Standard Project

Proposal title: Mechansims of metal uptake by Tillandsia, an original bioindicator				Proposal number: 20130612
Beamline: FAME (BM30B), ESRF	**Date(s) of experiment:** from: 6 Nov 2013	to:	12 nov 2013	**Date of report:** 4 Feb 2014
Shifts: 15	**Local contact(s): Isabelle Kieffer**			*Date of submission:*

Objective & expected results (less than 10 lines):
Tillandsia have a high potential as bioindicators of atmospheric contaminants, but the mechanisms involved in metal uptake and detoxification are still unknown. Such information is important for a finer use of these biomonitors. Moreover, thanks to their morphological and physiological characteristics intermediate between higher plants and lichens, tillandsia are interesting models for a more global understanding of foliar uptake of contaminants. As part of an interdisciplinary project in a mining and smelting area in Bolivia, tillandsia were sampled and characterized. The purpose of this experiment was to determine the speciation of Pb and As in the plant by EXAFS spectroscopy and compare it with the sources particles (from mine tailing, from smelters and from urban environment).

We expect different metal transfer and transformation rates as a function of the source particles and of the metal investigated (a cation and an oxyanion), and original detoxification mechanisms.

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

Samples studies were the following:

- Tillansdia plants transplanted and exposed for 5 months in three locations of Oruro area : Center (C), close to the smelter (V), and the mine (SJ)
- Tillandsias growing naturally on site, sampled at C and SJ
- Passive filters exposed for 5 months to atmospheric fallouts, placed at C, SJ and V
- Slags from the smelter
- Filter from a mechanisal filter respirator used by miners
- Metallic sulfides originating from the mine

Tillandsia samples, slags and minerals were ground, diluted in BN if necessary, and pressed as 5 mm diameter pellets. Filters were cut in 5 mm discs and superimposed in the cryostat sample holder. Pb LIII-edge EXAFS spectra and As k-edge XANES spectra were recorded at 10°K in fluorescence mode.
All spectra were fitted by linear combination fits (Figure 1 and 2). The comparison of Pb and As speciation in the various samples, together with chemical analyses and microscopic observations, will provide some insights on the fate on the contaminants in the atmosphere and associated health risks, and on metal transfer and detoxification mechanisms in the plant.

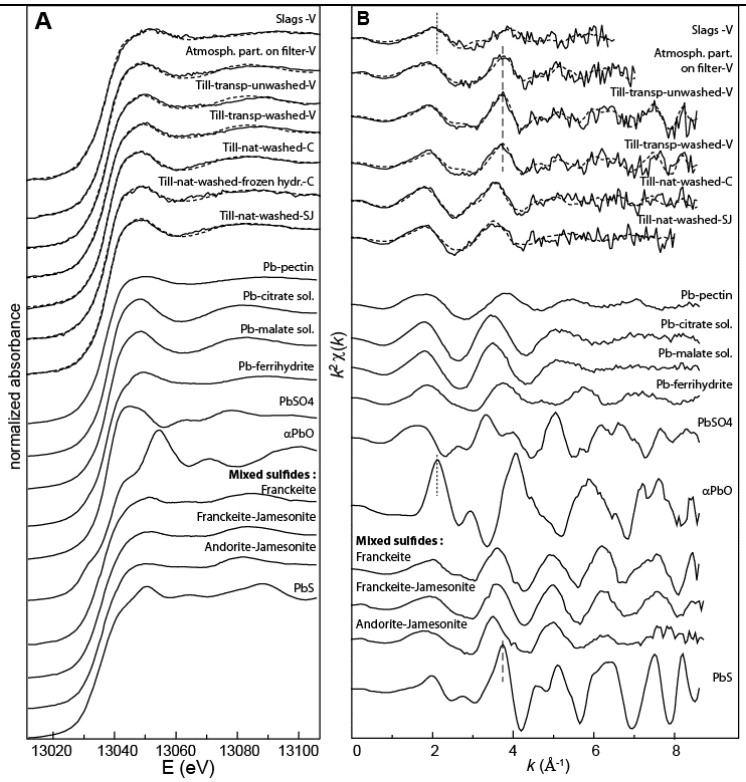

Figure 1. Pb LIII-edge XANES (A) and EXAFS (B) spectra for Pb reference compounds and samples from the mining and smelting area, and linear combination fits (dashed lines).

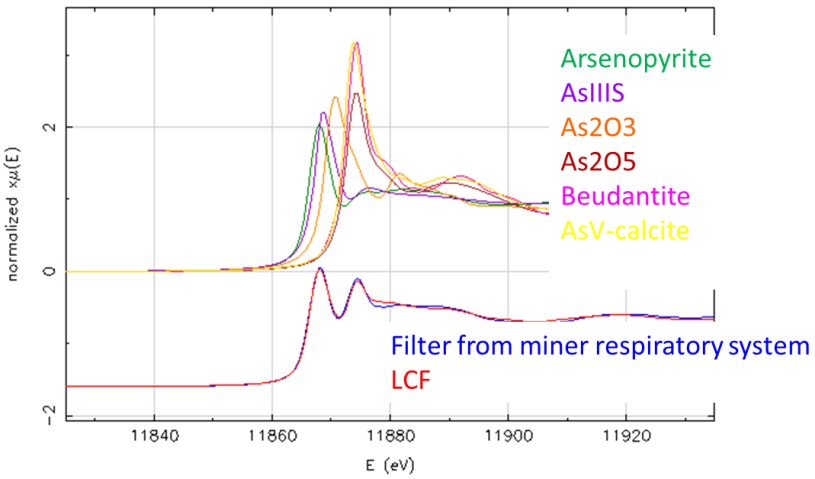

Figure 2. As K-edge XANES spectra for As reference compounds and for one sample, and linear combination fit.

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

The beamline run very smoothly during the experiment, the change in energy and cryostat loading were done with no problem.

Publication(s):

- Two publications in preparation

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