



# ARC activities 2019



Examples of activities since last years ASP meeting

# ICOS AT STATION NORD

North East Greenland, is located at 81° 36' N, 16° 40' W, 25 m ASL.

At our Arctic ICOS station we will follow the development of the greenhouse gases  $\text{CH}_4$  and  $\text{CO}_2$  in the atmosphere in High Arctic from the Villum Research Station, on the edge to the Arctic Ocean.

- > Tubing to sample air is installed at an 80 meter mast with inlet in 3.6 m, 20, m, 40 m and 60 m to measure concentrations of  $\text{CO}_2$ ,  $\text{CH}_4$  and  $\text{H}_2\text{O}$ .
- > Fluxes of  $\text{CO}_2$  and  $\text{CH}_4$  is measured at 60 m.



View from the mast toward north



View from the mast towards south



# Transition #1 - local



Active layer, surface exchanges. 20 yrs of monitoring

Segregated ice, trapped gas, high  $\text{CH}_4$  content (30+ ppm), depleted  $^{13}\text{CH}_4$

Deeper permafrost, mineral rich, poorly known  $\text{CH}_4$  dynamics

Marked impact on ambient concentrations (20+ ppm) in cracks suggesting increased landscape emissions with more thermokarst occurrence

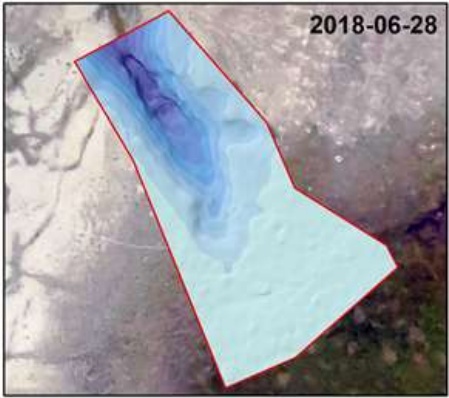
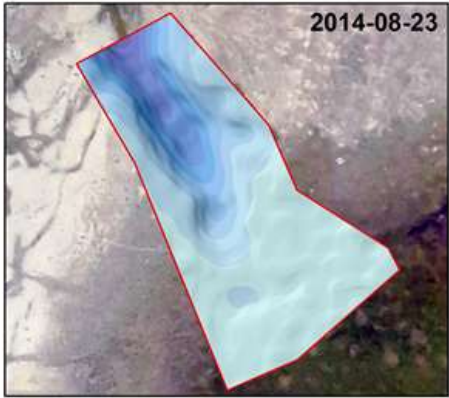
# Transition #1 - local

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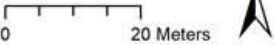
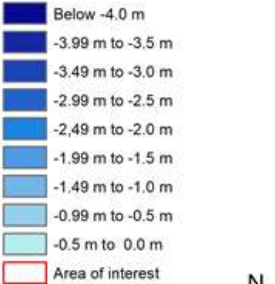


# Thermokarst first shots



Date	Volume loss [m3]
23-08-2014	0
2018-06-28	66.92
2018-08-07	469.12
2018-08-18	445.16
2018-09-09	499.3

Elevation relative to the surface



# CARMA

CARbon sequestration by Greenland's Marine forests in a warming Arctic (Dec 2018-Nov 2021)

Hypothesis: Arctic marine forests support a globally relevant contribution to C-sequestration, which is expected to expand as climate change propels the expansion of these forests in the Arctic

