



ÉCOLE DOCTORALE  
SCIENCES DE LA TERRE



Subject offered for a contract starting in September 2012

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**SUBJECT TITLE: Couplages entre circulation/écoulement et dynamique chimique dans des masses d'eau continentales (lacs ou rivière).**

Advisor: **BENEDETTI Marc, Pr, benedetti@ipgp.fr**

Second Advisor/ Supervisor: **METIVIER François, Pr, metivier@ipgp.fr**

Host lab/ Team : **IPGP- Géochimie des eaux – UMR7154**

Financing: **Doctoral contract with or without mission**

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*For more information go to <http://ed109.ipgp.fr>, section: Offres de these ( PhD offer), You must apply on the Doctoral School website*

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Presentation of the subject: (1 or 2 pages)

Concern has been recently rising on the river water environment effect produced during basin sediment transport process. Sediment fluxes show a close relationship with heavy metal pollutants migration from erosion in the watershed upstream, to transportation in the middle, and to deposit in the estuary. In river sediments, the interactions between heavy metal pollutants and sediment particles include sediment adsorption or desorption to pollutants, and heavy metal pollutants biodegradation. These effects that are most probably grain size dependant, control the transport and transformation processes of heavy metal ions in the sediment rivers.

In the seine river previous work showed that during an episode of discharge of storm, contamination of the water column is more a function of mixing of bottom sediments by the sudden increase in flow than a contribution of metallic contaminants by the discharge itself. Physical speciation techniques based on spectroscopy of X-ray absorption (XAS) has made it possible to show that a significant fraction of zinc (up to 40% of total Zn in some samples taken downstream of Paris) is present as Zn sulfide in the particles in suspension. In parallel, the first isotopic measurements show that the analysis of zinc isotope ratios allow a better characterization of the processes leading to the formation and transformation of these reactive phases. Our objective is therefore to address the fundamental question of the interaction between sediment dynamics and heavy metal cycles in riverine systems. We will do it through a survey in a large and polluted river system in China and compare to the surveys performed on a French river system

## Description of the project

We propose to apply the methodology developed on the Seine river to the Yuqiao reservoir in the Lunanhe river system in China: we want to establish a detailed characterization of the dynamics of water, sediments and chemical species to better identify the sources (geochemical background included), the time scales and controlling factors of concentration, its variations and the role of speciation of solid phases. We aim to address the following questions :

Axis 1: What is the value of the geochemical background and the source of Zn and Pb (or other elements) in the watershed of the river ?

Axis 2: What are the concentrations, speciation and fluxes of dissolved elements mentioned above on the test sites selected as part of this project ?

Axis 3 : What is the dynamics of sediment and flow in the river and reservoir system

Axis 4: What is the speciation of metals on solid phases ?

The study will allow to understand the coupled dynamics of sediments and heavy metals in rivers. It will allow us to obtain survey of sources of particulate metals and their speciation. We will know the spatial and seasonal distribution of these metal species in suspended particles upstream and downstream of the antropogenic activities. We will obtain data on the reactivity of the carrier particles of metals and the transfer kinetics of metal elements to the dissolved phase.

## Candidate

The successful candidate should have a background both in physics and chemistry in order to be able to study

the coupling between fluid and sediment dynamics and the chemistry of metal species.

The Phd will include field measurements and surveys in China, fluid mechanics based analysis of flow and sediment transport and geochemical analysis of cycling of heavy metals.

