

PhD in Biogeochemistry at LPG Angers – 2023-2026 – PPR RIOMAR Project

Thesis' title:

Benthic/pelagic coupling of biogeochemical processes on the continental shelf under the influence of the Loire and Vilaine rivers in a climate change context.

Keywords: benthic biogeochemistry; benthic/pelagic coupling; carbon cycle; nutrients; environmental redox reactivity

Context:

Continental shelves, in particular coastal regions influenced by rivers, are particularly vulnerable ecosystems. These marine ecosystems (River-dominated Ocean Margins-RiOMar) face a double constraint: on the one hand, inputs of nutrients, particles and contaminants from rivers, which can cause eutrophication, hypoxia, toxic algal blooms, turbidity and contamination in the coastal environment; climate change, which is altering coastal circulation, raising sea levels, changing stratification, warming and acidifying the ocean, and increasing the occurrence and intensity of extreme events (storms, heat waves, floods). The RIOMAR project (Observer et anticiper l'évolution des zones côtières françaises sous influence des fleuves au 21e siècle: RIOMar), which includes this thesis, aims to better understand and anticipate the evolution of these ecosystems and their role in global warming, based on the collaborative work of researchers from 20 different institutes, covering a wide range of disciplines (oceanography, artificial intelligence, population dynamics, analytical chemistry, etc.) and all the coasts of mainland France.

This thesis, based at the LPG in Angers, aims to gain a better understanding of the biogeochemical processes governing interactions between the water column and sediment on a continental shelf influenced by the Loire River. While regular diffusive fluxes are relatively well constrained, the importance of localized processes, such as bioturbation, or punctual processes, such as resuspension during storms, is generally very poorly estimated in the literature, even though these processes are likely to correspond to the most important exchanges. Floods, storms, algal blooms and possible hypoxia will therefore be the subject of dedicated sampling in order to shed light on their role in C, N, P, Mn, Fe and Si cycles. The study of different mudflats on the continental shelf will enable us to characterize the heterogeneity of these processes and identify particle transformations as they are transferred along the continental shelf. These two approaches complete the observation effort already carried out through other projects such as Hoopla* or Rebelred** and DIETE***. In addition, these data will be integrated into the numerical models currently being developed in the RiOMar and MEDIATION projects, and will be interpreted in relation to the nutrient and phytoplankton dynamics studied in a second, dedicated thesis

Methodological approaches

Offshore campaigns and sampling of interface sediment cores. Analysis of diffusive and total benthic fluxes by incubation and chemical profiling of interstitial waters. Study of water column stratification using point-source approaches and deployment of high-frequency sensors. Experimental investigation of the reactivity of resuspended surface sediments (adsorption/desorption of metals and nutrients).

Required skills and background

Master's degree in Geochemistry or Chemical Oceanography. Experience in geochemical modeling. Fluency in English. Writing skills. Appetence for working at sea. Driving license.

*HOOPLA : Nouvelles approches méthodologiques pour l'étude de l'impact des ouvrages éoliens en mer sur les habitats benthiques en environnement côtier : cas d'étude d'un champ à Haploops

**REBELRED : Recyclage Benthique des Éléments Redox et nutriments associés à travers un estuaire sujet à l'Hypoxie : La Loire

*** DIETE : Diagnostique étendu de l'eutrophisation