

Maria Scheel¹, Torben R. Christensen¹, Mats Rundgren², Carsten S. Jacobsen³, Athanasios Zervas³

¹ Arctic Research Centre (ARC), Aarhus University, Denmark; ² Quaternary Sciences, Lund University, Sweden; ³ Department of Environmental Science, Aarhus University, Denmark

Background

Arctic: + 0.6 °C /decade in the last 30 years (Schuur *et al.*, 2015) = **2x global average**
+ 3 to 6 °C until 2050 (Hansen *et al.*, 2006; IPCC, 2018)
→ receding cryosphere & altered hydrological patterns (AMAP, 2017)

Climate change effect on PF (+1.5 to 2 °C):

- 28 - 53% of soil organic matter (SOM) → bioavailable (Cavicchioli *et al.*, 2019)
- 5 - 15% of PFC (158 Gt): microbial decomposition → GHGs (Jansson, 2019)



Permafrost (PF): >2 consecutive years frozen soil = ~15 to 25% of Earth's surface (Schuur *et al.*, 2015; Parmentier *et al.*, 2017)

Arctic PF zone = ~1850 Gt C = ~ 2x C_{atm}

→ 1035 ± 150 Gt C top 3 m soil + 800 Gt

frozen PF (Hugelius *et al.*, 2014; Schuur *et al.*, 2015; Parmentier *et al.*, 2017)

PF warming + 2 - 3 °C in last decades (IPCC 2013) = increasing active layer depth

abrupt soil ice **thaw** → **PF collapse**: thermokarsts

affect 20% of all PF areas = ~50% of all PF C = +50 %

RF (Turetsky *et al.*, 2020)



Methods and Study Site

• Zackenberg, NE Greenland (74°30'N, 20°30'W): continuous permafrost, thermal erosion gully after intense snow melt August 2018 → consistent monitoring & sampling → ice lense until August 2019

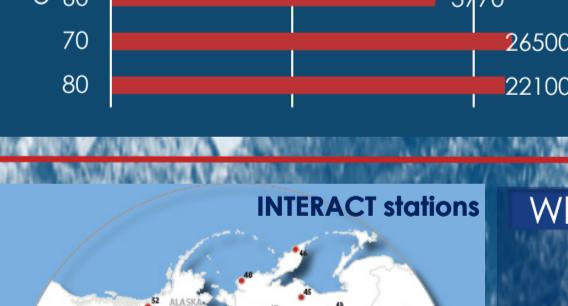
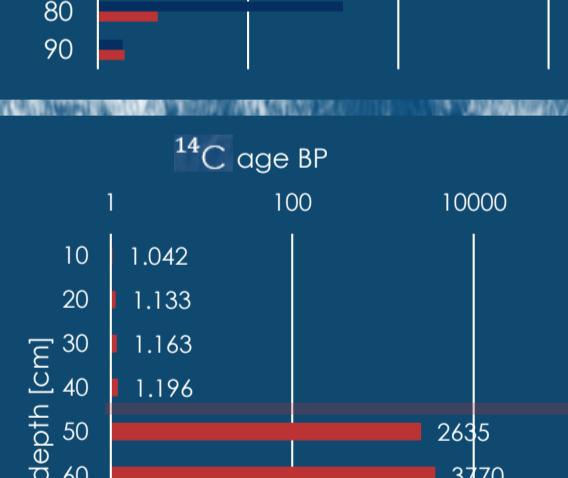
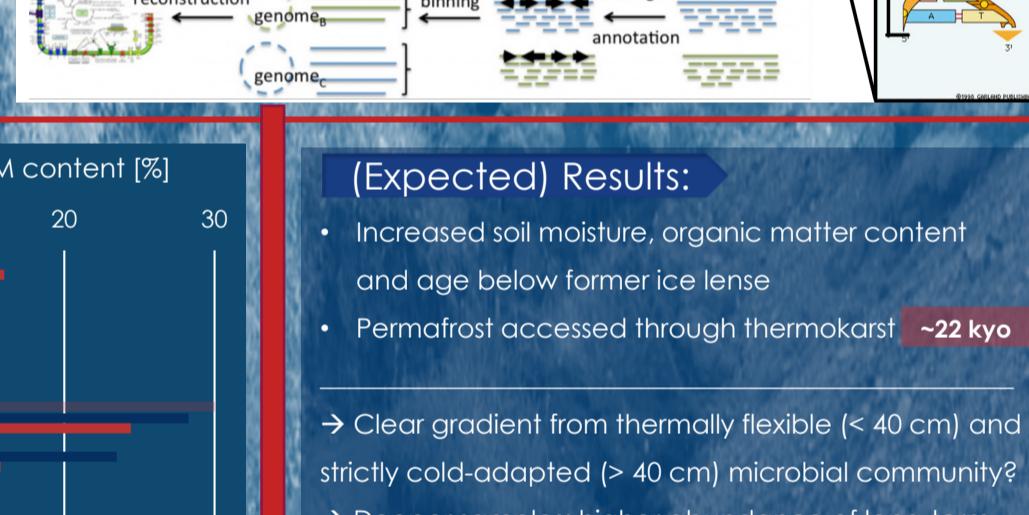
1st descriptive thermokarst microbiome characterization

→ taxonomy and diversity along:

- gully progression with **time** (2018...2020)
- depth (**vertical**) gradient: H₂O and organic matter content and age

now: 16S & ITS DNA amplicons → Illumina sequencing + ¹⁴C dating, loss on ignition

future: thermal incubations + gas flux + transcriptomics (adaptive C metabolism?)

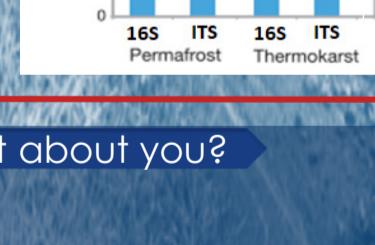


(Expected) Results:

- Increased soil moisture, organic matter content and age below former ice lense
- Permafrost accessed through thermokarst ~22 kyo

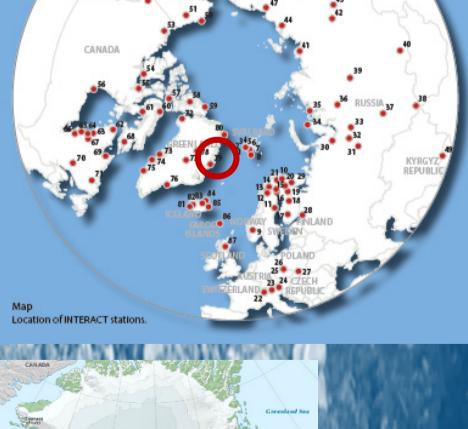
→ Clear gradient from thermally flexible (< 40 cm) and strictly cold-adapted (> 40 cm) microbial community?

→ Deeper samples: higher abundance of long-term resisting stages (dormancy, spores) and mineralization



of complex carbohydrates to CO₂ and CH₄?

→ Increasing relative abundance of thermally adaptive taxa with depth during time (thermal stress caused by thermokarst)?



What about you?

During this #EGUshareonline, let's exchange!

- Do you work on eroding permafrost?
- Where do you see permafrost eroding, e.g. at one of the many INTERACT stations (see left)?
- Do you assess its microbial community in taxonomy and diversity?



@Maria_Scheel_ maria.scheel@bios.au.dk

← Feel free to contact me!

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