Controls on Bioavailability and Mobility of Lead, Antimony and Arsenic Associated with Iron(III)- Oxyhydroxides and Organic Matter in Forested Soils

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Smelting of Au, and Cu-Zn ores in the Trail, British Columbia, Canada, region has been a major emitter of metal(loid) contaminants, predominately Pb, As, Zn and Cd, in the region since 1896 [1]. Surface soil horizon samples contain up to 2 wt% Pb, 980 ppm Sb and 1010 ppm As, concentrations 140, 50 and 85 times the Canadian soil quality guidelines for residential areas, respectively. Forested soils contaminated by smelting activities are studied to determine the behaviour and mobilisation potential of these elements in the environment. In this study, we investigate the association of Pb, Sb and As with specific soil organic and authigenic mineral phases using sequential extractions. The potential bioavailability of Pb, Sb, and As are examined using a 0.01M $LiNO_3$ solution. Studies have shown that Pb forms stable complexes with soil organic matter [2] and Sb and As are bound as inner-sphere complexes to Fe-oxyhydroxides [3], an association explored in this study using the dithionite – Na-citrate method. The association of Pb, As and Sb with soil organic matter, an important sink for metal(loid)s of concern [3], is investigated using pyrophosphate and peroxide extraction procedures. The examination of the association of metal(loid)s with mineral soil phases and organic matter through sequential extractions sheds insight to the potential mobilisation and attenuation of Pb, Sb and As in the soil system and, in turn, the biosphere. Supplementing the standard predictive risk assessment, which is based solely on bulk geochemical analysis, with the mineralogical and geochemical behaviour of these metal(loid)s will improve the development of procedures for land restoration projects impacted by Pb, Sb and As contamination.

[1] Goodarzi, Sanei & Duncan (2003), *GSC Bulletin* **573** 1-49. [2] Gao, Pearce, Jones, Taylor & Taylor (1997), *Enviro. Geochem. Health* **21** 13-26. [3] Dousova, Buzek, Herzogova, Machovic & Lhotka (2015), *Eur. J. Soil Sci.* **66** 74-82.