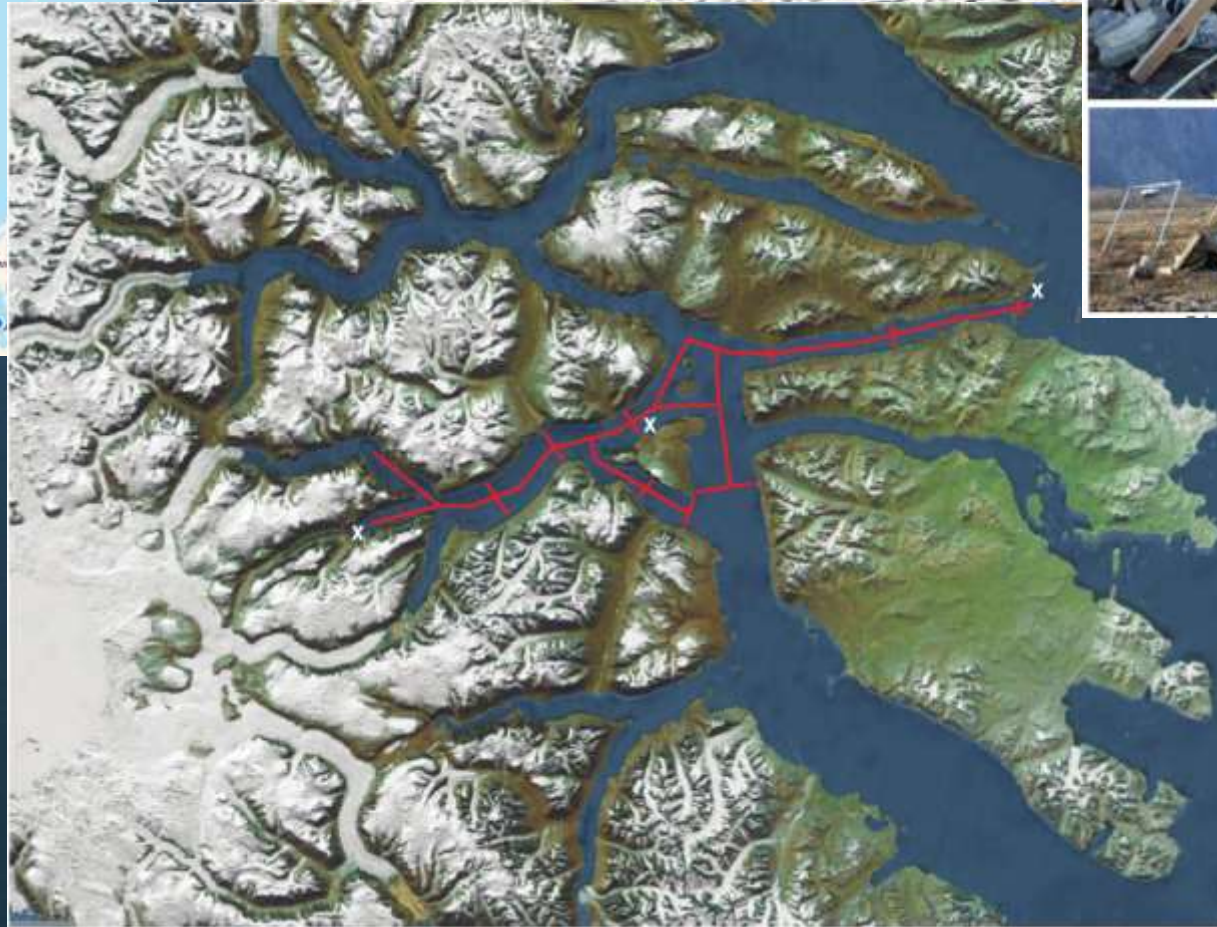
Aim: Develop the first estimate of the C-sink capacity of Arctic marine forests

Approach - interdisciplinary: eDNA and aminoacid isotopes for tracing C from marine forests in sediments along Greenland's coast. Upscale using remote sensing and ocean models.

Team: AU: Dorte Krause-Jensen, Carlos Duarte, Sarah Backmann Ørberg (PhD), Dan Frazier Carlson, Mikael Sejr, Marit-Solveig Seidenkrant; Collaboration w. Philip Francis Thomson MaxPlanck: Thomas Larsen.



Ella Ø - SR





# Daneborg – Moorings retriement - redeployment





# Zackenberg – GeoBasis

## April - Oktober

The GeoBasis programme is divided into a number of sub-groups, including:

**Snow properties;** including spatial and temporal variation in snow cover, depth and density.

**Soil properties;** spatially distributed monitoring of key soil parameters such as temperature, moisture, chemistry and seasonal progression of active layer depth.

**Meteorology;** monitoring of essential meteorological variables across various surface types and elevations.

**Flux monitoring;** plot and landscape scale flux monitoring of CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>O and energy in wet and dry ecosystems.

