

STABILITY ANALYSIS OF DRILLING WASTE SUMPS, WESTERN ARCTIC CANADA

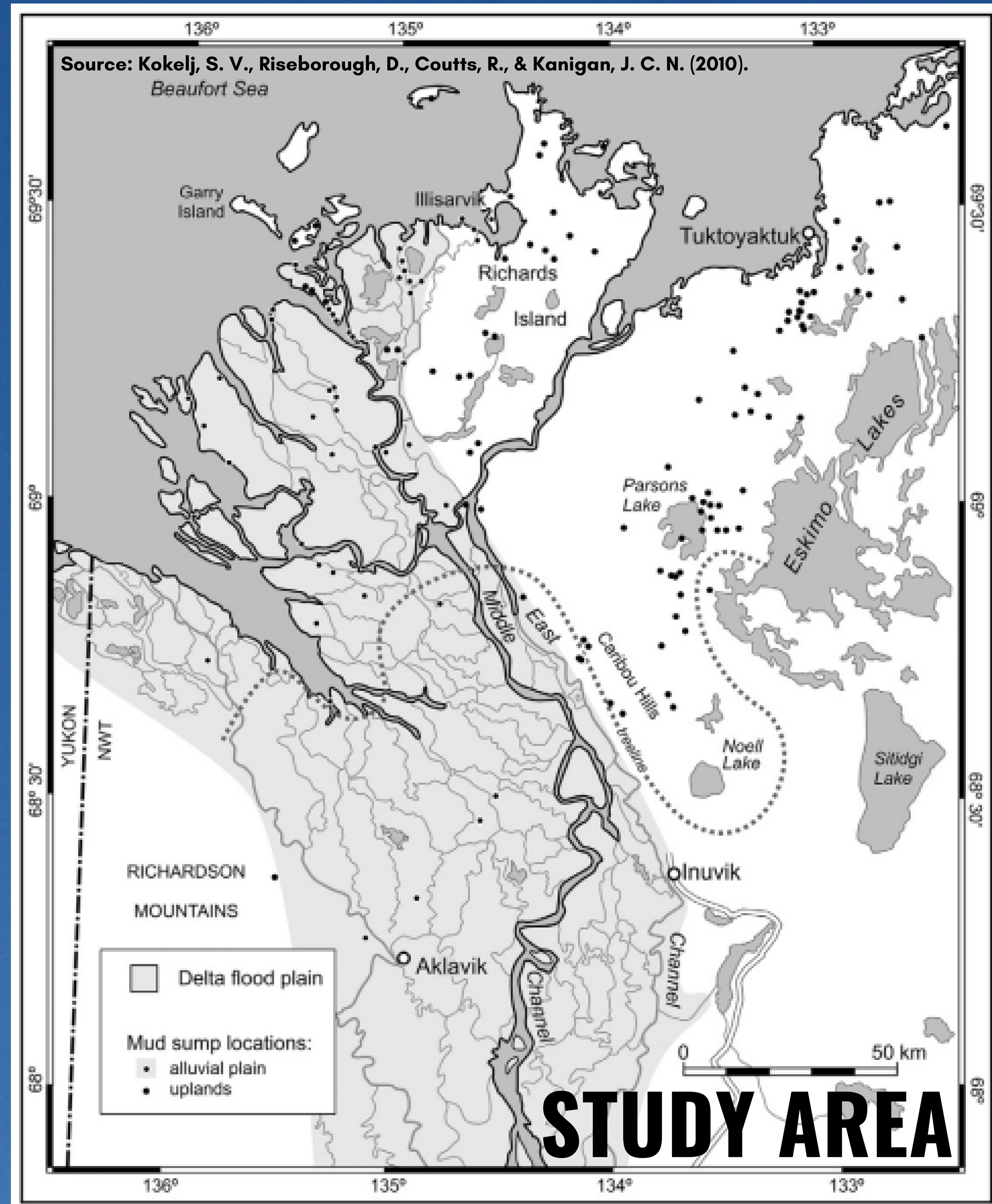
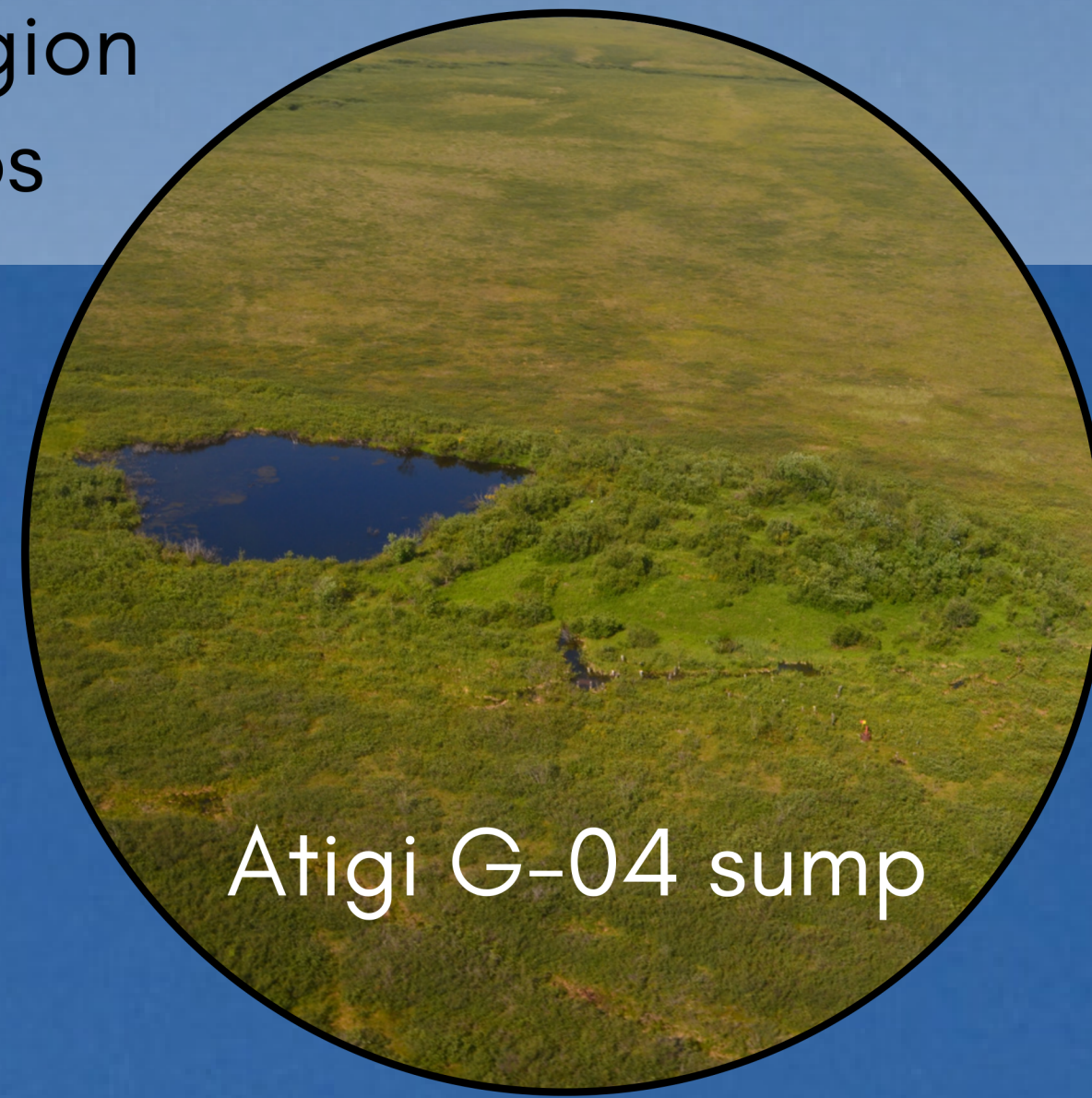


