Temperature-induced phase transition and remobilization of ecotoxic elements in AMD colloidal precipitates

CONSANI, S.[1]*, CARBONE, C.[1], SALVIULO, G.[2], ZORZI, F.[2], DINELLI, E.[3] AND LUCCHETTI, G.[1]

[1]DISTAV, Università di Genova, Italy
(*correspondence: sirio.consani@edu.unige.it)
[2]Dipartimento di Geoscienze, Università di Padova, Italy
[3]Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università di Bologna, Italy

Colloidal particles, as a direct consequence of their small size, have enormous sorption capacities due to their very high surface area to volume ratio, and can play a major role in the control of the dispersion and mobility of metal ions or organic pollutants [1]. Acid Mine Drainage (AMD), a weathering process of sulphides in mining areas, leads to the generation of very acidic waters with high amounts of dissolved SO_4^{2-}, Fe and other ecotoxic elements such as Cu, Zn, Pb, As, Co, Ni, Cd and Hg [2]. In AMD settings, the formation of amorphous to semi-crystalline, usually metastable, colloidal nanoparticles occurs as loose suspension acting as sinks for chemical elements and as a secondary source of pollution through destabilization or desorption reactions. Thus, the stability of colloidal phases and their behaviour during phase transitions is a critical point to determine the fate of ecotoxic elements in AMD environment [3]. In this work, three AMD colloidal precipitates and six fluvial precipitates generated by the mixing between mine and stream waters were sampled and their capacity to retain in the solid fraction ecotoxic elements after temperature-induced phase transition was tested. To study temperature-induced phase transition, High Temperature XRD were performed, and to assess the ecotoxic elements release potential, bulk leaching tests on unheated and heated at different temperatures aliquots were carried out. Bulk leaching tests were performed with sea water and deionized water in order to simulate sea and rain water-precipitates interactions. The results evidenced that the precipitates heated at high temperature have the minimum metals release, while those heated at low temperature show the highest metals release in solution. Moreover, the concentration of ecotoxic elements in the leachates was sensibly higher for sea water, which mobilized more efficiently the elements form the solid fraction.

[1] Schemel *et al*. (2000), *Appl. Geochem*. **15**, 1003-1018. [2] Blowes *et al*. (2014), *Treatise of Geochemistry* **11**, 131-190. [3] Acero *et al*. (2006), *Geochimica et Cosmochimica Acta* **70**, 4130–4139