Long term behavior of iron and zinc in steelmaking wastes.

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Blast Furnace Sludges (BFS), by-products of iron pig making, are characterized by relatively high contents of trace metals (Zn, Pb, Co, Cr) and iron (20-30%) [1, 2]. During the last century, such wastes were released in the environment (soils and aquatic media), and underwent various weathering conditions (anoxic or oxic conditions). Since iron bearing phases are widely reported to readily scavenge trace metals, specific investigations were perfomed to unravel the evolution of both iron and zinc speciation in those various physico-chemical conditions. A set of BFS was collected on ancient sites and from an active iron pig plant, including freshly produced and weathered BFS samples. A multi-scale analysis was performed using the combination of microscopic and microspectroscopic techniques (XRD, TEM, microXRF, and bulk and micro-XAS at the Fe and Zn K-edges). In anoxic conditions, besides the predominance of zinc sulfides, TEM and XAS data evidenced supplementary Zn bearing phases, including Zn adsorbed onto iron oxyhydroxides and Zn inserted in neoformed iron rich phyllosilicates. The neoformed Fe-rich clay minerals appear to be related to the oxidation of metallic iron spheres and/or iron oxides (mainly wustite and magnetite). The latter Fe bearing minerals are ubiquitous in BFS as evidenced by XRD patterns and XAS spectra at the Fe K-edge. Furthermore, TEM investigations strongly suggest a link between the formation of Fe-rich clays and Zn sulfides. In oxic conditions, Zn was shown to be mainly included in double lamellar hydroxydes for high Zn contents (15-20%), or in the neoformed phyllosilicates for lower Zn contents (about 0.1%).

[1] Kanbar et al. (2017) Sci. Total Environ. **599–600**, 540–553. [2] Kretzschmar et al. (2012) Environ. Sci Technol. **46**, 12381-12390