**Hydrology;** monitoring of seasonal variation in river water discharge, chemistry and suspended sediment.

**Geomorphology;** monitoring of shorelines, coastal cliff foots and cross-shore river profiles.

# Zackenberg – BioBasis

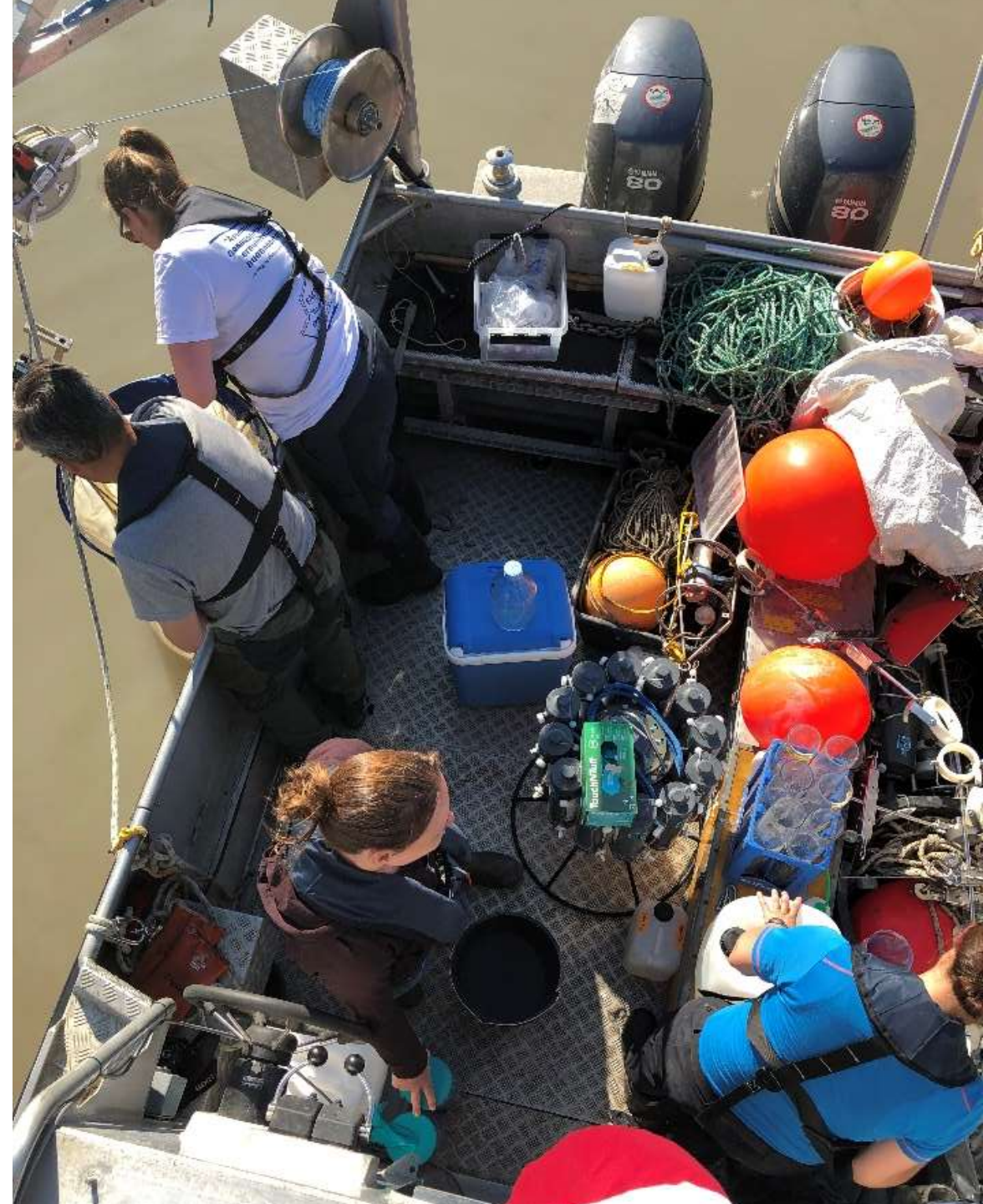
- Monitoring of **flora** (lichens, mosses and vascular) including species diversity, abundance and phenology, herbivory, and greening patterns.
- Monitoring of **arthropod** biodiversity and emergence phenology.
- Monitoring of **birds** including species diversity, abundance, and breeding phenology.
- Monitoring of **mammals** including species diversity, abundance and reproduction.
- Monitoring of **freshwater** biotic and abiotic dynamics, including biodiversity and phenology of phyto- and zoo-plankton, and abundance of fish as well as water chemistry.



