Salt Extractable Organic Matter Carbon in Alaskan Permafrost Region Soils

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Background

- The permafrost region underlies 23.9% of the Northern Hemispheric exposed land area and is estimated to hold over twice the amount of carbon contained in the atmosphere[1,2]
- As global warming continues, there is an increased risk of release of this carbon into the atmosphere, contributing to a positive feedback loop that can speed up the rate of climate change[1]
- Salt extractable organic matter (SEOM) has been used as a proxy for the most readily decomposable organic matter[3]
- **The objectives of this study were to see the relationships between SEOM and 1) other measurements of stored organic matter, 2) soil type, and 3) land cover type**

Methods

Sample Sites: Throughout Alaska, USA

- 167 samples, 1990-2015 (Fig 1)
- Trench digging and soil cores

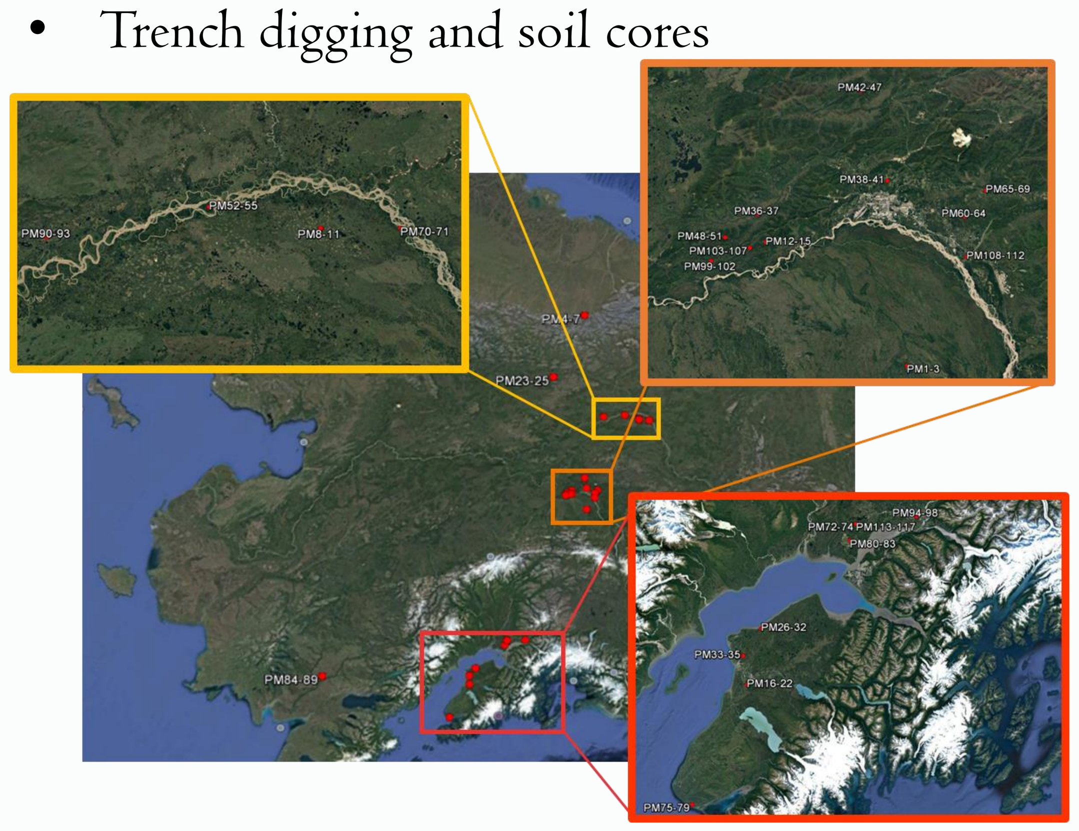

Fig. 1. Map showing sample site locations throughout Alaska, USA

Salt Extractable Organic Matter

- Standard extraction procedures using 0.5 M K_2SO_4 to extract SEOM
- UV Spectrophotometer used to measure absorbance to calculate absorptivity
- Shimadzu TOC-V used to analyze organic carbon content

