

PhD project Oceanography – Marine Biogeochemistry



Context

Over the past century, oxygen concentrations have decreased dramatically in the deep water of the Estuary and Gulf of St. Lawrence (EGSL) with negative consequences for marine life, the fishing industry, and ecosystem health. Hypoxia and warming also impact biogeochemical cycling, including the nitrogen (N) cycle. Nitrogen (N) is a limiting nutrient in the ocean and is intimately linked to the CO₂ biological pump via various feedback loops. In EGSL, the upwelling of deep waters at the head of the Laurentian Channel (near Tadoussac) accounts for more than 60% of the nitrate input to the surface waters and it supports the biological production, at least during the ice-free seasons. However, how the severe O₂ depletion will impact the nitrogen (and phosphorus) budget and, consequently, the biological production in surface waters is unknown. The processes of bioavailable nitrogen loss and N₂ production (i.e. denitrification and anammox) generally occur under suboxic conditions (O₂ < 5 μM). Consequently, a large proportion of these reactions take place in sediment where O₂ content is low. In the EGSL, a significant proportion of N₂ production appears to take place, however, in the water column even though ambient O₂ concentrations exceed 5 μM. This suggests the presence of suboxic microenvironments and strong O₂ gradients within the water mass itself.

It is therefore imperative to test the sensitivity of bioavailable nitrogen loss and N₂ production processes under EGSL oxygenation conditions and then to incorporate these mechanisms correctly into the biogeochemical budget. **Here, we propose to work on the microbial pathways supporting nitrogen loss and N₂ (and N₂O) production processes in the deep waters and sediments of the Laurentian Channel.**

Qualifications

The candidate will take part in various missions at sea on the St. Lawrence, and will carry out incubations and isotope pairing experiments in the ISMER/UQAR geochemistry laboratories. The candidate will join a multidisciplinary team and benefit from the support of competent professionals for his/her work. The candidate will be based at ISMER/UQAR, under the supervision of Gwénaëlle Chaillou and Ludovic Pascal. He/She will also benefit from the expertise of Jean-Éric Tremblay of U. Laval and Douglas Wallace of U. Dalhousie.

We are looking for someone who is i) motivated and committed to completing the project and publishing the results, ii) has experience in marine biogeochemistry or environmental chemistry or oceanography, and iii) is eligible for the Oceanography Ph.D. program at ISMER. As an inclusive workplace, we strive to attract, retain and develop our staff based on inclusive principles. We celebrate the richness that gender identity, ethnicity, sexual orientation, disability, and age bring. We encourage all applications.

The preferred start date is September 2024 but it remains negotiable through January 2025. The eligibility criteria for this scholarship are available on the ISMER/UQAR website. Applications (including a cover letter, CV, and contact information for two referees) should be submitted to Gwénaëlle Chaillou (gwenaelle_chaillou@uqar.ca) and Ludovic Pascal (ludovic_pascal@uqar.ca).