	Experiment title: Mechanisms of long term Co trapping in deeply weathered ultramafic rocks from New-Caledonia	Experiment number: 30-02 1042
Beamline: BM30B/ FAME	Date of experiment: from: 21 nov 2012 to: 26 nov 2012	Date of report: Sep 2, 2013 <i>Received at ESRF:</i>
Shifts: 17	Local contact(s): Olivier Proux	
Names and affiliations of applicants (* indicates experimentalists): Emmanuel Fritsch Guillaume Morin* Gabrielle Dublet* Farid Juillot Vincent Noël*		

Report:

The aim of this project was to assess the behavior of Co in deeply weathered ultramafic rocks in New Caledonia, where Co is scavenged over very long time scales by Mn- and Fe-oxides. Indeed, the above considerations emphasize the strong need for a spectroscopic analysis aimed at elucidating the relative importance of the various mineral species that can hold cobalt at the different weathering stages along lateritic regoliths developed on ultramafic rocks in New Caledonia. This information will allow to link the relative Co-trapping efficiency of these various mineral species with the geochemical behavior of Co as described with mass-balance, and more generally to better depict the processes that control long term Co dynamic in the environment.

Due to the high iron concentration in the laterite samples studied (10 – 45 wt% Fe), the use of a specific setup was required to properly detect the Co K α emission line. For this purpose, we used an angle dispersive setup to select the Co K α fluorescence line during the XANES and EXAFS measurements at the FAME beamline. The sample fluorescence was analyzed through a Bragg reflection on spherical Si single crystals analyzers focusing on the sample. The analyzed signal was collected on a Si pin diode.

Thanks to a great dependence of the XANES spectrum on the Co oxidation state (Co²⁺ and Co³⁺) and on the local structure of the Co-bearing mineral phases, the speciation of Co in the analyzed samples could be well determined by using a Linear combination fitting approach. For this purpose, we have recorded XANES data on a large set of natural and synthetic Co model compounds minerals phases, including sorption samples.

