# Mineral transformations and contaminant release dynamics under wetting-drying cycles in simulated Hanford sediments

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In order to successfully predict waste plume migration and understand possible mechanisms of radionuclide release after removal of the caustic waste source at the Hanford Site, the impact of background pore water (BPW) on impacted sediments and transport processes have to be elucidated. Using Hanford sediments (HS) weathered by synthetic tank waste leachate (STWL) and co-contaminated with Sr, Cs and I, we investigated mineral transformation and sorbate speciation over a matrix of field-relevant gradients in contaminant concentration, $P_{CO2}$, and reaction time. Further, we monitored the elemental release induced by BPW infiltration through HS packed columns.

Characterization of STWL reaction products using EM and quantitative-XRD indicate the importance of STWL reaction conditions on the kinetics of mineral transformation during contact with STWL (native silicates → zeolite → sodalite → cancrinite). Additionally, we found that $P_{CO2}$ affects calcite weathering such that elevated $Ca^{2+}$ release in absence of $CO_2$ promotes strätlingite formation.

Sediments reacted for 12 months with various STWL solutions were subjected to both continuous flow and four 24h dry/wet leaching cycles with BPW. After each drying event, large $NO_3$ pulses were observed in effluents, but these were not accompanied by corresponding Si pulses that would signal zeolite/feldspathoid dissolution. Wetting-drying increased $NO_3$ desorption 4-5 fold over continuous flow experiments. Sr and Cs desorption is diminished in the wet/dry cycle experiments relative to continuous saturated or unsaturated flow, except for Sr in cases where $CO_2$ was eliminated from the STWL weathering reaction.

Our results indicate that STWL composition, $P_{CO2}$, and reaction time strongly influence contaminant sequestration mechanisms and, therefore, the rate and extent of subsequent re-mobilization and transport in Hanford vadose zone sediments.

# Environmental geochemistry of Argemela Mine area (Barco, Central Portugal)

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Mining and mineral-processing activities affect relatively small areas, but they can have a large local impact on the environment. The Argemela mining area is located at Central Iberian Zone, central Portugal. The mineralized veins intersect the Cambrian schist-metagraywacke Complex and is situated at about 13 km, to the east of the famous wolfram Portuguese producer, Minas da Panasqueira. Argemela and Panasqueira mines are included in the metalogenetic Sn-W province of Portugal. The Sn veins contain mainly quartz, albite, moscovite, lepidolite, cassiterite, columbite group minerals, amblygonite-montebrasite, pyrite, arsenopyrite and pyrrhotite.

At Argemela mine, the underground exploration of cassiterite was dominant and ceased since fifty years ago. The tailings and rejected materials were deposited on the ground and are exposed to the air and water that can change the environmental geochemistry of the area.

The geochemical soil data show anomalies in the dependency of the mineralizations and mining activities. Representative soil samples of the local geochemical background and soils collected inside mine influence were analysed. Soils inside mine influence present higher electrical conductivity (62 μS/cm), Cd (28 mg/Kg), Pb (21 mg/Kg), Cu (4990 mg/Kg) and Zn (1168 mg/Kg) contents than soils collected outside mine influence (EC= 29 μS/cm; Cd = 0.3 mg/Kg; Pb = 2 mg/Kg; Cu = 35 mg/Kg; Zn = 51 mg/Kg). Most of soils are contaminated in Cu and Zn and must not be used for agriculture and human residences. Plants growing on the abandoned mine area have been study for their biogeochemical indication and mine remediation potential. The obtained results indicate that *Erica cinerea* L., *Cytisus striatus* and *Cistus Ladanifer* are adaptated to enriched Cu, Zn and Ni soils. *Erica cinerea* roofs tend to accumulate Cu (27 mg/Kg), while leaves from *Cytisus striatus* (9 mg/Kg) presents the highest Cu content of this species. Leaves from *Erica cinerea* L. and *Cytisus striatus* contain higher Zn, Cr, Ni and Pb contents than respectively roofs and stalks. The informations obtained for these species allows biogeochemical delineation of areas from similar soil anomalies.