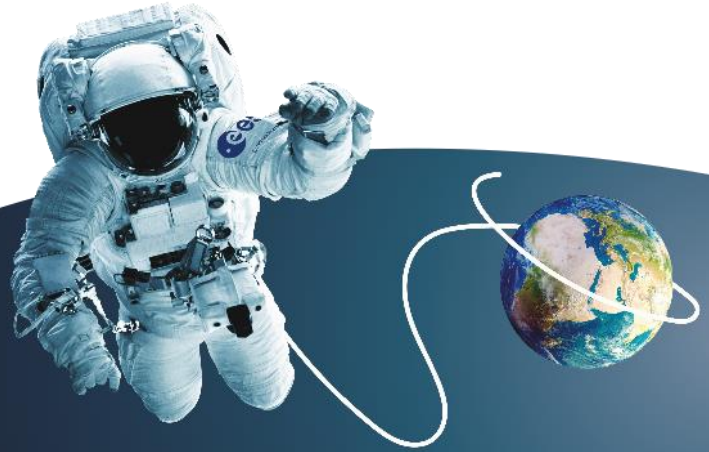
MELISSA
MICRO-ECOLOGICAL LIFE SUPPORT SYSTEM ALTERNATIVE

CREATING A CIRCULAR FUTURE

REBUS-CYANOBACTERIA: The use of the desiccation-, radiation-tolerant cyanobacterium *Chroococcidiopsis* sp. CCMEE 029 for *in situ* resource utilization on the Moon and Mars



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In Situ Resources BioUtilization per il Supporto alla Vita
ReBUS

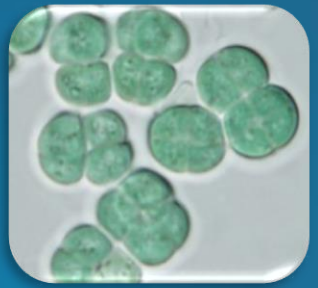
The aim:

linking *in-situ* resources to life support systems

using **desert cyanobacteria**

Mars regolith analog

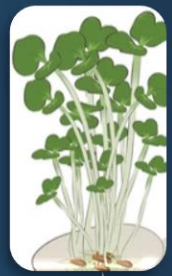
Lunar regolith analog



Desert cyanobacteria

Cyanobacterial lysate-based medium as feedstock/fertilizer

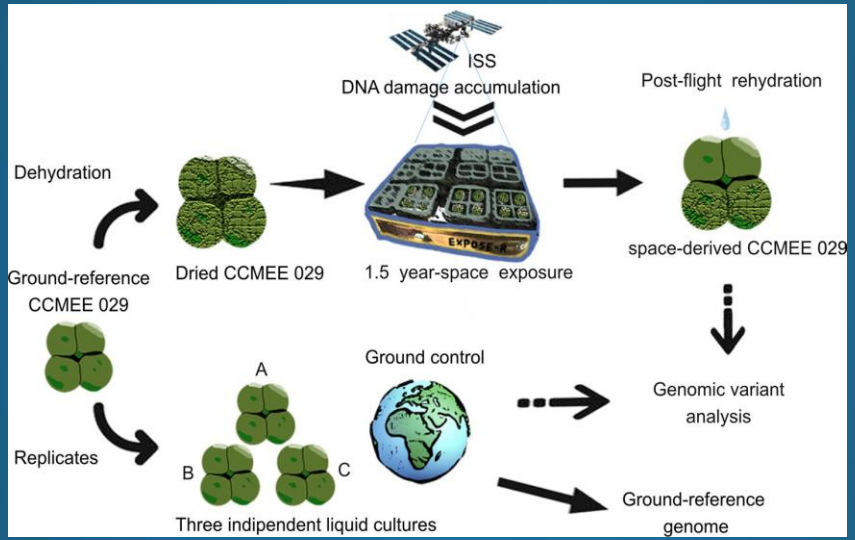
Bacteria

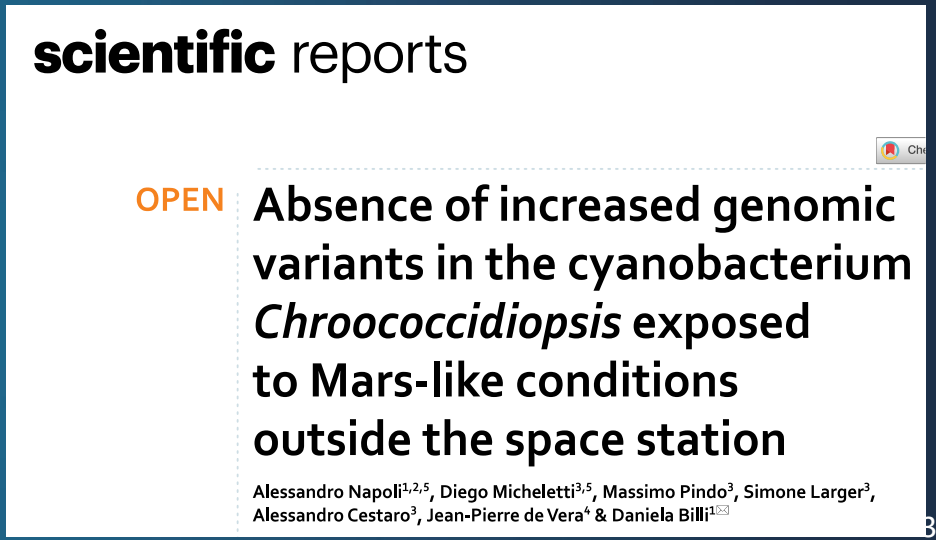


Microgreens

The desert strain *Chroococcidiopsis* sp. CCMEE 029 was selected because :

- it is desiccation and radiation tolerant
- It survives in the dried state under space and Mars-like conditions
- Its genome sequence has been sequenced
- It repairs efficiently DNA damage accumulated under space or Mars-like conditions




scientific reports

OPEN

Absence of increased genomic variants in the cyanobacterium *Chroococcidiopsis* exposed to Mars-like conditions outside the space station

Alessandro Napoli[1,2,5], Diego Micheletti[3,5], Massimo Pindo[3], Simone Larger[3], Alessandro Cestaro[3], Jean-Pierre de Vera[4] & Daniela Billi[1]

Features relevant when moving an experimental approach form Earth to space

desiccation

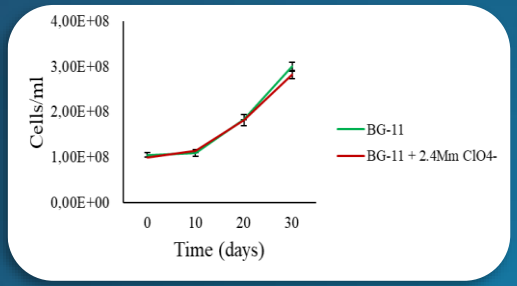
Earth
Desiccation of cyanobacteria

Travel in Space
Damage accumulation in dried cells

rehydration

Moon or Mars
Rehydration, damage repair and exploitation of cyanobacterium-based technologies for ISRU on the Moon or on Mars

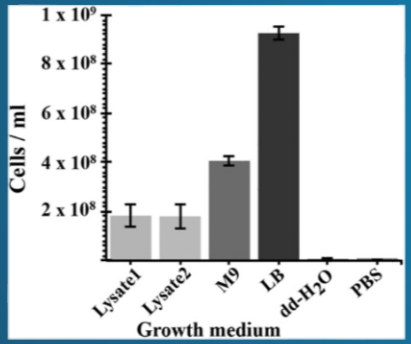
A feature relevant for ISRU on Mars is *Chroococcidiopsis* resistance to perchlorate ions

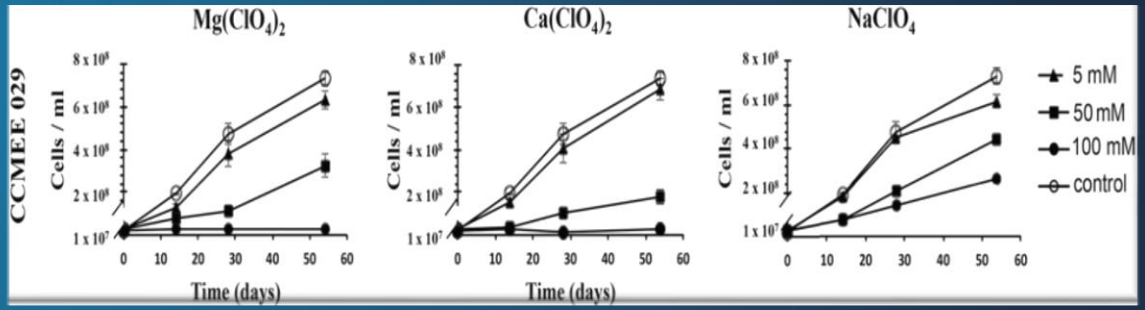


International Journal of Astrobiology

Exploiting a perchlorate-tolerant desert cyanobacterium to support bacterial growth for in situ resource utilization on Mars

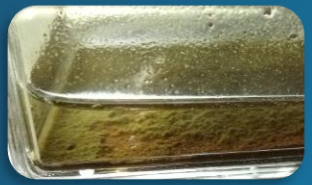
Daniela Billi[1], Beatriz Gallego Fernandez[1], Claudia Fagliarone[1], Salvatore Chiavarini[2] and Lynn Justine Rothschild[3]