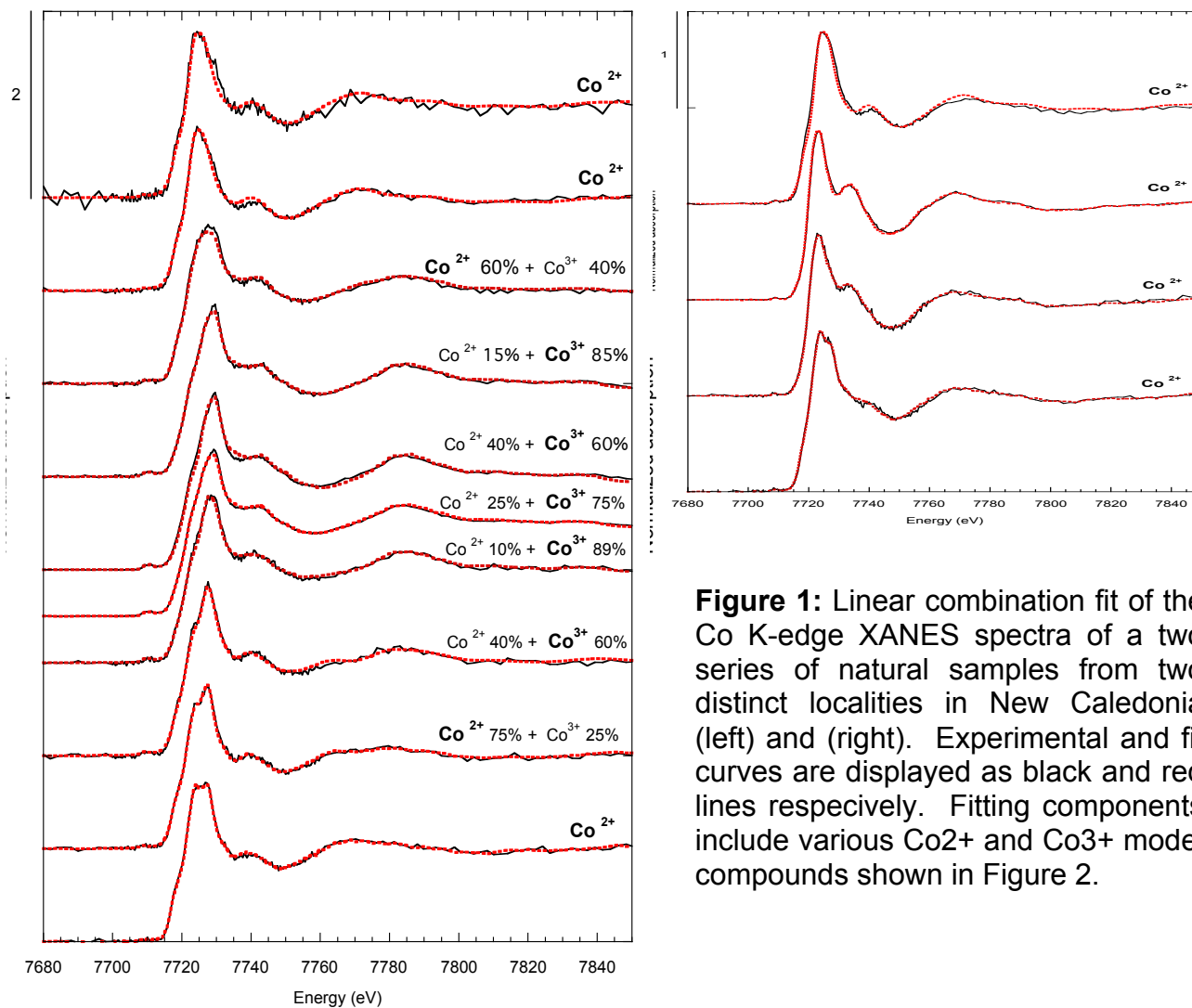


Figure 1: Linear combination fit of the Co K-edge XANES spectra of a two series of natural samples from two distinct localities in New Caledonia (left) and (right). Experimental and fit curves are displayed as black and red lines respectively. Fitting components include various Co²⁺ and Co³⁺ model compounds shown in Figure 2.

EXAFS data were also recorded on the model compounds in order to accurately identify Co speciation in these reference samples including the identification of crystallographic sites as well as the surface sorbed species. (Figure 2).

These data are part of an article in preparation entitled “Long term evolution of cobalt speciation in ultramafic lateritic deposits from New Caledonia.”

See figure 2 next page

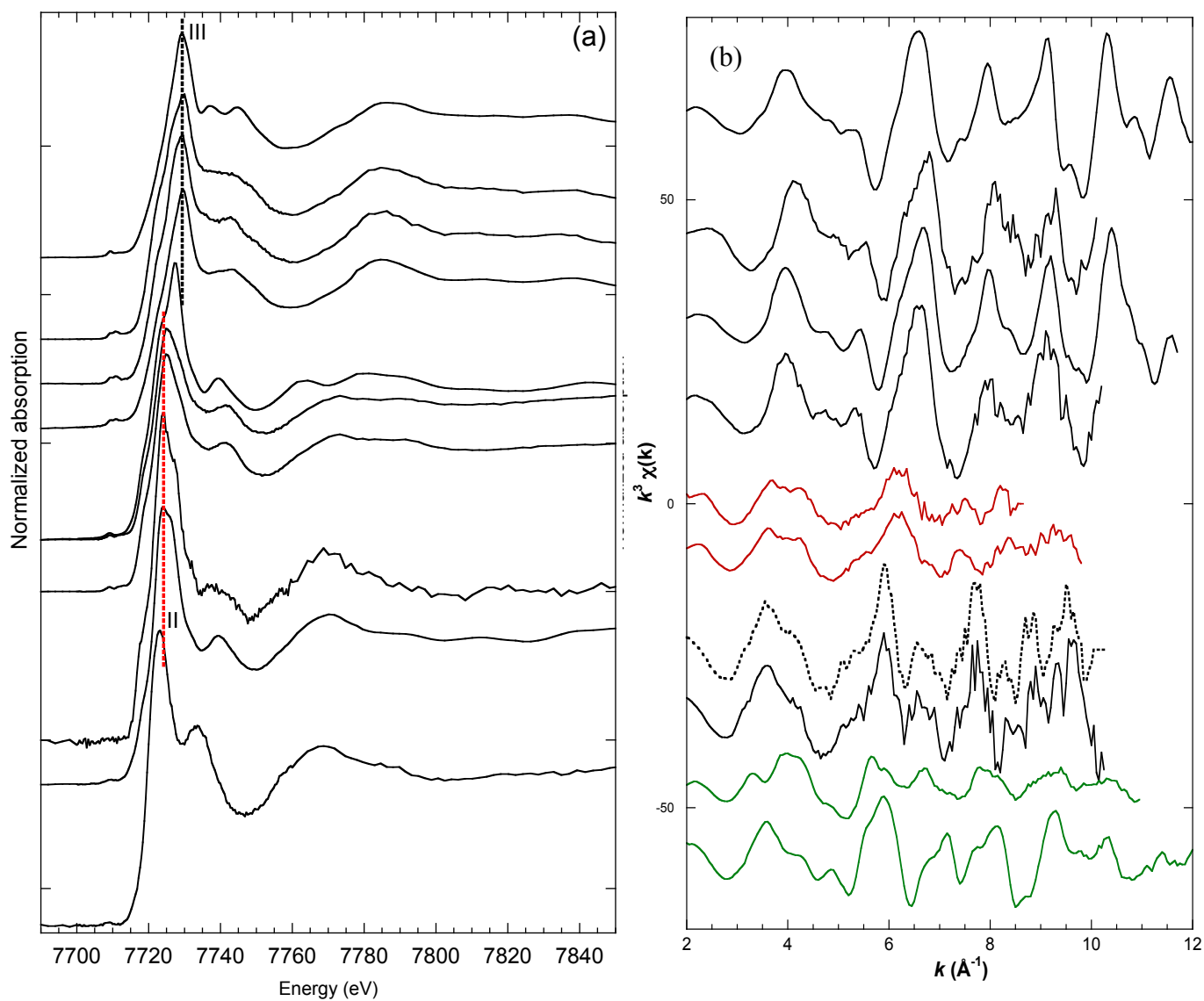


Figure 2. XANES (a) and EXAFS (b) data at the Co K-edge collected on a series of natural and synthetic model compounds representative of the speciation of Co ultramafic laterite deposits.