EXAFS evidence of simultaneous As and Pb mineral incorporation

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Dissolved potentially toxic elements (PTEs) in acid environments, such as those produced during and after mining and metallurgical activities, may be mobilized and transported extensively to surrounding locations promoting the contamination of soils, sediments, ground and surface waters [1]. However, high concentrations of PTEs can be naturally attenuated by a series of pH-buffering, precipitation and sorption reactions when fresh secondary Fe oxides, oxyhydroxides and oxihydroxysulphates (i.e. ferrihydrite, goethite, hematite, schwertmannite, jarosite), along with other low crystalline Fe phases are formed in these scenarios [2]. The purpose of this work is to deepen into the geochemical understanding of Fe-bearing secondary minerals behaviour when PTEs are present either during or after its formation by means of X-Ray Absorption Spectroscopy (XAS).

Natural samples were collected from soil and sediments affected by mining waste-weathering processes at three different locations in Mexico based on in-situ X-Ray Flurescence analysis. Also, series of pure and PTE-dopped Fe-bearing secondary minerals were synthesized in order to get standards for comparison. EXAFS spectra of soil samples were fit by linear combinations of model compounds spectra.

Lead and molecular-level arsenic speciation have been determined in soil and sediments impacted by acid discharge derived from mining-waste weathering by combining conventional techniques (XRD, FTIR, chemical digestion) with XAS. Both As and Pb have been found incorporated into the mineral structure of Fe-oxihydroxysulphates (jarosite, schwertmannite), indicating that both elements can be efficiently removed simultaneously while these secondary phases are formed. Subsequent thermodynamic stabilization of these phases due to incorporation of PTEs is likely [3, 4].

The results of this work have important environmental implications: Fe-bearing secondary minerals play a major role in controlling the water chemistry of many acidified streams by structural incorporartion of PTEs.

[1] Sparks (2003) *Environmental Soil Chemistry*. Academic Press, San Diego. [2] Carbone *et al*. (2013) *J. Geochem. Explor*. **132** 188-200. [3] Acero *et al*. (2006) *GCA* **70**: 4130-4139. [4] Majzlan (2011) *EST* **45**: 4726-4732.