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Research on Arctic Lagoons along the Alaska Beaufort Sea Coast – Perma-X Field Work in April 2022

Research focus:

Sea level rise and coastal erosion are one of the main drivers for the formation of thermokarst lagoons. The inundation of permafrost with sea water is leading to intensified permafrost thaw and therefore the unlocking of formerly frozen soil organic carbon (SOC). Due to microbial decomposition, SOC is released as carbon dioxide and methane, leading to further heating. In April 2022 we conducted field work around Utqiagvik and Teshekpuk Lake Observatory to further study the formation of Arctic lagoons and its effect on permafrost carbon cycles.

Coring

unfrozen sediment below lagoons and lakes

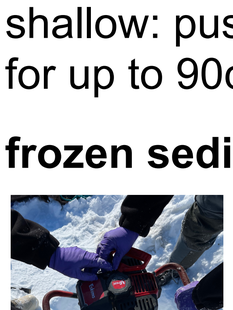
shallow: push core system for up to 90cm cores

deep: vibra-coring system for up to 300cm cores

frozen sediment at frozen ground settings

SIPRE coring system for bottom fast ice locations and permafrost coring

Water hydrochemistry

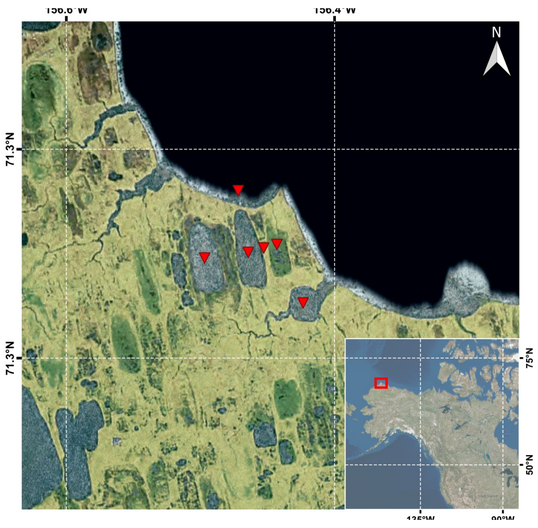


on site measurement of water conductivity, temperature and depth using a CastAway CTD device

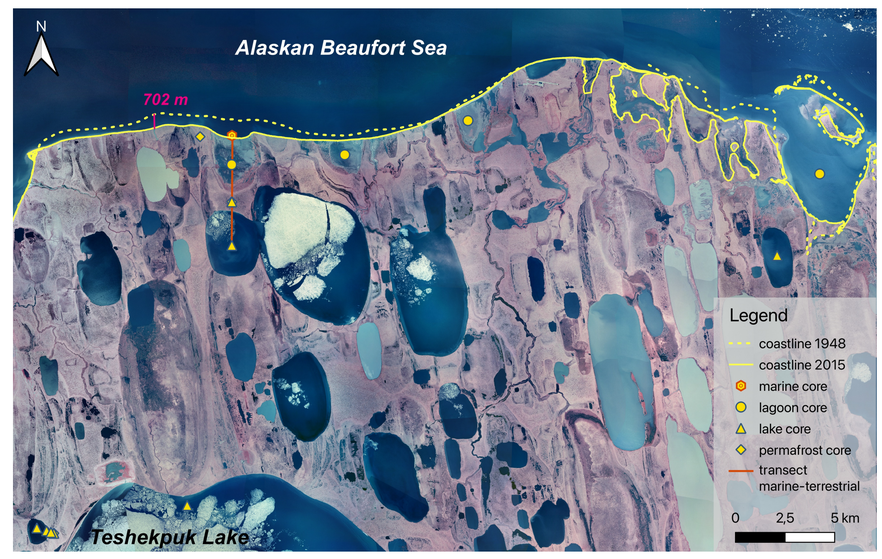
water sampling for further lab analyses such as stable isotopes of water, dissoved organic carbon, pH, anions and cations

Study areas:

Drilling took place in two study areas on the Alaska North Slope: Close to Utqiagvik at Elson Lagoon and Twin Lakes (Map 1) and around Teshekpuk Lake (Map 2) 125 km further east on the Alaskan Beaufort Sea coast.



Map 1: Coring locations at Elson Lagoon. Taking sediment and water samples along a salt water gradient enables us to study the role of varying levels of saltwater on the methane production in wetlands and lagoons.



Map 2: Coring at Teshekpuk Lake and the nearby coast. The inland migration of the sea led to the loss of up to 1km ice-rich coastal permafrost in 67 years. By sampling on a transect from tundra landscapes (including thermokarst lakes) into saltwater affected coastal wetlands and lagoons and further offshore, we are able to study this regime shift and its effects on the carbon stocks and potential carbon release.

Planned future work:

Determination of:

- ❖ lagoon formation processes
- ❖ soil organic carbon quantity and quality
- ❖ current and future greenhouse gas emissions from thawing permafrost deposits (incubation experiments)
- ❖ carbon sources and degradation states by lipid biomarker analyses
- ❖ mercury contamination
- ❖ pore and surface water composition

We thank UIC for the logistical support, especially for the fixing of snow machines in remote areas.

We further thank Ben Jones, Mikhail Kanevskiy, Alexandra Vereemeva, Ken Hinkel, Andrew Parsekian, Rodrigo Rangel, Caleb Kaminski, and Noriaki Ohara for their scientific insights and for making the field work as fun as it was.

Thanks to Chris Maio and his vibra-coring system we were able to drill up to 2,5m long unfrozen sediment cores and thanks to Craig Tweedy and LTER wegot to know where to drill them.

linked references:

B.M. Jones, **G. Grosse** et al. 2022. Lake and drained lake basin systems in lowland permafrost regions. *Nature Reviews Earth & Environment*

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