Heavy metals characteristics in the gold and iron mine soils in the upstream area of Miyun Reservoir

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Metal contamination of soil from anthropogenic sources is an important global issue. Some recent studies have worked on the importance of metal contamination of soils in ecologically sensitive areas that are the source sites of drinking water. In this study, a preliminary survey of soil contamination had been carried out around the Miyun Reservoir, Beijing, China. Some results as follows: (1) the metal concentrations in the gold and iron mines soil samples exceed the background soil levels in Beijing, and the content of heavy metal in gold mine soils are higher than those of iron mine soils with Ti and Mn as an exception; the pollution of heavy metals in mine soils have reached a serious degree, and Hg is the most serious pollution element of all selected elements in gold mine soils. (2) Selected elements have been found the residual fractions is the most predominant in all gold and iron mine soil samples; the distribution of Ni in gold mine was similar to that of iron mine; Mn had the greatest acid-soluble per portion (27.95% and 23.24%, respectively) reflecting that Mn was more mobile and potentially more bioavailable in the study areas; the acid-soluble and reducible portion of Cd (20.06%, 16.45%) in gold mine was significantly higher than that of iron mine (3.70%, 1.36%), and as well as Pb. (3) the selected heavy metals in both soil samples have different degrees of enrichment; the pollution degrees of gold mine soil samples was aligned to Pb>Hg>Cd>Cr>Cu>Zn>Co>As, while Pb>Cd>Cr>Co>Cu >Zn> Hg>As for iron mine soil samples.

Zn immobilization by *Lumbricus terrestris* calcium carbonate biomineralized granules

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Many species of earthworm secrete granules of calcium carbonate. In this study we investigated the incorporation of Zn into granules produced by the earthworm *L. terrestris*, cultured in an agricultural soil (Hamble) amended with Zn and a soil from a former Zn mine (Cwmystwyth, UK).

Bulk and μ-X-ray diffraction were used to determine granule mineralogy. Both vaterite and calcite were detected.

Synchrotron μ-X-ray fluorescence (XRF) was used to determine the distribution of Zn within granules. Zn occurred in concentric zoning (Fig. 1) and as discrete hotspots. X-ray absorption spectroscopy was used to determine the Zn bonding environment within the calcium carbonate granules. The Zn exhibited several different speciations; replacing Ca in the calcite structure and as the minerals hydrozincite, $Zn_5(CO_3)_2(OH)_6$ and aurichalcite, $(Zn,Cu)_5(CO_3)_2(OH)_6$.

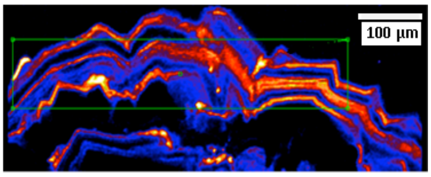

Figure 1: XRF map showing Zn distribution as concentric rims on the edge of a slice of a granule originating from Hamble soil amended with 750 ppm Zn. XRF average Zn concentration for this granule is 64 ppm and the bulk concentration from digested granules from this treatment is 164 ppm.

Zn is immobilized within biomineralized granules. Although, the degree of Zn uptake and granule production rates indicate that these biogeochemical processes have a less significant impact on Zn mobility comparied to that for Sr [1] and Pb [2] at contaminated sites.

[1] Brinza et. al. (2013) *Geochim. Cosmochim Acta* DOI, 10.1016/j.gca.2013.03.011; [2] Fraser et. al. (2011) *Geochim Cosmochim Acta* **75,** 2544-2556.

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