# Daneborg – Marin Basis

Marin Basis Monitoring Program is a part of the GEM program, and take place in Young Sund every year in late July until middle of August. The program follows the levels and changes in

- Sea ice
  - Ice cover and thickness
- Water column
  - Temperature, salt, pressure on transects and continuous measurements
  - Sedimentation
  - Nutrients, DIC/TA and plankton composition
  - Light, Fluoresence and Chlorophyl
- Sediment
  - Flux experiment
  - Oxygen profiles
  - Sulphate reduction
  - Benthic fauna
  - Laminaria saccharina
- Walrus – registration



# eDNA – Ilulissat

Field Work

March - July - November 2019

January 2020

Sascha Schiøtt

Science / project plan

Part of the ecosystem survey will be through samples collected by locals. Samples consists of stomach, lower jaw, adipose tissue, muscle and lever from ringed seals, tissue and stomach samples from halibut is also included. Samples from bicatched species also included.

Sampling of water from the fjords watermasses are planned to occur four times during 2019. The water samples are for eDNA analysis. Fieldwork in March, July, November and January in Ilulissat Icefjord.

As another part, an interviewsurvey in Ilulissat, Qasigianniguit, Ilimanaq and Oqaatsut is expected in spring 2019, in which local and traditional ecological knowledge will be collected.





# Mooring with oil-coated adsorbents

## NUUK - MAY

- Recovering moorings with oil-coated adsorbents in Nuuk (Godthåb and Kobbefjord)

## DISKO BAY – JUNE AND OCTOBER

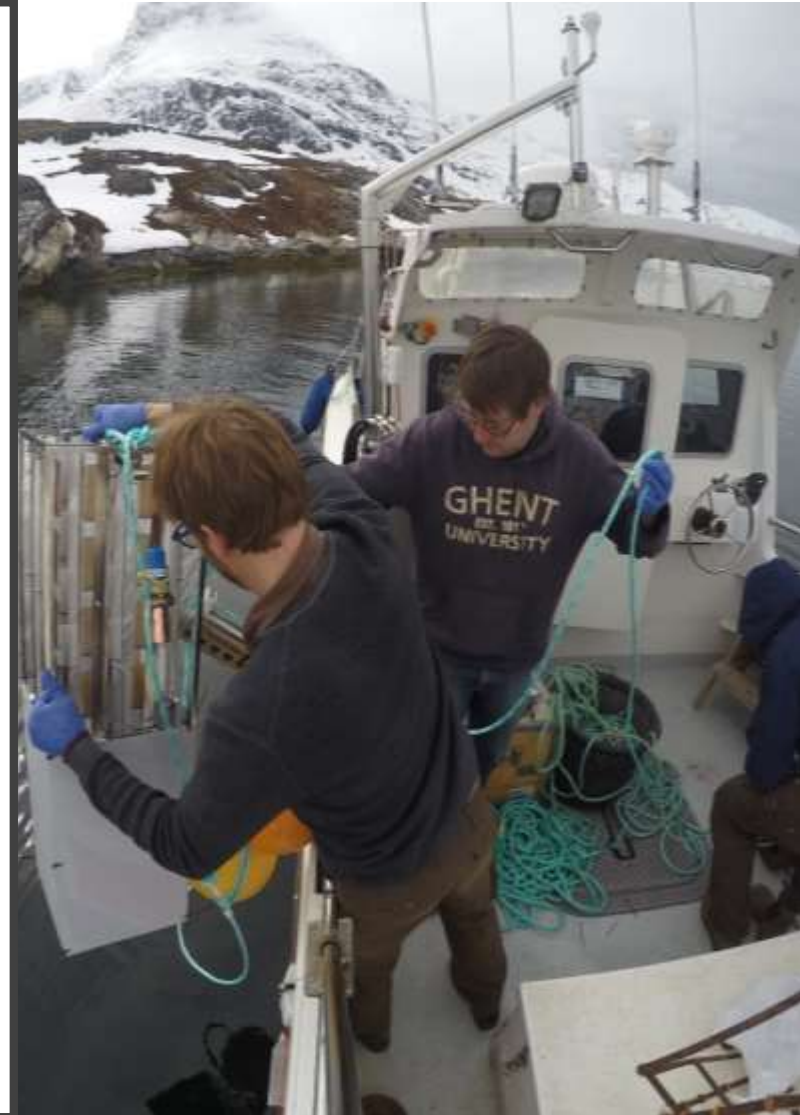
- 2 weeks in Vaigat, Disko Bay
- Ship: 4-5 days Porsild
- Deploying moorings with oil-coated adsorbents and CTD and other sensors

