Deep material eroded form retrogressive thaw slumps: case study in Peel Plateau, west Canadian Arctic

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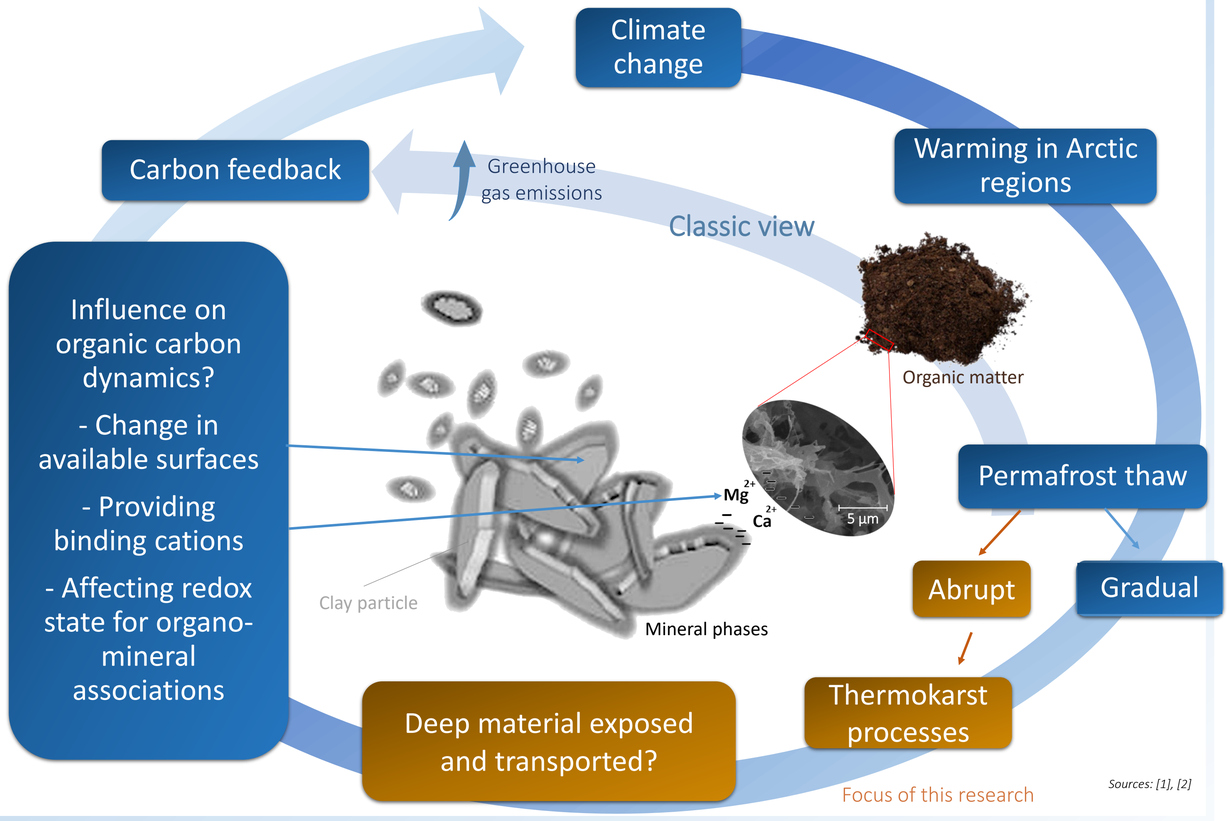
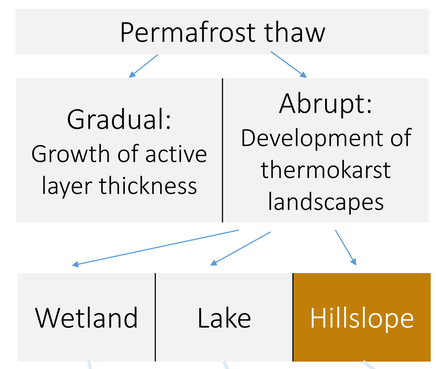
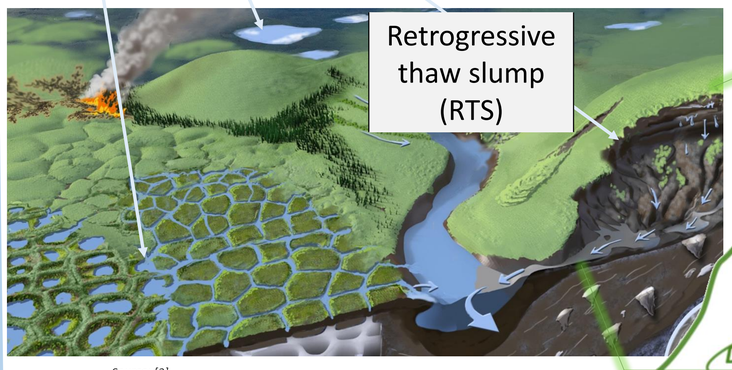
Permafrost thaw: implications for constituents exposed and carbon feedback