Data Analysis

- One-way ANOVA

Results

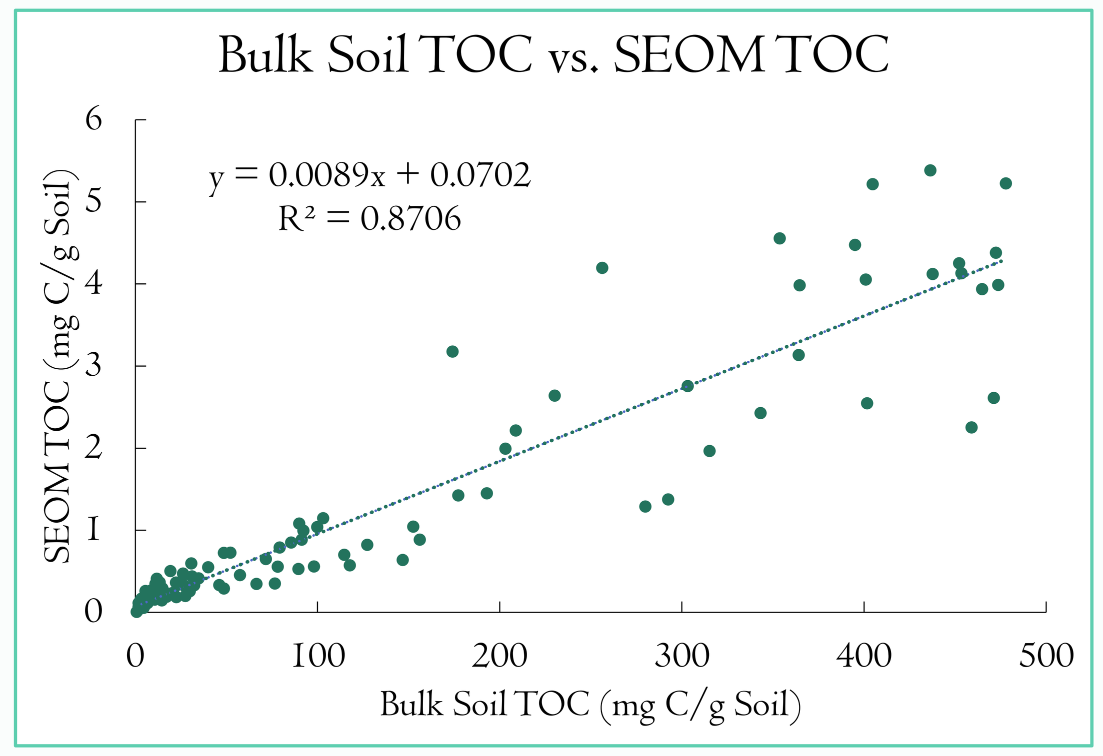

Fig. 2. Relationship between bulk soil total organic carbon (TOC) and salt extractable organic matter (SEOM) TOC

