Public Registry - Project Proposals

NPC 150627: Permafrost organic carbon fluxes to the Canadian Arctic Ocean

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Proposal Status: Conformity Determination Issued

Overview Documents

Project Overview

Type of application: New

Proponent name: Stephanie Kusch

Proponent company: Institute of Marine Sciences, University of Quebec Rimouski

Project Description:

Permafrost, the perennially frozen ground spanning the Arctic, stores large stocks of 'old' and labile organic carbon (OC). Sharply rising circum-Arctic temperatures accelerate the thaw of this vulnerable OC pool, making it accessible to remineralization and erosion. Upon remineralization, the previously freeze- locked OC is emitted to the atmosphere as carbon dioxide or methane and causes a feedback mechanism that further amplifies the greenhouse effect, warming, and permafrost thaw. Erosion/mobilization of permafrost OC into aquatic settings, such as rivers and coastal oceans, leads to additional OC remineralization but also burial and sequestration in sediments. Re-buried permafrost represents an archive of past permafrost dynamics beyond observational records, which allows assessing the sensitivity and response of permafrost OC to natural climatic as well as anthropogenic forcing. This information is critical to predict the future response of permafrost to climate change, which has already had profound effects for Arctic ecosystem functions, infrastructure and economies, and the livelihood of local communities. This research project, we quantify past and present permafrost OC fluxes to the Canadian Arctic Ocean in response to natural climatic and anthropogenic forcing. Marine sediments, permafrost field samples, and laboratory--based microcosm experiments will be used on different spatial and temporal scales to determine the quantity and quality of permafrost OC released following warming--induced permafrost thaw and the associated atmospheric and oceanic feedbacks. This project will assess permafrost type--specific vulnerabilities (continuous, discontinuous, and sporadic), use an integrated isoscape approach to gain a holistic understanding of changing molecular permafrost dynamics, and investigate feedbacks to the ocean carbonate system. This program will help solve a conundrum in the global carbon cycle by delivering unprecedented insight into the molecular isotopic heterogeneity of terrestrial OC on land, during transfer into and alteration/priming in the ocean, and burial in sediments.

Project Schedule

Start Date: 2025-06-01

End Date: 2028-04-01

Project Map

List of project geometries:

Id	Geometry	Location Name
14278	polyline	Study area

NPC Planning regions:

No Approved Plan

Project Land Use and Authorizations

Project Land Use:

Scientific Research

Licensing Agencies:

Nunavut Research Institute

Material Use

Equipment:

Type	Quantity	Type	Use
ATV	2	50x50x80inch	Transport across island to individual sampling sites, transport of material and samples; to be rented on site

Fuel Use:

Type	Container	Capacity	Use
Gasoline	6	40	Operation of ATV; fuel to be bought on site from outfitter

Hazardous Material and Chemical Use:

Type	Container	Capacity	Use
No data found			

Water Consumption:

Daily Amount (m2)	Retrieval Method	Retrieval Location
0		

Waste and Impacts

Environmental Impacts:

During sampling campaigns, permafrost soils samples will be taken from small soil pits, approximately 15x15 wide and up to 30 deep. The environmental impact is minimal. Samples will be transported back to the laboratory in Rimouski and not treated chemically on site. Sediment samples of 200ccm will be obtained from a zodiac and transported back to the laboratory in

Rimouski without environmental impact. Suspended matter will be filtered from approximately 100L of coastal waters and filters will be transported back to the laboratory in Rimouski for analyses.

Waste Management:

Waste Type	Quantity Generated	Treatement Method	Disposal Method
No data found			