## DISKO BAY – JULY-AUGUST

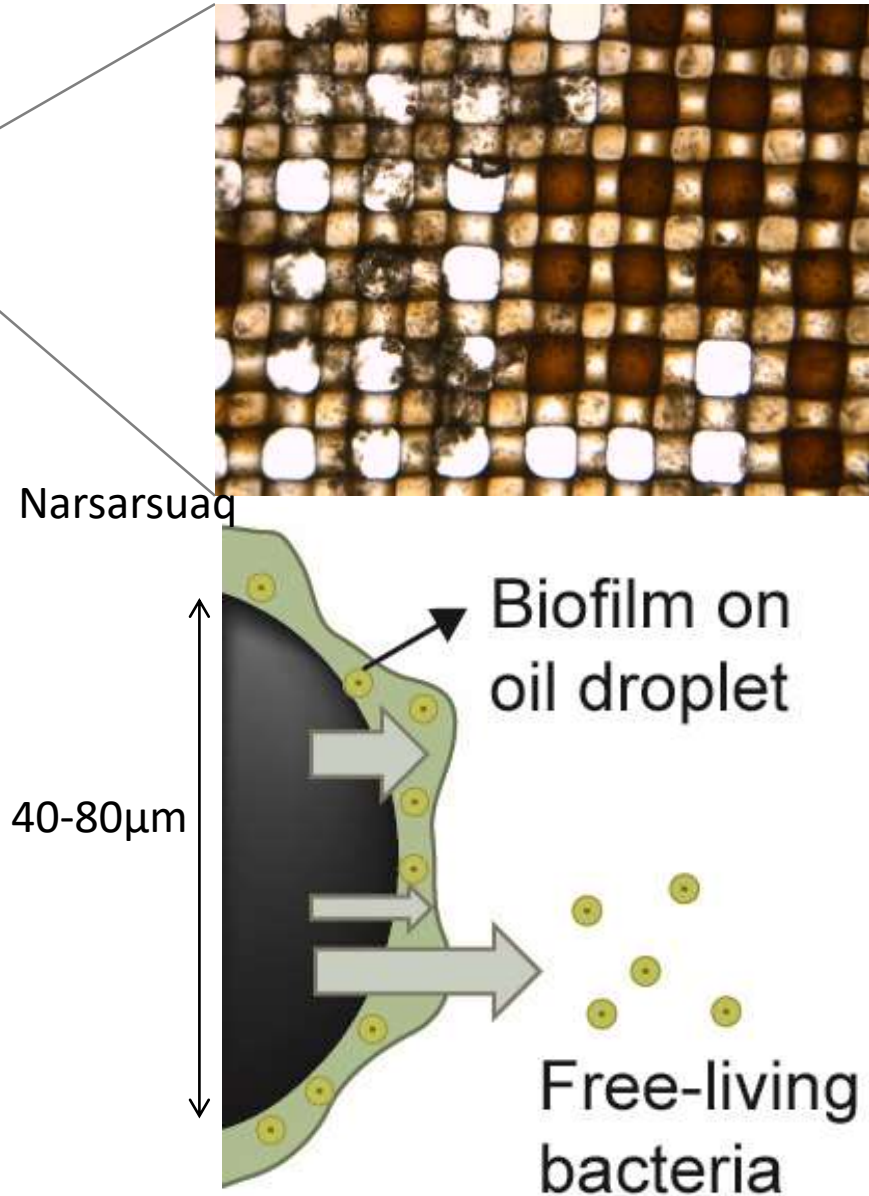
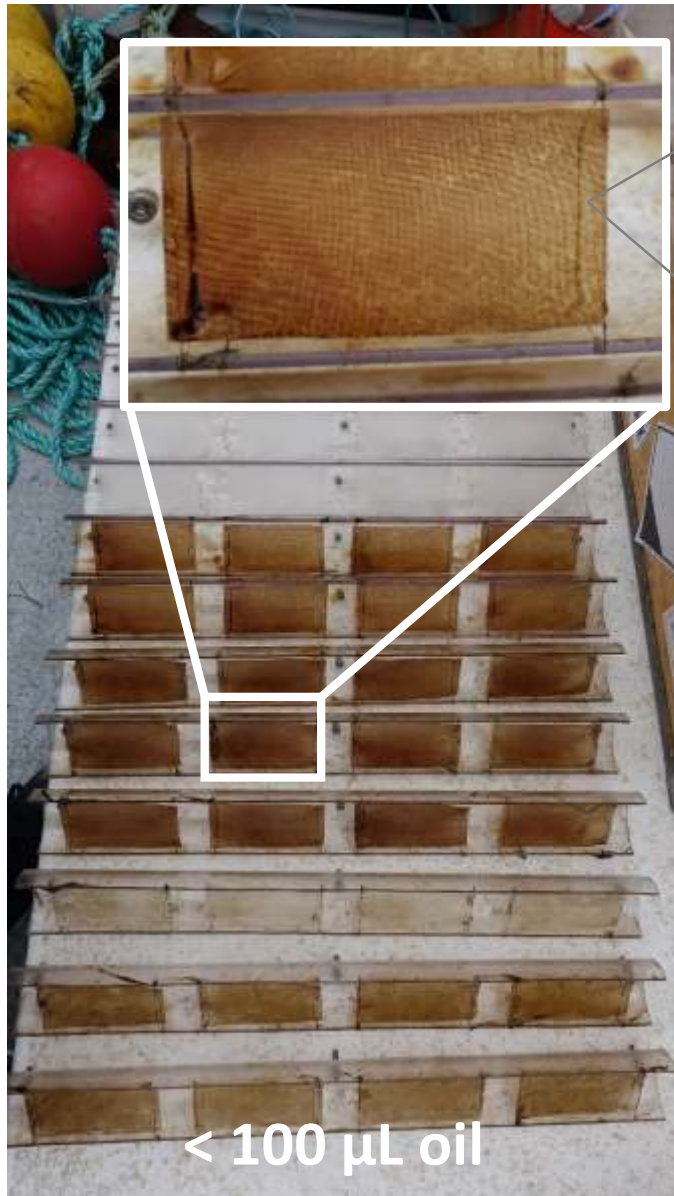
- 3 week scientific cruise:
- The Vaigat Iceberg – Microbial Oil Degradation and Archaeological heritage investigation (VIMOA)
- Ship: Tulu
- Info on isaaffik: <https://www.isaaffik.org/vaigat-iceberg-microbial-oil-degradation-and-archaeological-heritage-investigation-vimoa>