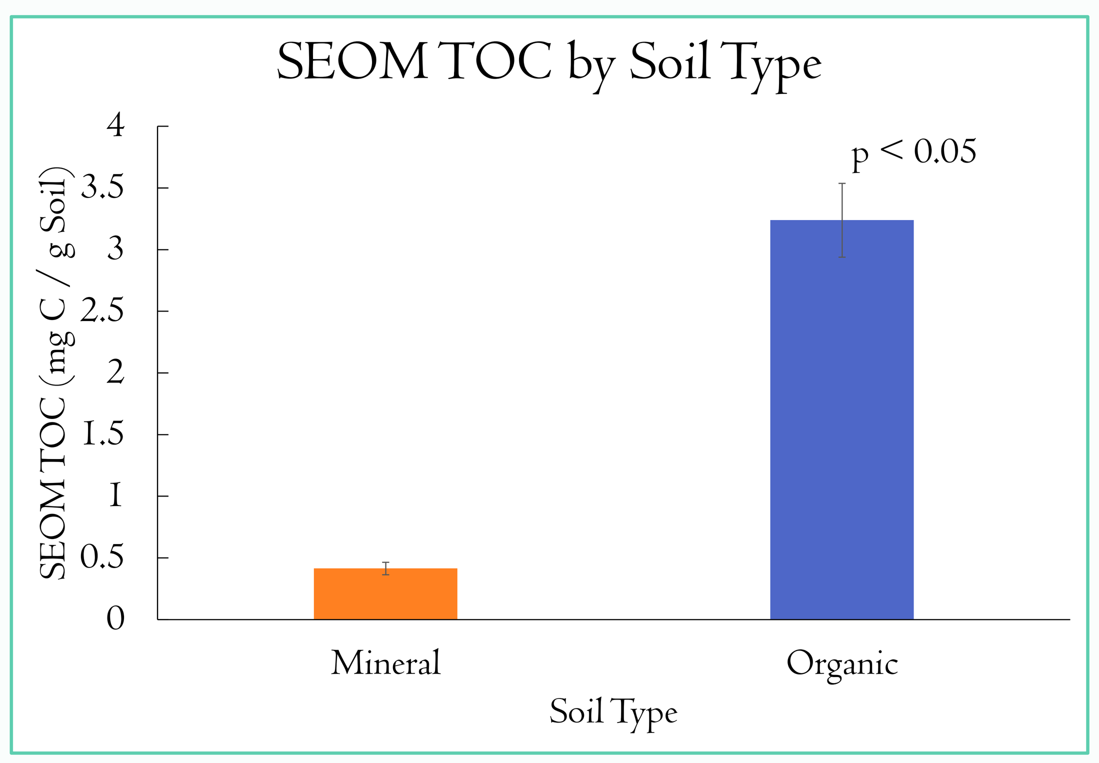

Fig. 3. Average SEOM TOC levels by soil type. Error bars represent standard error.

