

Reactive transport modelling of weathering processes in intensely stratified mine tailings

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Abstract Reactive transport simulations have been applied to investigate possible effects of stratification on the potential of sulfide-bearing mine tailings to form protective cemented layers and to retain toxic elements. Our research is based on a German tailings site, where material is intensely stratified on a mm-cm scale. The computational domain was defined as an one dimensional column the size of a microscopic thin section of 22 mm length. Detailed quantitative information on changes in mineralogical composition was obtained by mineral liberation analysis (MLA). The resulting reactive transport model was applied to simulate Acid-Rock-Drainage (ARD) formation, the interaction of ARD with the tailings sediment, the formation of cemented layers, and the fate of arsenic, zinc, and lead. The results show that the identity and spatial distribution of weathering products is strongly dependent on local variations in the primary mineral assemblage.

Key words reactive transport modelling; mine tailings; mineral liberation analysis; weathering; cemented layers; metal retention; unsaturated zone