Ph.D. position in marine geology and geochemistry

Unlocking the Arctic Iron Cycle: How Canadian Arctic Glaciers Shape Marine Productivity and Carbon Sequestration



Aerial view of marine-terminating glaciers draining the Devon Ice Cap, Devon Island, Canadian Arctic (@ J.-C. Montero-Serrano)

Iron (Fe) is an essential micronutrient that regulates primary productivity in large regions of the Arctic Ocean and influences key biogeochemical processes, including carbon sequestration and nutrient cycling. Glaciers and ice caps of the Canadian Arctic are important sources of reactive Fe to marine ecosystems through the delivery of meltwater, suspended sediments, and glacially derived particles. As Arctic warming accelerates glacier retreat, alters meltwater discharge, increases coastal erosion, and modifies weather patterns, the magnitude and characteristics of Fe export to coastal waters are expected to change. However, the contribution of Canadian Arctic glaciers to the marine iron cycle remains poorly constrained, limiting our ability to predict how ongoing cryospheric changes may affect Arctic marine productivity and carbon cycling.

Over the past decade, the marine geology team at ISMER has recovered numerous sediment cores from fjords and coastal environments influenced by marine-terminating glaciers draining the Devon Ice Cap, the Manson Icefield, the Prince of Wales Icefield, and the Agassiz Ice Cap in the eastern Canadian Arctic. These sedimentary records provide a unique opportunity to investigate the long-term variability of glacier-fed sediment and iron delivery to Arctic marine systems. Reconstructing changes in the export and fate of glacially derived Fe through time will improve our understanding of how ongoing glacier advance and retreat may alter nutrient availability, primary productivity, and carbon cycling in the Arctic Ocean.

To address these questions, this PhD project will adopt a multiproxy approach combining ^{210}Pb and radiocarbon geochronology with sedimentological, mineralogical, and geochemical analyses. This PhD project aims to quantify specific reactive iron phases preserved within Arctic marine sediment archives and to reconstruct how past pulses of glacial meltwater influenced marine ecosystem dynamics. By integrating iron speciation analyses with a suite of biogenic proxies, the project will assess how variations in the supply of this essential micronutrient have stimulated primary productivity, altered macronutrient cycling, and contributed to carbon sequestration in the Arctic Ocean over time.

The PhD project will be supervised by Professors André Pellerin (ISMER-UQAR; supervisor) and Jean-Carlos Montero-Serrano (ISMER-UQAR; co-supervisor) and will benefit from a strong multidisciplinary and institutional collaboration involving Stephanie Kusch (ISMER-UQAR) and Guillaume St-Onge (ISMER-UQAR). Together, this team provides complementary expertise in marine geology, paleoceanography, geochemistry, and Arctic environmental change.

DESIRED QUALIFICATIONS. The candidate should hold a M.Sc. degree in Earth Sciences, Oceanography, Geology, Geochemistry, Geological engineering, or any related discipline at the time of appointment, and having experience in geochemistry and paleoclimatology will be seen as an advantage. Applicants must be proficient in written and spoken English. As ISMER-UQAR is a French-speaking university, knowledge of French is considered an asset.

HOW TO APPLY. Please get into contact with André Pellerin (Andre_Pellerin@uqar.ca) prior to submitting the full application. The application file should be one pdf that includes:

1) Cover letter explaining the candidate's background and how it fits with the proposed project and the PhD in oceanography at ISMER;
2) CV (including scientific communications, fellowships, awards, missions at sea, etc.);
3) All university transcripts;
4) Three letters of recommendation (one of which must be from a research supervisor).