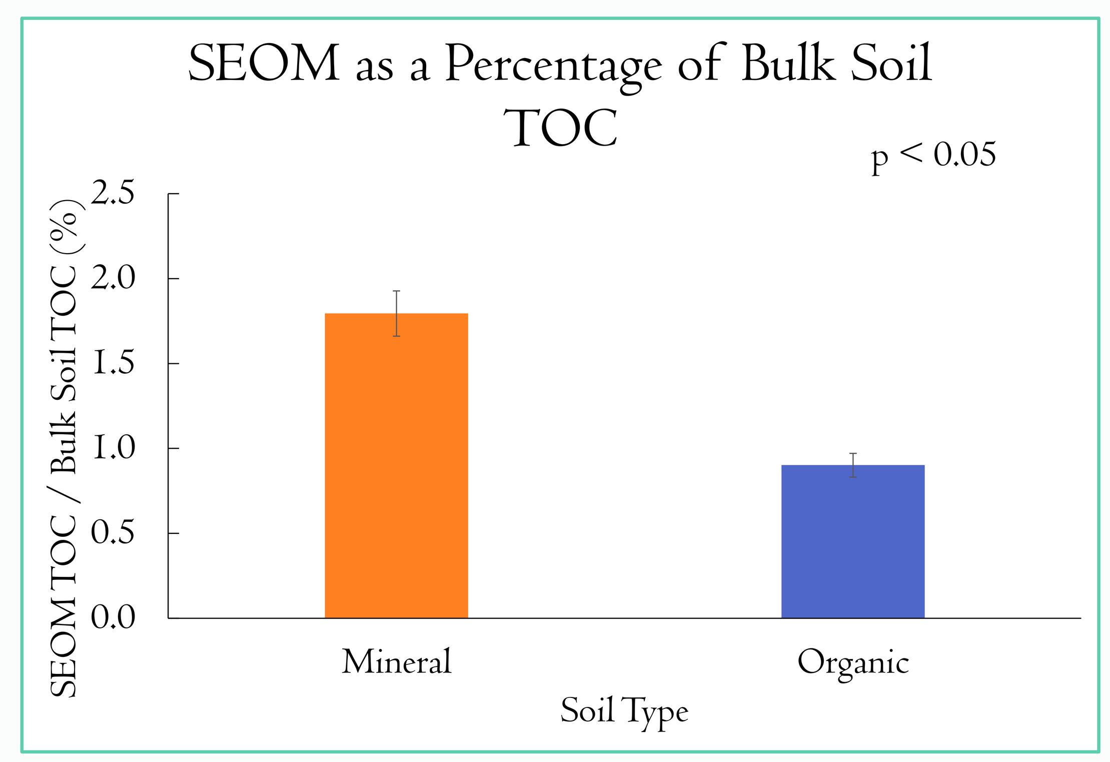

Fig. 4. Average SEOM TOC as a percentage of bulk soil TOC, by soil type. Error bars represent standard error.

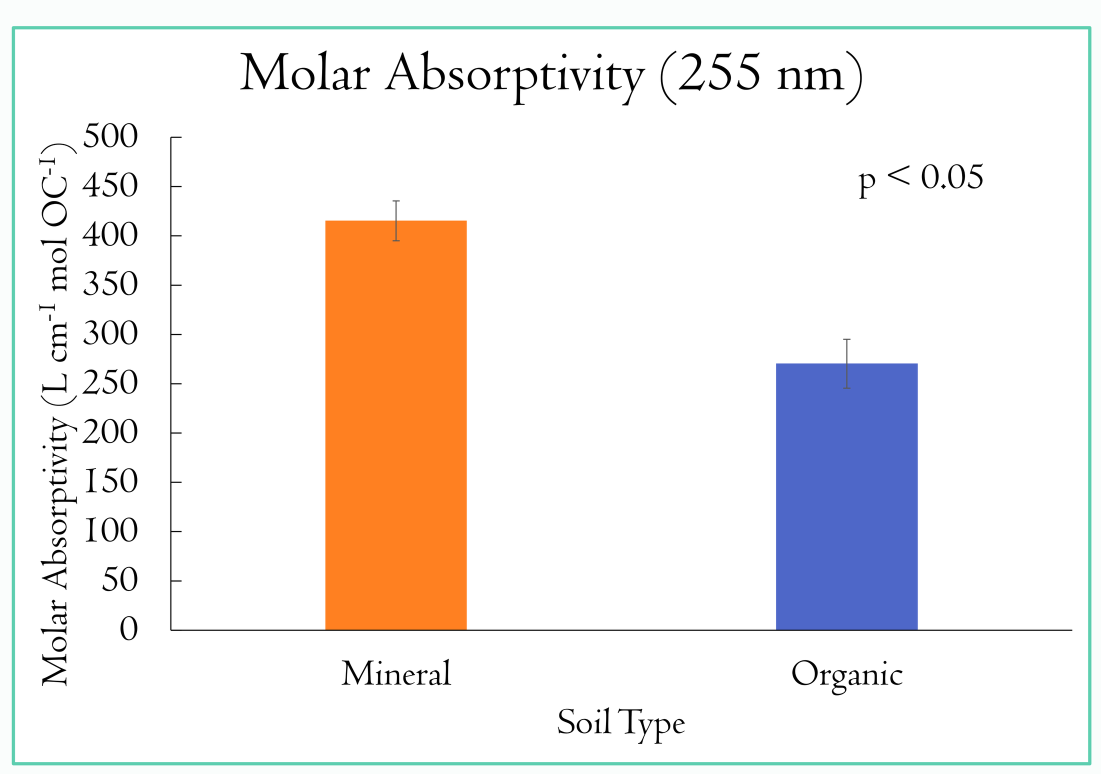

Fig. 5. Average molar absorptivity of SEOM TOC levels by soil type. Higher molar absorptivity indicates lower decomposability.[4,5,6] Error bars represent standard error.