## DANEBOURG – AUGUST

- End of long term experiment from 2018-2019
- Sort time experiment 2-3 weeks



# Mimicking oil droplets on oil-coated adsorbents





# VIMOA Archaeological Cultural Heritage (and site degradation survey)

Leendert Vergeynst and Dan Carlson (*et al.*) were awarded 898,600 DKK from Dansk Center for Havforskning to mount an expedition as part of the Vaigat Iceberg - Microbial Oil degradation and Archaeological heritage investigation (VIMOA) project. During this project, Matthew Walsh will undertake archaeological survey of select archaeological sites that can be accessed during the voyage.

Sites will be chosen on a number of criteria but with a particular focus on visiting sites where previous investigations have revealed pre-/proto-historic use of bitumen in the manufacture of artifacts (e.g. Kalkreuth et al. 1993). Bitumen is not archaeologically uncommon in the North American Arctic as, for example, an adhesive to secure baleen in composite tools. We will attempt to map proximity to known exposures/seeps to determine how this resource may have been accessed in the past and whether or not it is feasible that particular settlements/camps may have strategically targeted this resource (along with others).

Sites will also be recorded visually from the ground (and by drone where possible) and erosion profiles will be recorded to create a synchronic “snapshot” of current geomorpho- and hydro-logical conditions that will 1) serve as a pilot study of methods in development for future projects in the works with Pelle Tejsner and others at ARC; 2) provide a record of site conditions in the area to be made available for future studies of climate driven site deterioration.