

Europlanet TA Scientific Report

PROJECT LEADER

Project number: 22-EPN3-077
Name: Charlotte Spencer-Jones
Home Institution: Durham University
TA Facility visited: Greenland, Kangerlussuaq

Project Title:

Scientific Report Summary.

(plain text, no figures, maximum 250 words, to be included in database and published)

In the search for extra-terrestrial life, environments that have previously contained water are a key target. Glacial environments, such as those found in Greenland, are highly dynamic ephemeral systems with a range of habitat types that support many different species, from bacteria and archaea to large mammals and higher plants. Organic carbon (OC) compounds, the fundamental building blocks of life, can be used to trace different species and/or biogeochemistry. The aim of the fieldwork campaign was to characterise OC in the lake water column to establish OC synthesis patterns in glacial lakes. In this study we collected water, sediment, and soils from 13 sites from a range of lake types near Kangerlussuaq, Greenland.

The second phase of this study will be to characterise organic compounds within the samples. The outcome of this work will be to establish the key parameters that control organic compound preservation with the potential to impact the interpretation of putative extra-terrestrial biosignatures.

Full Scientific Report on the outcome of your TNA visit

The presence of liquid water is a key parameter used in the search for extra-terrestrial life. It is within these water bodies that modern and ancient extra-terrestrial life may be present and, therefore, has renewed interest in the search for appropriate biosignatures that could indirectly identify extra-terrestrial organisms. Organic carbon (OC) compounds are the fundamental building blocks of all terrestrial life. Terrestrial OC compounds that are synthesised in the water column are subsequently deposited and preserved in the sediment, with similar processes proposed for extra-terrestrial environments. The aim of this work was to characterise OC in lake water column to establish OC synthesis patterns in glacial lakes.

The field campaign in Kangerlussuaq ran between 24th July– 2nd August 2023. The flights from the Copenhagen arrived at Kangerlussuaq International Science Support (KISS) facility on 25th July following which we undertook a reconnaissance to the Russell Glacier where we were able to identify potential lake targets and assess accessibility (Figure 1).

Field sampling occurred between 26th – 1st July/August. During the fieldwork, lake water, surface sediment and soil were collected from 13 sites.



Figure 1. Images of ice dammed lakes near Kangerlussuaq, Greenland.

Water sampling: Samples were collected from lake surfaces, inlets and outlets. A multimeter was used to measure water temperature, pH, conductivity, and dissolved oxygen. Water samples were filtered at KISS within 24 hours of collection.

Where possible, lake sediments were collected and stored in pre-combusted aluminium foil for future analysis. Soils surrounding the lake were also samples, this included removing the vegetation layer, collecting a surface (0-5cm) and subsurface (5-10cm) sample. Air and soil temperatures were also recorded.

Post field work analysis: The second phase of this research will include organic compound characterisation using a selection of techniques to quantify molecules and identify the controls on biomarker distributions. Using these approaches, we aim to identify suites of compounds that could be diagnostic indicators of extra-terrestrial life (biosignatures) and establish mechanisms for their preservation in equivalent Martian environments.

- Give details of any publications arising/planned (include conference abstracts etc)

- We envisage multiple scientific journal articles will come from this work. Notably, at least 2 journal articles will arise from the organic compound analysis.
- Conference abstracts will be submitted to BOGs 2024 and EGU 2025.

- Host confirmation

Please can hosts fill in/check this table confirming the breakdown of time for this TA project:

Dates for travel to accommodation for TA visit (if physical visit by applicant)	Start Date of TA project at facility	Number of lab/field days spent on TA Visit pre-analytical preparation	Number of days in lab/field site for TA Visit	Number of days spent in lab for TA Visit data analysis	End Date of TA project at facility	Dates for travel home (if physical visit by applicant)
Departed: 02-08-23 Arrived: 24-07-23	24-07-23	0	7	0	02-08-23	Departed: 03-08-23 Arrived: 23-07-23

The host is required to approve the report agreeing it is an accurate account of the research performed.

<u>Host Name</u>	<u>Keld R. Rasmussen</u>
<u>Host Signature</u>	<i>Keld Rasmussen</i>
<u>Date</u>	<u>14/08/2023</u>

- Project Leader confirmation

Do you give permission for the full version of this TA Scientific Report (in addition to the 250 word summary) to be published by Europlanet 2024 RI on its website and/or public reports? YES

<u>Project Leader Name</u>	<u>C. Spencer-Jones</u>
<u>Project Leader Signature</u>	<i>C Spencer Jones</i>
<u>Date</u>	<u>10/08/2023</u>