

# Europlanet TA Scientific Report

## PROJECT LEADER

<b>Project number:</b> 20-EPN2-120
<b>Name:</b> Ali Nawaz
<b>Home Institution:</b> Technical University of Munich – Germany
<b>TA Facility visited:</b> TA1 Facility 1 – Iceland Field Sites, Matis

## Project Title: **A molecular toolkit to hunt and resolve Fungal Dark Matter (FDM) in extreme planetary environments**

### **Scientific Report Summary.**

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

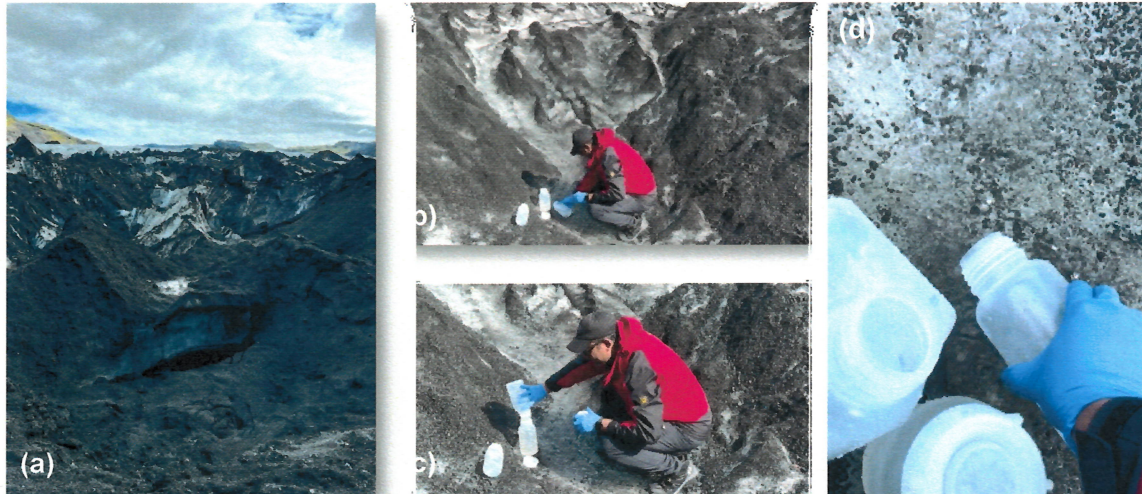
Fungi are amazing but largely enigmatic creatures with huge diversity and biological potential in any conceivable ecosystem known so far. This holds for our planet, but this also seems true for outer space and other planetary bodies. However, we do not know what kind of extremophile fungi are or have been growing on other planets.

To have a clue, we need to explore the extreme analogue sites on our planet using novel and advanced methods. Therefore, we here propose to collect and study samples from various extreme habitats of Iceland using a unique combination of Laser-microdissection of single cells and long-read sequencing to fully resolve the Fungal Dark Matter (FDM) of Mars-analogue extreme sites of Iceland.

We believe that the output of this project will bring novel fungal species into scientific arena and the findings of this proposal will help the broader scientific community dealing with AstroMycology in specific and Astrobiology, in general, to rightly speculate on the capabilities and limitations of microbial life in extreme environments and correlate it with the conditions of other planets.

## Full Scientific Report on the outcome of your TNA visit

Fungal omnipresence is an established fact in a wide range of extreme or harsh environmental settings, where they endure diverse environmental pressures while carrying out vital ecological roles. Such capabilities of fungi to grow and function in extreme environments led the scientific community to believe in their presence in other planetary bodies as well. In this perspective, in order to capture, identify, and investigate the extremophile fungi in their natural environment, Mars-analogous field sites in Iceland are ideal sites. Therefore, we collected water samples from glacial streams representing extreme cold environment (Figure 1), hydrothermal vents / bubbling ponds representing extreme hot environment, and last but not the least an acidic lake with pH 2.8 (Figure 2) and a nearby neutral lake with pH 6.8 as a negative control.



**Figure 1:** Sólheimajökull Glacier: Melting water flowing from the glacier like small streams was collected (b), (c) in 1L water bottles (d) and transported to the laboratory for further processing and storage.

The work plan and study sites were discussed and finalized after consultations with colleagues at MATIS. From each site, five replicated samples were collected in 1L water bottles and transported to the laboratory at MATIS, where the filtration process was carried out. Briefly, before filtration the water bottles were shaken to homogenise the samples. Then, water was first filtered through 100 $\mu$ m sieve to remove any higher organisms and sample impurities which might clog the filters with smaller pore sizes in the process later. Then the filtrate was filtered sequentially through three filters with pore sizes 5.0  $\mu$ m, 0.65  $\mu$ m and 0.22  $\mu$ m for fungal single cells and whole microbial community analysis.

After the filtration process, the filters were immediately stored at -20°C for whole microbial community analysis and the filters for fungal single cells were stored at 4°C. The filters will be transported to Technical University of Munich (TUM) for further downstream molecular processing to hunt fungal and microbial dark matter.



**Figure 2:** Natural Lake (Grænavatn) in the region Hafnarfjörður. The pH of the water samples collected from the lake was 2.8.



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


From the collected samples and their subsequent fungal single cell and fungal community exploration, we plan to prepare at least two manuscripts enlightening the potentially new or undescribed fungal species and the overall fungal community structures in hot, cold and acidic environments. These manuscripts will be submitted to Science of the Total Environment, Frontiers in Microbiology or Environmental Microbiology. The preliminary insights of the field trip is planned to be presented at the Europlanet Science Congress (EPSC) – Spain, 2022.

**- 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: 18-07-2022  Arrived: 18-07-2022	19-07-2022	0	5	0	23-07-2022	Departed: 24-07-2022  Arrived: 24-07-2022


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

<b><u>Host Name</u></b>	René Groben, Matís
<b><u>Host Signature</u></b>	
<b><u>Date</u></b>	08.08.2022

**- 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 /NO**

<b><u>Project Leader Name</u></b>	Ali Nawaz
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<b><u>Project Leader</u></b> <b><u>Signature</u></b>	
<b><u>Date</u></b>	04-08-2022