1 Year Post-Doctoral Position

Title: **Mineralogical investigations on steel-river sediments.**

People involved in the project: **Emmanuelle Montargès-Pelletier (LIEC); Isabelle Bihannic (LIEC); Delphine Vantelon (SOLEIL); Laurence Mansuy-Huault (LIEC);**

FORMATION REQUIRED**: Mineralogy, Environmental Geochemistry.**
Skills Required: X-ray diffraction, synchrotron related spectroscopies and microscopies, Rietveld refinement.

Duration: **12 months**

Level of salary: **2000 € per month**

Place: **LIEC, CNRS-Université de Lorraine, Vandœuvre-les-Nancy, France**

FINANCIAL SUPPORT: ANR MOBISED and "Region Alsace-Champagne-Ardenne-Lorraine" dotation

BACKGROUND

River sediments are recognized as reservoirs of multiple pollutants, either chemical (nitrates, pesticides, medical drugs, metals...) or microbiological (virus, bacteria, parasites). Indeed, surface waters are often the common receptacle of anthropogenic pollutants from diverse origins, which, once combined to suspended mater, settle to enrich the sediment compartment. During flood events, the remobilization of these sediments associated to the inflow sediments will impact water quality, (i) physically by the redistribution of aggregates between the dissolved, colloidal and particulate compartments (ii) chemically and biologically by the modification of the speciation of micropollutants and the selective release of pathogens. Actually, the fate of the settled materials in the sediments and the dynamics of their re-mobilization need to be better understood for improving the management of our water resources in terms of quality and downstream treatments for the production of drinking water. Furthermore, it was demonstrated that about 40% of the annual transport of trace metals occurred during the 10% highest flow days.

In the research project related to this postdoctoral position (ANR France-Luxembourg MOBISED, http://mobised.liec.univ-lorraine.fr), the stock of contaminants in sediment profiles from the Orne River (Moselle watershed, Lorraine, France) was investigated, and sediment deposit in the front of a dam was showing particularly high contents of "trace metallic elements", greatly higher than in other sediment profiles of the same river. Spatial distribution of elements and mineralogy of sediments were investigated using a combination of analytical techniques (XRD, FTIR, electron microscopies, X-ray absorption spectroscopy). In order to evidence the nature of interactions between micro-pollutants and sediment constituents, molecular methods were used to study the chemical speciation of trace elements.

First results on the sediments collected in the Orne River showed mineralogical modifications with depth, and in particular the formation of Fe enriched phyllosilicates and the formation of polymetallic sulfides. Zn sulfides, certainly due to the microbial activity within the sediment matrix are constituted of nanometric entities, are amorphous and could not be evidenced though classical XRD. Those nano-sulfides are however the main Zn scavengers in the sediments.

GENERAL PURPOSE

The first objective will be to quantify the different iron-bearing phases in order to follow the weathering of iron oxides introduced in the water system during the steel making activity period. The various iron bearing phases could be quantified combining different sets of data including XRD patterns and X-ray absorption spectra collected at Fe K-edge. From XRD patterns, the quantification of mineralogical phases will be performed on the basis of the Rietveld refinement method, which consists in the comparison of experimental and calculated (or theoretical) patterns, taking into account the structural data of each mineralogical phase occurring in the sample. The specific case of clay

minerals, described as disordered stacks of layers, will be undertaken with a recent methodology developed by the team of R Kleeberg.

Spectroscopy data will be analysed using different methods, (1) theoretical modelling or layer by layer method, (2) standard procedure by principal component analysis and linear combination fitting using in-house reference spectra and (3) multivariate analysis or MCR. The candidate will work on previously collected data and will also be involved in the acquisition of complementary data (XRD, synchrotron sessions in autumn 2017).

A second objective will be to conceptualize and build sediment resuspension experiments in controlled conditions. Those experiments should help us to evidence the particle remobilization as a function of experiment duration and physical constraints. Beside the quantification of particle resuspension, the distribution of elements in the particle, colloidal and dissolved compartments should be monitored.

METHODS

-XRD, X-ray absorption spectroscopy (bulk and micro-beam experiments), TEM (EDXS, SAED), SEM
-PCA, MCR, Rietveld refinement, Theoretical modelling of X-ray absorption spectra (with software based on FEFF code)

AGENDA:

- Application deadline: December 1st.
- Audition of candidates: December 2016-Januray 2017
- Recruitment: from February 1st 2017

CONTACT

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For application please provide the following documents:

- Motivation letter
- list of publications,
- a detailed CV including a summary of research activity (5-10 pages).
- 2 letters of referees