Permafrost thaw: thermokarsts as physical consequences

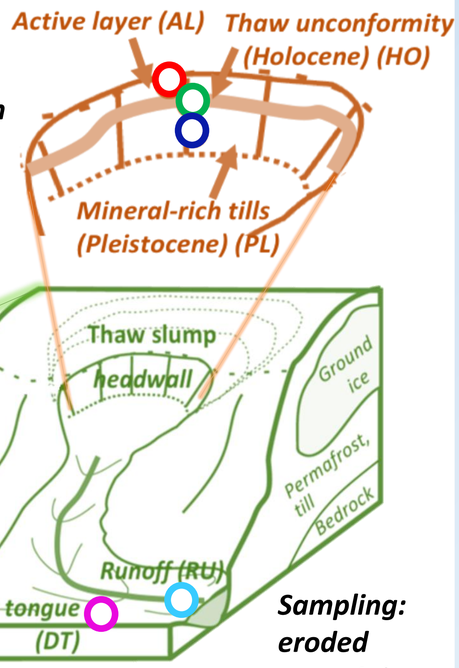


***Research question**: Does material eroded from retrogressive thaw slumps (RTS) and transported downstream originate from upper or deeper soil horizons ?*



Source: [3]

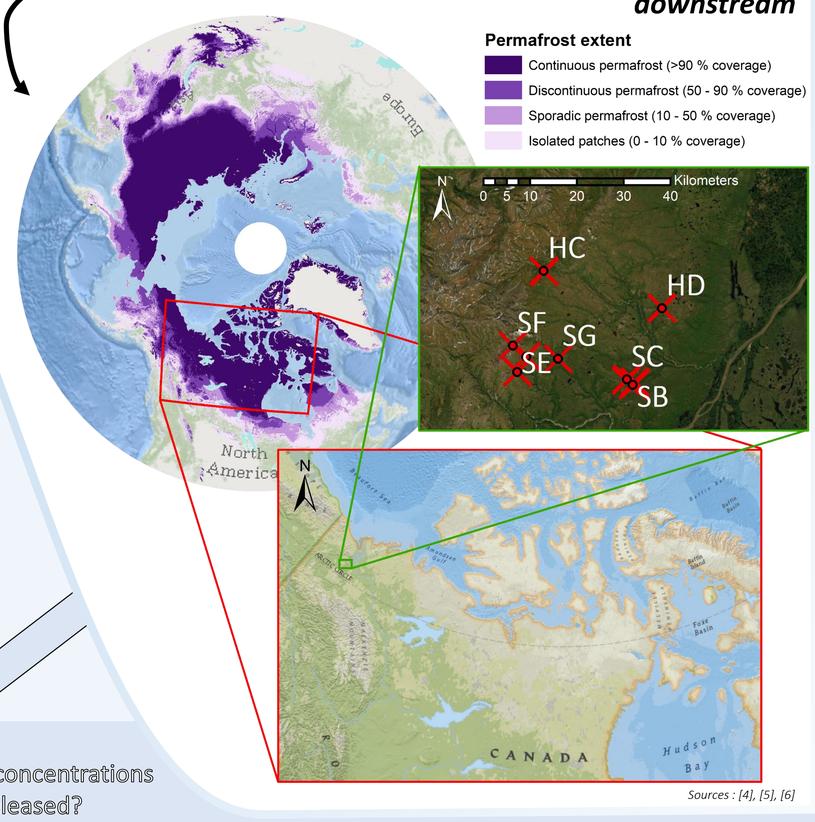
Sampling: sources upstream



Source : [7], [8]

Sampling: eroded materials downstream

8 different RTS structures (slumps) in Peel Plateau (west Canadian Arctic)

