from the alteration of the granite host rock), gypsum (due to reagents input during the ore treatment) and U-phosphates (both inherited and newly formed). Geochemical modellings indicate the presence of soddyite controlling the [U] in the porewater.

The average U content is 100 ppm. The ^{238}U/^{226}Ra disequilibrium is constant in dynamic treatment tailings, consistent with a homogeneous ore treatment and a limited migration of U and Ra. This ratio is more variable in heap leaching tailings, suggesting a heterogeneous ore treatment.

All these results are considered in the modelling of the long term evolution of mill tailings, taking into account the sorption properties of the newly-formed minerals.

[1] Somot *et al*. (2000) *Tailings and Mine Waste ’00*, 343-352.

The importance of dry deposition in estimating nitrogen input in peat bogs

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It has been recently reported that rain-fed peat bogs in pristine areas store more nitrogen (N) than the amount of N that could have been supplied by atmospheric deposition. In such calculations, cumulative input of nitrate and ammonium are compared with the total N content in ^{210}Pb-dated peat cores. We have performed a similar comparison in N-polluted Central Europe. Four sites exhibited 2 – 3 times higher N pool size in *Sphagnum* peat since 1880 than cumulative atmospheric input. This discrepancy might be explained by a large contribution of dry deposition. Dry deposition depends on the surface roughness (leaf area index) and is extremely difficult to measure directly in peatlands. In a first approximation, we have used data on spruce canopy throughfall as a proxy for *Sphagnum* interception of airborne N. At 6 sites of the monitoring network GEOMON, N input via spruce throughfall was smaller than via open area deposition. At another 7 sites, N input via spruce throughfall was slightly higher than via open area deposition (59 vs. 26 kg N ha^{-1} yr^{-1} in Orlicke Mts. was an extreme). It appears that dry deposition may not fully explain excess N in wetland ecosystems.

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