BACKGROUND

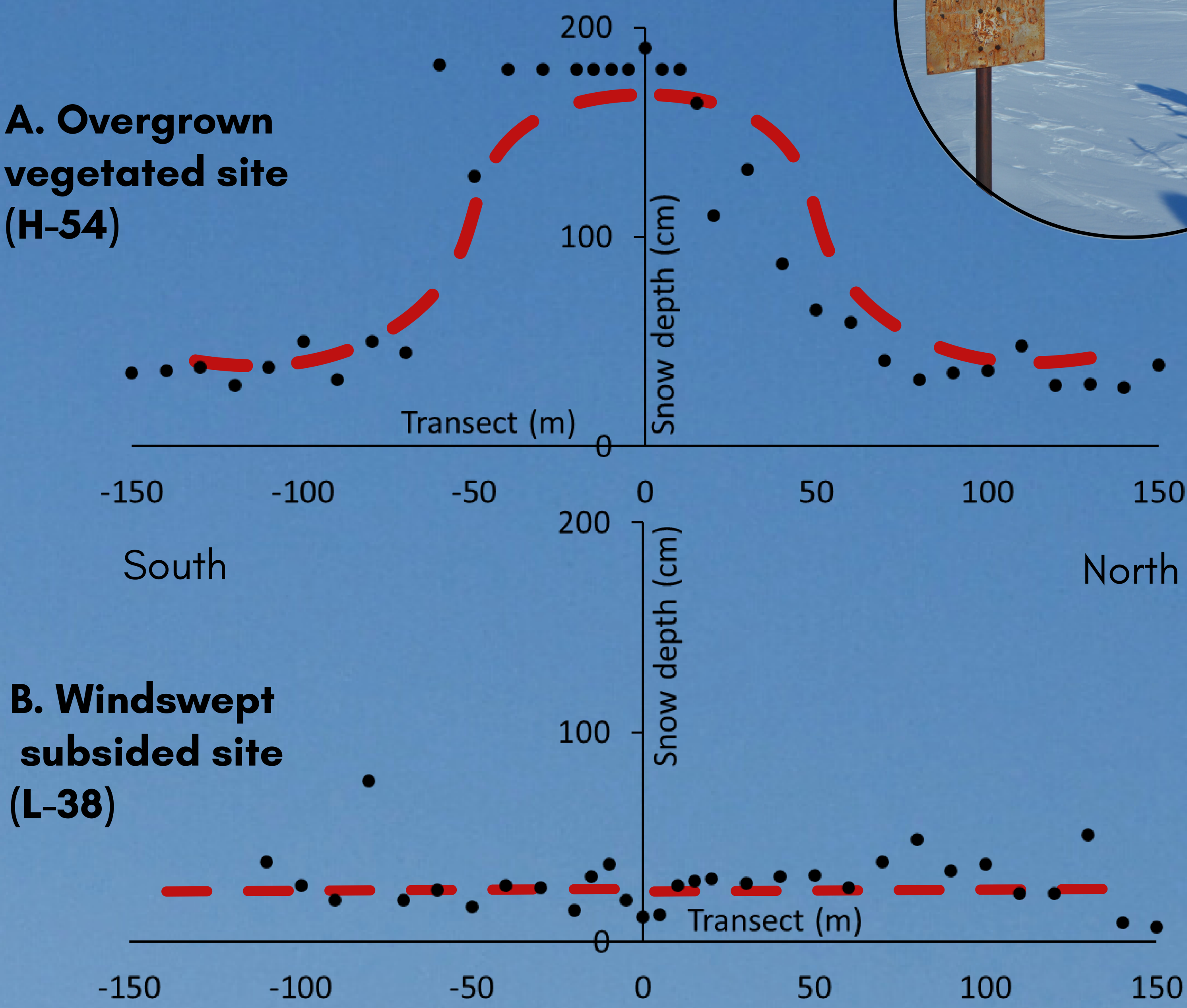
- Petroleum development projects in the western Arctic excavated large pits in permafrost to dispose of primarily industrial drilling waste assumed to be stored in permafrost long-term
- Primary additives of salts act as freezing point depressants allowing drilling in frozen ground
- Approx. 280 sumps in the Mackenzie Delta Region
- Climate change threatens the stability of sumps



Tim Ensom and Jen Humphries collecting snow density and depth data. 03/27/2022



Snow distribution on sumps



WINTER FIELDWORK

- Understanding the distribution and depth of snow on sumps
- Measure snow depth and density at sumps to understand the insulative effects of snow on annual ground temperatures
- More snow = warmer ground temperatures and can cause thermal degradation of the permafrost
- H-54 accumulated lots of snow on the sump cap, significantly deeper than the surrounding undisturbed terrain
- L-38 had little snow accumulation (no difference from the surrounding terrain)

RESEARCH OBJECTIVES

- Investigate the stability of sumps in different permafrost conditions (delta vs. uplands)
- Investigate contaminant migration from sumps and compare with past data sets
- Determine a priority order for continued monitoring and aid in sump risk assessment

SUMP FAILURE RISKS

- Uncontrolled contaminant release into surrounding soils
- Migration of contaminants from sumps into adjacent surface waters (ponds, lakes, rivers, etc.)
 - potential to affect wildlife and vegetation
 - entry into the food web and readily available for human consumption
- Sea level rise causing flooding of landmass and dispersion of sump waste into adjacent water bodies

SUMMER FIELDWORK

- conductivity surveys with EM 31 to trace KCl additives
 - KCl = conductive
 - permafrost = resistive
- Active layer samples to calibrate EM 31 readings
- Water samples collected from sump pond water
- Samples will be tested for presence of (nonvolatile) hydrocarbons



The project is in collaboration with the Inuvialuit Regional Corporation to develop a sumps monitoring protocol and assist in the training of environmental monitors.