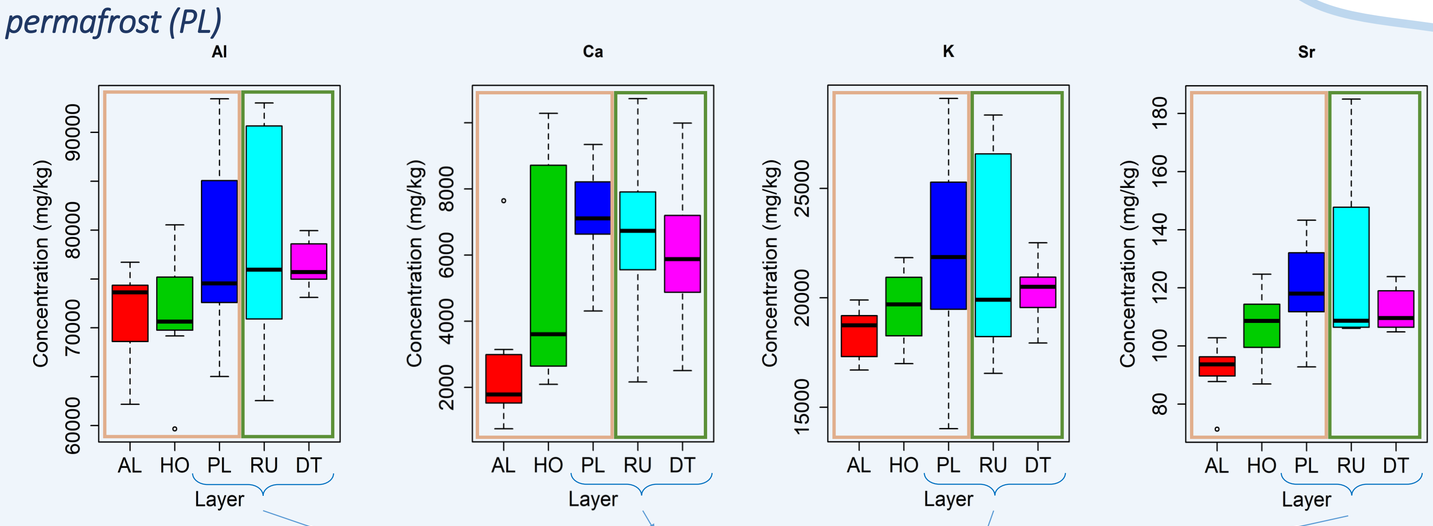


Sources : [4], [5], [6]

Data from 3 slumps

Total element concentrations?

Similar total concentrations in Ca, K, Al and Sr between dowstream mud (RU) and debris (DT), and Pleistocene permafrost (PL)



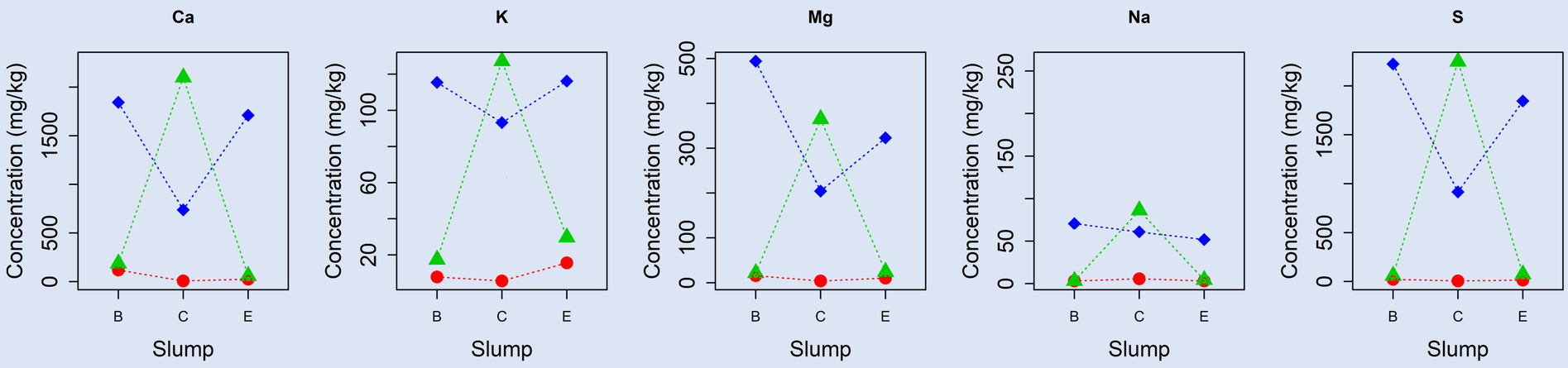
Data from 8 slumps

No significant difference between mean concentrations in Pleistocene, Runoff and Debris Tongue

