

Europlanet TA Scientific Report

PROJECT LEADER

Project number: 20-EPN-066
Name: Camila Cesar
Home Institution: Bern Universität
TA Facility visited: Mars Chamber Facility (UK-Open University)

Project Title: “Experimental investigation of CO₂ frost condensation and sublimation through sediments in Martian conditions: implications for martian gullies and jets”

Scientific Report Summary.

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

Our experimental campaign aimed to understand sediment transport driven by CO₂ ice sublimation condensed inside a porous regolith. To quantify the erosion of sediment associated with the sublimation of CO₂ frost in the subsurface of a ~30° slope, we tested various compositions (MGS-1, sand, sand-dust mixtures). While some sediment showed little to no activity over several attempts (sand), others showed significant slope activity (sand + >=10% MGS clay). The results form part of a paper in preparation and will be presented at EGU 2023.

Full Scientific Report on the outcome of your TNA visit

We encourage you to add figures to your report, which should be approx. 1 page of text plus figures.

During this experimental campaign, we tested six sediment types (Sand, MGS-1 or a mixture of sand + % of MGS dust) inside the Mars Chamber facility at the Open University of Milton Keynes (Fig.1). The first three days of the visit were focused on putting in place the system (chamber + electronics) and troubleshooting. The setup is composed of a copper sample container where the sample is placed in a slope $\sim 30^\circ$, a set of fixed cameras, a video recorder, and a heat lamp. 18 target markers are placed on top of the small container's rim to allow 3D reconstruction of the slope's surface (Fig.2). The sediment temperature is recorded by sensors at various locations inside the sample and the chamber pressure is recorded at 1s interval.

We performed a total of 15 runs. The sample composition varied and we conducted two runs of Sand + 20% MGS Dust; Two runs of Sand + 10% MGS Dust; Five runs of Sand + 7.5% MGS Dust; Three runs of Sand + 5% MGS Dust; Two runs of Sand ; One run of MGS-1.

The chamber is first depressurized to 20 mbar then filled with CO₂ gas (at least twice to ensure no residual component is left inside the chamber) and finally cooled down with LN₂ at ~ 300 mbar. Once the sample is sufficiently cool to allow condensation of CO₂ frost onto the sample (surface and subsurface), the sample is heated up from above (heat lamp) initiating the sublimation phase. As the CO₂ sublimates, it can trigger mass movement on the slope and eruptions near the base of the slope as seen in previous experiments (Sylvest et al. 2015; 2019).

We observed significant slope activity for the sand + $\geq 10\%$ MGS Dust mixtures while lower dust contents showed little to no slope movement. Additionally, several experiments had small slope failures not caused by the sublimation of subsurface CO₂ frost, but by pressure drops.

A publication detailing these results is in preparation and they will also be presented at EGU 2023: the provisional title is "An experimental study of the effect of dust on sublimation induced mass movements on Mars".



Figure 1 : Mars Chamber facility at the Open University.

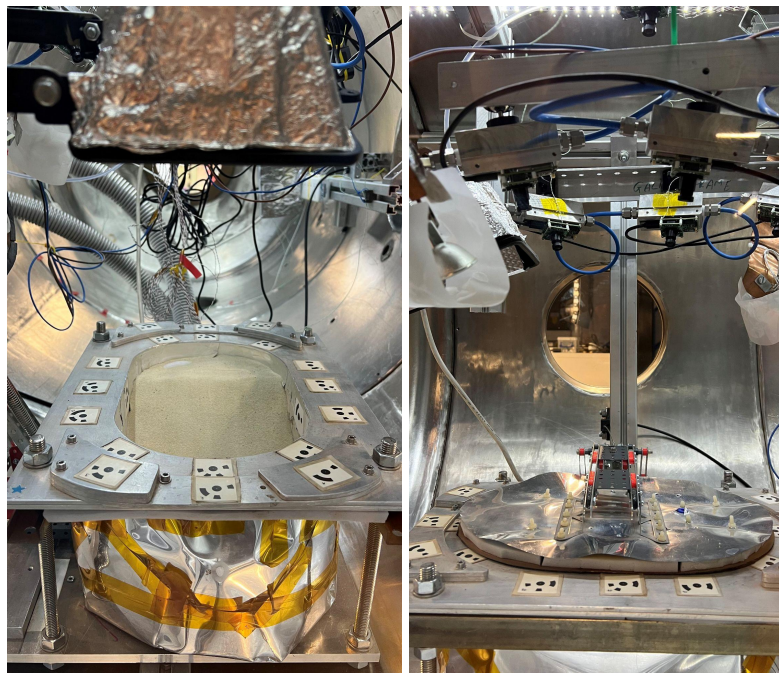



Figure 2 : Experimental setup of a sand slope inside the Mars Chamber. The sample holder (small chamber) is marked with photogrammetry targets. An array of seven cameras located above the chamber record images of the slope during the sublimation phase.

Host confirmation

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

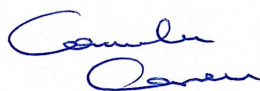
Dates for travel to accommodation for TA visit (if physical visit by applicant)	Start Date of TA project at facility	Number of lab/field days spent on TA Visit pre-analytical preparation	Number of days in lab/field site for TA Visit	Number of days spent in lab for TA Visit data analysis	End Date of TA project at facility	Dates for travel home (if physical visit by applicant)
Departed: 22-10-22 Arrived: 23-10-22	24-10-22		20		18-11-22	Departed: 20-11-22 Arrived: 21-11-22

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

<u>Host Name</u>	Mars Chamber Facility (UK-Open University)
<u>Host Signature</u>	
<u>Date</u>	11.01.2023

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>	Camila Cesar
<u>Project Leader Signature</u>	
<u>Date</u>	11.01.2023