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NATURAL RESOURCES CANADA
GENERAL INFORMATION PRODUCT 143e

**Permafrost Degradation and
Geochemistry project**

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2021

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Permanent link: <https://doi.org/10.4095/331800>

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PERMAFROST DEGRADATION AND GEOCHEMISTRY PROJECT

Permafrost underlies approximately 50% of the Canadian land mass, including offshore beneath the Arctic shelf. Active thawing of permafrost is a natural geological process that is being accelerated by climate change. As permafrost degrades, contaminants can be released into the environment, such as heavy metals, trapped greenhouse gases and saline pore fluids. The impacts of these processes have profound and poorly understood implications for environmental practices in permafrost terrains.

This project will document the environmental effects of permafrost degradation in the western Canadian Arctic, including along:

- coastal areas where permafrost destabilization leads to marine erosion (Tuktoyaktuk Coastlands, northern Yukon, Beaufort Sea);
- highway corridors where infrastructure development has disrupted permafrost and released contaminants (Inuvik-Tuktoyaktuk Highway, Dempster Highway).

This research will be undertaken using both novel and traditional geophysical, geochemical and hydrological techniques. Quantification of the environmental impacts of changing permafrost conditions will guide methodological and regulatory developments for assessing and monitoring these impacts.

EXPECTED OUTCOMES

Global warming strongly affects Arctic regions. It causes permafrost degradation, which is exacerbated by resource and infrastructure developments. The research will provide critical knowledge for improving Canada's capacity to evaluate and regulate the cumulative environmental impacts of resource and infrastructure development and climate change in continuous permafrost terrains.

The research is expected to discover more about or inform:

- physical hazards associated with various states of permafrost degradation;
- chemical and hydrological impacts of permafrost degradation, particularly contaminant chemistry;

Aussi disponible en français sous le titre :
La dégradation et la géochimie du pergélisol

Cat. No. M34-56/2022E-PDF
ISBN 978-0-660-43726-2

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- assessing and predicting the impact of permafrost degradation on the environment, particularly associated with infrastructure and resource developments;
- the regulatory framework that controls development in permafrost terrains;
- design and engineering solutions to permafrost degradation.

The ultimate goal of this research is to provide guidance on best practices for characterizing and monitoring permafrost degradation so that environmental and hazard risks can be adequately assessed and mitigated for Arctic regions.

PARTNERS

This research is part of the Environmental Geoscience program and includes the following partners

- **Canada:** Geological Survey of Canada; Polytechnique Montréal; Environment and Climate Change Canada; Carleton University; Wilfrid Laurier University; Department of Fisheries and Oceans, Aurora College (Northwest Territories); Government of the Northwest Territories (Dept. of Infrastructure; Geological Survey of the N.W.T.); Imperial Oil Limited; ION Geophysical
- **Korea:** Korea Polar Research Institute
- **Germany:** Alfred Wegener Institute for Polar and Marine Research; GEOMAR Helmholtz Centre for Ocean Research
- **United States:** Monterey Bay Aquarium Research Institute; Bigelow Laboratory Ocean Sciences; University of Maryland

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