Soluble concentrations released?

mass of element released by 1 kg of dry soil, in soluble fraction

Deeper Pleistocene permafrost contribution to solute element concentrations is significantly higher than previously thawed active layer (or locally Holocene permafrost)

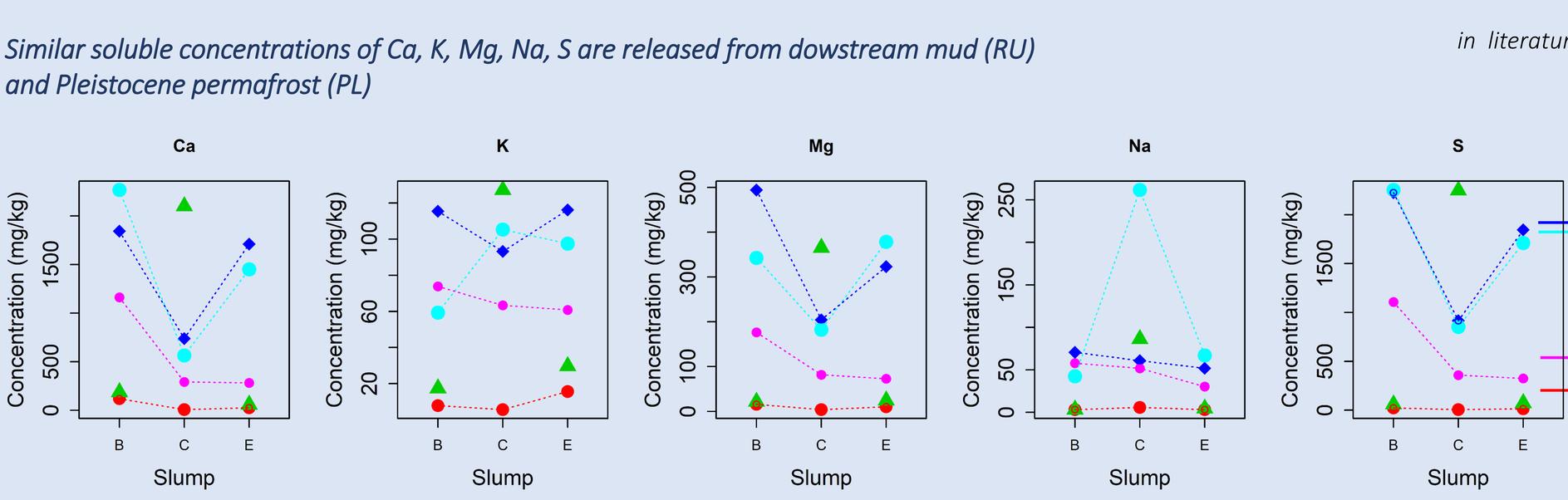


Hypothesis of thaw unconformity for Holocene permafrost (HO): past thaw history controls soluble mineral elements release

Presence of gypsum in Holocene from slump C and not from slump B

Similar soluble concentrations of Ca, K, Mg, Na, S are released from dowstream mud (RU) and Pleistocene permafrost (PL)

in literature [7] : SB = FM2
SC = FM3



PL and RU release very similar soluble concentrations: hypothesis of further transport of fresh material downstream

DT releases less soluble concentrations: hypothesis of progressive release with time

AL depleted in soluble elements due to seasonal thaw

Take-home message

Retrogressive Thaw Slumps development is responsible for horizontal transfer of deep perennially frozen mineral elements downstream, originating from Pleistocene permafrost deposits.

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[2] Boylan et al. (2016). Q. J. Eng. Geol. Hydrogeol., 41, pp 93–108
[3] Schuur et al. (2018). Annu. Rev. Ecol. Evol. Syst., 49, pp 279 – 301
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[7] Zolkos et al. (2018). Geophys. Res. Lett., 45, pp 1 – 10
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