

From *October 15<sup>th</sup>, 2020* to *October 15<sup>th</sup>, 2023*

**Title: Mollusks as bioindicators of metal exposure**

**Thesis abstract:**

Metals are natural components of aquatic ecosystems, background concentrations of which can increase due to anthropogenic activities. That potential degradation of water quality can negatively impact aquatic life. One way to assess metal effects towards aquatic ecosystems is to use a biological indicator, which will respond to the presence of metals through their accumulation and sensitivity. Mollusks (gastropods and bivalves) possess several qualities to be a good bioindicator (sessile, easy to collect, ubiquitous, etc.). They also have the particularity to protect their soft bodies with a shell. This calcified structure is inert or with a very slow turnover and is formed by layers that grow throughout their life. The chemical analysis of the shell would thus theoretically represent a temporal recording of the ambient organism environment and would allow the access to specific events such as episodes of pollution. The aim of the present PhD project is thus to evaluate if mollusk shells could be used to monitor bioavailable concentrations of metals in aquatic ecosystems. To that end, the studied mollusks will be exposed to metals in the lab and in artificial rivers (PERL facilities hosted by Total at Lacq) and will be analyzed for metal accumulation and distribution in shells and soft tissues using state-of-the-art mass spectrometry-based techniques (LA-ICP-MS and TOF-SIMS). Metal accumulation and distribution in shell and body will be related to mollusk sensitivity to metals to infer conclusions on their use to evaluate the quality of their ambient environment. The overall results will bring insights on the evaluation of metal toxicity towards aquatic communities and are expected to improve current metal-toxicity predicting model.

**Keywords:** Ecotoxicology, analytical chemistry, biogeochemistry, limnology

**Funding:** Partnership research chair e2S-UPPA-Total-Rio Tinto

**Working conditions:**

**Hosting laboratory:** IPREM (UPPA)

**Localisation address:** 2 avenue du Président Angot,

**Laboratory expertise:** Ecotoxicology laboratory

**Thesis Director:** Dr Séverine Le Faucheur and Dr Gilles Bareille

**Starting Date:** *October 15<sup>th</sup>, 2020*

**Duration:** 3 years

**Gross salary:** 1 870 € / month (which includes extra gratification for teaching duties – 32h per year)

**Mission - Main activities:**

**Scientific framework**

Metals are natural components of aquatic ecosystems, background concentrations of which can increase due to anthropogenic activities. That potential degradation of water quality can negatively impact aquatic life. One way to assess metal effects towards aquatic ecosystems is to use a biological indicator, which will respond to the presence of metals through their accumulation and sensitivity. Mollusks (gastropods and bivalves) possess several qualities to be a good bioindicator (sessile, easy to collect, ubiquitous, etc.). They also have the particularity to protect their soft bodies with a shell. This calcified structure is inert or with a very slow turnover and is formed by layers that grow throughout their life. The chemical analysis of the shell would thus theoretically represent a temporal recording of the ambient organism environment and would allow the access to specific events such as episodes of pollution.

**Purpose(s)**

The aim of the present PhD project is thus to evaluate if mollusk shells could be used to monitor bioavailable concentrations of metals in aquatic ecosystems. To that end, specific questions need to be answered, *i.e.* (i) what is the link between metal concentrations and speciation in the ambient water with metal concentrations in mollusk shells? (ii) What is the influence of water quality (hardness) on metal accumulation in mollusk shells? (iii) what is the relation between metal concentrations in mollusk shell and body? and (iv) what is the relationship between shell metal concentration and metal toxicity? To answer those questions, mollusks will be exposed to metals in the lab and in artificial rivers (PERL facilities hosted by Total at Lacq) and will be analyzed for metal accumulation and distribution in shells and soft tissues using state-of-the-art mass spectrometry-based techniques (LA-ICP-MS and TOF-SIMS). Metal accumulation and distribution in both shell and body will be related to mollusk sensitivity to metals to infer conclusions on their ability to evaluate the quality of their ambient environment.

**Expected results**

The overall results will bring insights on the evaluation of metal toxicity towards aquatic communities and are expected to improve current metal-toxicity predicting model.

**Research collaborations**

Total and Rio Tinto scientists

Dr Cécile Courrèges, Dr Sandra Mounicou and Dr Hélène Tabouret

**Applicant 's profile:**

The candidate will work with mass spectrometry techniques and bioanalytical approaches, develop rigorous ecotoxicological bioassays in laboratory and mesocosms, and use computational techniques. The ideal candidate has a master's degree in analytical chemistry with a special interest in ecotoxicology or biogeochemistry or in environmental sciences with a strong background in chemistry. He/She is passionate for environmental problematics, rigorous and highly motivated to be part of our scientific teams composed of ecotoxicologists, analytical specialists and biogeochemists. A previous experience with mass spectrometry techniques would be a plus. The candidate must have a good English level and the capacity to work autonomously.

**Application - Evaluation criteria:**

Application file assessment: Selection committee

Candidates will first be selected based on their application file.

Those selected after this first step, will then be interviewed.

Application files will be evaluated based on the following criteria:

- Grades and ranking during your Master degree, steadiness in your academic background
- English language proficiency
- Candidate's ability to present her/his work and results

Work experience similar to an internship in a laboratory – or likewise; previously achieved research work (reports, publications).

**Application will include: (in a single pdf file)**

- CV
- Cover letter
- Master degree grade transcripts and ranking
- Reference letter
- Contact details of at least two people, from you work environment, who can be contacted for further reference

Application must be send to the following email address with the title "Doctoral application":  
**severine.le-faucheur@univ-pau.fr** and **gilles.bareille@univ-pau.fr**

For more details, please visit our websites: <http://e2s-uppa.eu/en/index.html> and <https://iprem.univ-pau.fr/fr/collaborations/chaieres/ecotox/presentation.html>

**Application deadline:**

September 9<sup>th</sup>, 2020