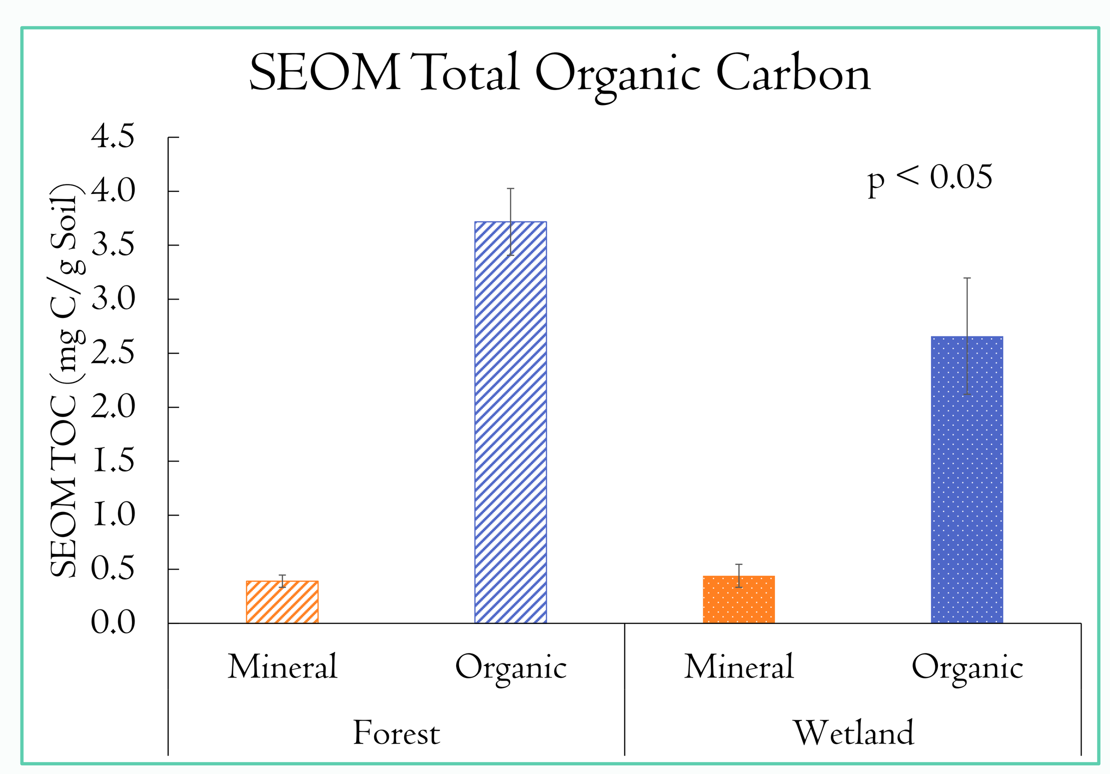

Fig. 6. Average SEOM TOC levels by land cover type and soil type. Error bars represent standard error.

Discussion

- There was a strong correlation between bulk soil total organic carbon (TOC) and SEOM TOC (Fig 2)
- Organic soils had more SEOM TOC than mineral soils, but a higher proportion of bioavailable carbon exists in mineral soils (Fig 3,4)
- Organic soil SEOM is potentially more labile than mineral soil SEOM (Fig 5)
- SEOM TOC is greater in forest soils than in wetland soils, but this difference is driven by the organics (Fig 6)

Future Direction

- Understanding the SEOM composition of different soil types and land cover types will help to identify vulnerable permafrost areas
- The data collected in this study will contribute to the creation of a mid-infrared spectroscopy calibration curve to predict future carbon release vulnerability

Acknowledgements

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