

Post-doctoral position at the University of Lorraine

Laboratoire Interdisciplinaire des Environnements Continentaux (LIEC), CNRS UMR 7360

Title: Predicting and understanding Rare Earth Element (REE) effects at the sediment-water interface

Context: Effective and sustainable use of strategic mineral resources is a high societal, scientific and economical priority. Yet, information on the interactions between REE and biota is often limited, especially for sediment-dwelling organisms that may be the most impacted by such activities.

In the absence of acid-mine drainage (AMD), cationic metals mobilized into the environment from mining activities (extraction and processing) actually tend to associate with suspended particulate matter (SPM) and accumulate into bed sediments. These phenomena reduce exposure of pelagic organisms to potentially harmful trace elements, but result in their corresponding accumulation in bottom sediments. Furthermore, even in the presence of AMD, the gradual neutralization of the acid effluents will eventually result in the deposition of metals to bed sediments via colloidal pumping, adsorption onto SPM and sedimentation. Understanding if and how mining of REE will result in adverse effects to organisms living inside bed sediments or at the sediment-water interface is therefore a highly relevant question for the all decision concerning present and foreseeable REE mining.

Objectives and work summary: In the current geopolitical and economical context, (re)opening of mining facilities for REE extraction is being explored in several countries. This project proposes to study if and how (re)opening of REE mines will alter the normal ecology of organisms living at the sediment- water interface. The proposed approach includes a field study at sites being considered for mining activities, *in situ* experiments with animal and vegetal model aquatic species and laboratory experiments. The overall objective of this post-doctoral position is to establish a solid knowledge of REE ecotoxicity to benthic organisms in order to ensure a sober management of natural resources.

The following specific objectives will constitute the core of the proposed work:

- **Establish baseline environmental conditions and trophic transfer at sites where rocks naturally rich in REE occur.** The LabEx consortium has already identified suitable study areas (perspective mining sites with different mineralogies of REE containing rocks) in Canada. Water, sediments and representative benthic organisms will be collected and analyzed for their REE content. Knowledge of baseline environmental conditions before anthropogenic activities is invaluable to manage mining activities during and after exploitation.
- **Determine the safe concentrations of REE mixtures to representative benthic organisms.** Field sediments collected at perspective mining sites will be spiked with REE mixtures representative of the corresponding ore composition. A battery of model organisms will be exposed to the spiked sediments and monitored for relevant endpoints. Detailed

characterization of exposure conditions will be carried out throughout the duration of the organisms' exposure to contaminated sediments.

- **Explore possible early-warning endpoints of REE effects.** Current knowledge surmises that a contaminant causes adverse effects when its metabolically active concentration inside an organism exceeds a certain threshold. Sub cellular distribution of REE will be studied in an attempt to establish such links. Alternatively, the use of behavioral responses or cellular biomarkers will be explored as early signals for effects at the individual and population levels.

Student profile: The candidate must be a highly-motivated and self-directed person with a recent university doctoral degree (or equivalent) in ecotoxicology or environmental toxicology. A solid background in biology, ecotoxicology, stress ecology and a strong interest for both experimental and *in situ* studies are required. He or she may demonstrate fundamental knowledge and / or quantitative analytical techniques and document acquired knowledge in these topics. Basic level in freshwater physico-chemistry will be also appreciated. The candidate will need to be fluency in English and in French (or willingness to learn French).

Funding: This post-doctoral position will be funded by the LabEx RESSOURCES21 which was selected by the French Ministry of Research and Education in the framework of the "Laboratoires d'Excellence" initiative. RESSOURCES21 proposes an integrated scientific and educational approach to the understanding, exploitation and environmental management of strategic metal resources for the 21th century. This post-doctoral fellowship is funded for one year with the possibility of a further extension for an additional year.

Host institution: LIEC (Laboratoire Interdisciplinaire des Environnements Continentaux), Metz, France. <http://www.liec.univ-lorraine.fr>

Salary: 45 k€ annual gross salary

Entry into service: April/Mai 2016

Applicants should send via email Curriculum Vitae and the names and email addresses of two references to:

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Application deadline: March 15th 2016