3 Year Post-Doctoral Position

Title: **Role of hyperaccumulating plants in the biogeochemical cycle of nickel: distribution, chemical speciation and isotopic fingerprint**

People involved in the project: **C. Cloquet (CRPG) ; F. Fraysse (LIEC) ; E. Montargès-Pelletier (LIEC) ;** G. Echevarria (LSE) ; F. Guerold (LIEC) ; E. Gross (LIEC) **;**

Formation Required**: Environmental Geochemistry, Soil Science.**
Skills Required: Isotope geochemistry, water and soil chemistry, synchrotron related spectroscopies and microscopies.

Duration: **36 months**

Level of salary: **2500 € per month**

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

FINANCIAL SUPPORT: ANR AGROMINE and LABEX R21

BACKGROUND

The role of vegetation in the cycle of metals, on their transformation and transfer at the Earth's surface is widely assumed. Our knowledge about the mechanisms of soil-plant transfer is currently improved whilst unraveling the role of « sink » that plants can constitute for metallic contaminants. However, release mechanisms and fluxes towards environment are still rarely investigated. The contribution of litter to major and trace element fluxes is undeniable as this sink is able to provide the greater part of major and trace elements. This contribution remains to be evidenced in the case of ultramafic soils and associated metallophyte species, which might involve specific mechanisms of element transport and transformation. Indeed, hyperaccumulation of heavy metals in plants is intriguing biologically and is extremely rare (exhibited by <0.2% of angiosperms). About 500 taxa of hyperaccumulators have been identified today (about 400 are reported as Ni-accumulators). They are encountered on all continents, both in temperate and tropical environments. Such plants develop efficient root absorption mechanisms, which allow them to specifically accumulate metals from soils in above-ground parts, even in cases where metals bioavailability is too low to affect other non-accumulating plant species.

The use of stable isotopes to understand the dynamics of trace elements during the development of hyperaccumulator plants is an emerging science. It allows tracing Ni fate in Ni hyperaccumulators to monitor its optimal accumulation in the organs of interest (identifying when absorption/translocation processes reach their maximum). The discrimination of stable isotopes of Ni in plants through accumulation processes has just started during a preliminary study so far. Nothing is known either about the replenishment of available Ni pools in soils by mineral dissolution of biogeochemical recycling. Stable isotope studies could help in tracing the contribution of each of the biogeochemical process to the long term available Ni pools in soils or wastes.

Understanding how plants are able to specifically accumulate or exclude essential elements and toxic metals, is fundamental for selecting species that could then be utilized for phytomanagement or phytomining. Applications of such plants in phytomining context will lead to the implementation of cropped fields of hyperaccumulators. The fate of metals in such engineered systems as well as in the biomass produced and processed, and possibly in the end- and by-products, will need to be investigated with the same approaches.

GENERAL PURPOSE

In ultramafic background, the proposed study aims to evidence the role of hyperaccumulating plants in Ni flux and chemistry (isotopic fingerprint and speciation).

- Estimation of Ni contents in soils, litter, plants and waters.
- Use of isotopic tools to decipher Ni uptake, storage, excretion, release.
- Use of microscopic and spectroscopic tools to evidence localization and chemical speciation of Ni in soils, litter and plants.
- Simulate in the lab, leaching phenomena and metal transfer towards aqueous medium, during the degradation process of plant material.

METHODS

- Isotope chemistry (clean lab work and MC-ICP-MS measurements).
- Leaf-litter decay and leaching tests: kinetic experiments using lab-built reactors, batch and mixed flow reactors
- Microscopies and micro-spectroscopies to investigate Ni status in soils and plants.

AGENDA:

- Application deadline: February 15th 2015.
- Audition of candidates: February-March 2015.
- Recruitment: April 2015

CONTACT

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For application please provide the following documents:

- list of publications,
- CV
- summary of research activity (5-10 pages).
- 2 Referees