Permafrost thaw negatively impacts groundwater quality



PROJECT SUMMARY

Exploring relationships between permafrost thaw and groundwater chemistry in sub-arctic regions, with an emphasis on geogenic metal(loid) contamination of groundwater in the Yukon, Canada.

Elliott K. Skierszkan (elliott.skiers@usask.ca), Matthew D. Fellwock (matt.fellwock@usask.ca), Anna C. Grunsky (grunskac@mcmaster.ca), Grant A.G. Ferguson (grant.ferguson@usask.ca), Sean K. Carey (careysk@mcmaster.ca), M.B.J. Lindsay (matt.lindsay@usask.ca)

Project Title: Geogenic Contamination of Groundwater Resources in Subarctic Regions

Progress

We have collected permafrost core samples in the Dawson Range (2021) and in the Ogilvie Mountains along



Results

We have commonly observed elevated dissolved metal(loid) concentrations in thawing permafrost and associated

the Dempster Highway (2022).

- Pore-water extraction and analysis completed for 2021 samples, and ongoing for 2022 samples.
- Geochemical and mineralogical analysis completed for 2021
 samples and ongoing for 2022
 samples.

We have initiated laboratory experiments examining metal(loid) release during and following permafrost thaw.

 Data collection is ongoing, and these experiments will be completed in early 2023.



Permafrost core sampling in Dawson Range (YT, Canada). Credit: E.K. Skierszkan

Engagement

Approximately 97% of Yukon residents depend upon groundwater resources as their primary drinking water supply.

- Northern communities could experience increasing metal(loid) concentrations in groundwater and surface waters.
- We have engaged with First Nations
 to learn about firsthand experiences
 with changing water quality.
- We have collaborated with the Yukon

groundwaters.

- Permafrost composition and geochemical conditions determine metal(loid) source terms.
- Metal(loid)s including arsenic, cobalt, copper, nickel, vanadium, and uranium can be hazardous to human and ecosystem health.



Yukon River in the Dawson Range (YT, Canada). Credit: E.K. Skierszkan

Government, YukonU, and First Nations on a new proposal for ongoing research into this pressing northern water security issue. active la **permafr** groundwa surface wa

Arsenic (As) and copper (Cu) concentrations in various water samples collected in the Dawson Range (YT, Canada).

Discharge of acidic and metalliferous groundwater to a streambed in the Ogilvie Mountains (YT, Canada). Credit: E.K. Skierszkan













Bourses postdoctorales Banting Postdoctoral Fellowships

Outcomes

Permafrost thaw represents a substantial risk to water security that spans varied geomorphic environments from southern to central Yukon.

Groundwater discharge is also contributing metal(loid)s to surface waters, and this process may become increasingly important with time.