

Nanoparticles from evaporite materials in Colombian coal mine drainages

Luis F. O. Silva; James C. Hower; Guilherme L. Dotto; Marcos L. S. Oliveira; Andrea L. Moreno

Abstract

Ultrathin and nanometric materials (minerals and amorphous phases) are detected in transitory deposits of potential hazardous elements (PHEs), especially in acidic coal mine drainages. The main goal of this work was to evaluate the occurrence of PHEs in nanoparticles (NPs) in evaporative structures in coal mining areas with high concentrations of PHEs. The precipitates were sampled in several coal mining areas in Colombia, with the purpose of evaluating the geochemical and environmental structures. In the present work, to better diagnose areas affected by coal mining, an innovative analytical procedure is proposed to define the association between PHEs in mine drainage sediments. The procedure includes the analytical study with X-Ray Diffraction (XRD) and advanced electron microscopy, before and after a series of sequential extractions to separate amorphous, magnetic, and crystalline compounds. Of the three main types of precipitates identified, the yellowish precipitates had the highest amounts of PHEs while the white precipitates had only small amounts of PHEs and the greenish precipitates contained TiO_2 nanoparticles. The results from this study will be usable for more than fifty countries that have coal mine drainages.

Keywords

Coal drainages; Massive minerals precipitation; River sediments; Environmental contamination