

Standard Project

Experimental Report template

Proposal title: Relating Pb speciation and trophic transfer in a simplified food chain in a Pb contaminated site		Proposal number: 20150573, 30-02-1095
Beamline: BM30B	Date(s) of experiment: from: Nov 26, 2015 to: Dec 2, 2015	Date of report: Jan 2016
Shifts: 18	Local contact(s): Isabelle Kieffer	<i>Date of submission:</i>

Objective & expected results (less than 10 lines):

The study aimed at investigating the fate of Pb in a simplified trophic chain (soil – plant – snail) implemented in a site contaminated by past Pb mining and smelting activities, in Vosges area in France. The site presents a gradient in Pb contamination. We have chosen two points in this gradient, a forest soil highly contaminated with Pb, and a soil from a kitchen garden in the village for EXAFS analyses. Microcosms were installed on site by placing snails in cages on the soil with natural vegetation. The purpose of the experiment was to determine Pb speciation in the various compartments (soil, litter, plants and snail digestive glands) by Pb LIII-edge EXAFS spectroscopy. Currently, there is some knowledge on Pb chemical forms in soils contaminated by smelters and shooting range activities. There is little knowledge on Pb speciation in plants, and even less in animals. There is no study relating Pb speciation, Pb bioavailability and Pb transfer in a trophic chain. Results obtained should help to improve models of trophic transfer and risk assessment in contaminated sites.

Results and the conclusions of the study (main part):

We have recorded the EXAFS spectra for the forest soil (CF28) and its residues after various chemical extractions, for the litter, grass plants growing on this soil, and digestive glands of snails exposed to the medium for 2, 3 and 4 months. A soil collected in a kitchen garden in the village was studied as well. For each soil, three replicates coming from different microcosms were studied. Slags from local tailings were studied as well (Fig. 1).

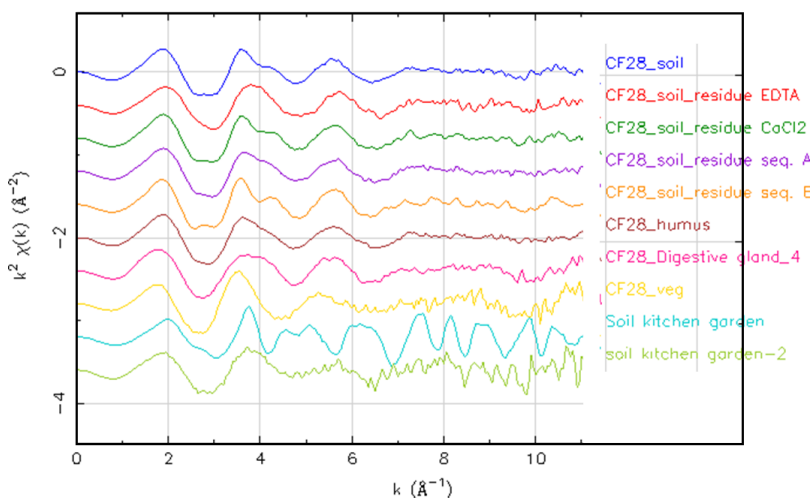


Figure 1: Selection of Pb LIII-edge EXAFS spectra obtained for the soil and animal samples.

The set of EXAFS spectra was treated by principal component analyses (PCA) and linear combination fits (LCFs). An example of LCF is given in Fig. 2.

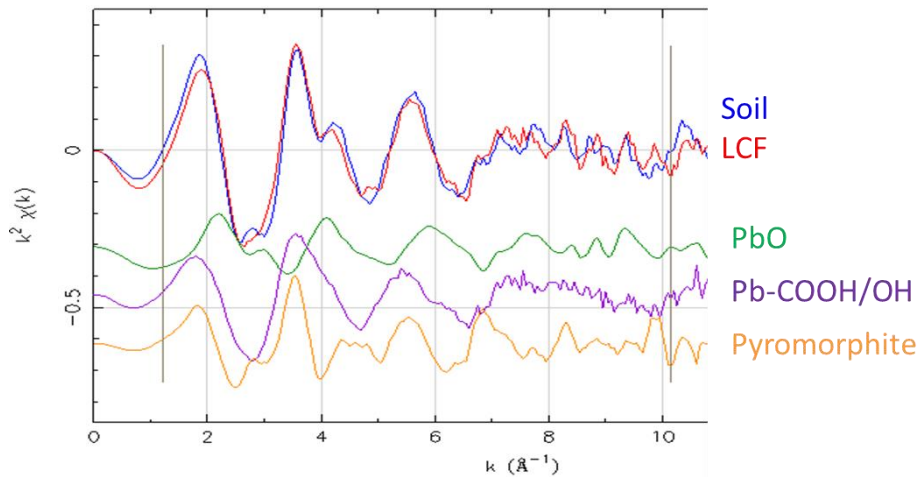


Figure 2: Example of linear combination obtained.

Results showed a complete change in speciation for Pb, from the original contamination (mostly Pb sulfides) to the present forest soil, and a possible recent contamination by slags for the kitchen garden soil. Results for the plant and animal samples are still under interpretation. The results on speciation will be combined with results on the bioavailability and trophic transfer of Pb, already determined.

Justification and comments about the use of beam time (5 lines max.):

The experiment was highly successful, we manage to get spectra of good quality for samples containing down to a few tens of mg kg Pb. The cryostat run very well, as well as other components of the beamline.

Publication(s): in preparation