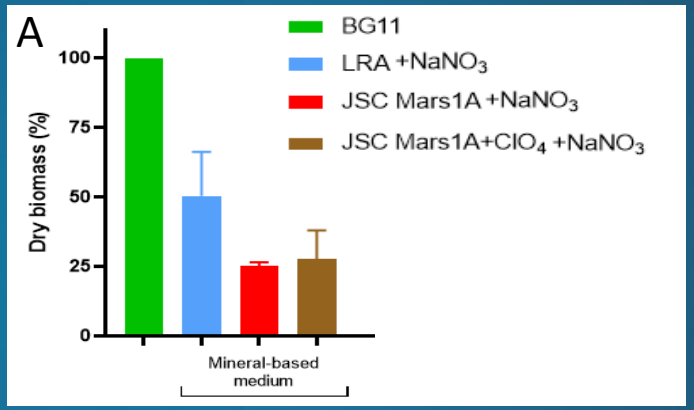
Relevant *Chroococcidiopsis*'s features for ISRU on Mars and Moon are:

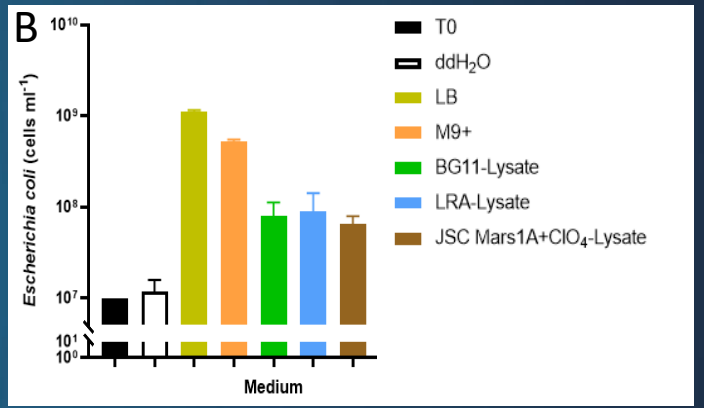
- capability of using Martian and Lunar regolith simulants as nutrient source, supplemented with $NaNO_3$ (Fig. A)
- Lysate suitability as feedstock for *E. coli* (Fig. B)



Mars regolith analog

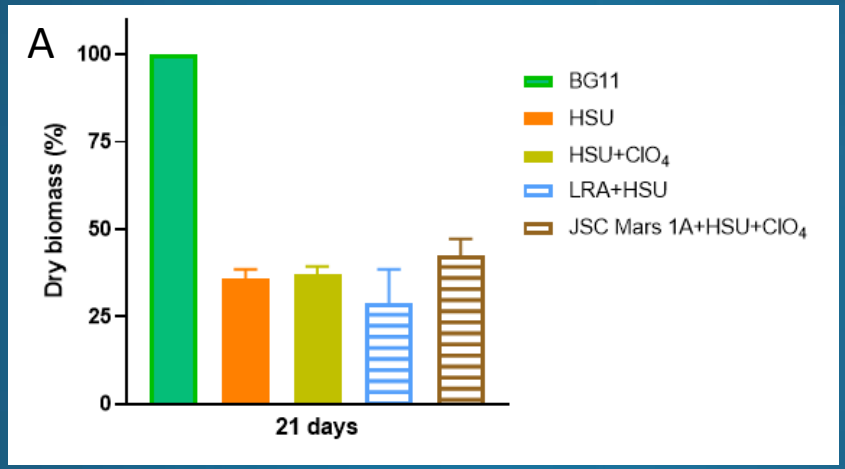
Lunar regolith analog

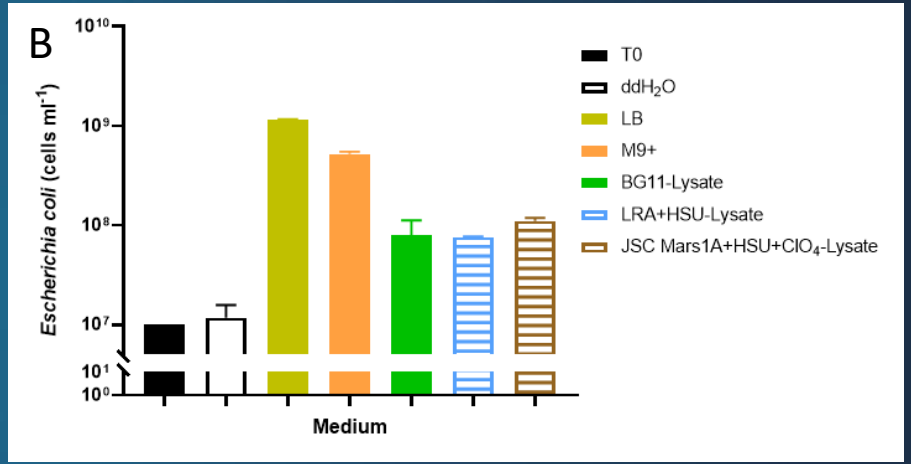




Relevant *Chroococcidiopsis*'s features for ISRU on Mars and Moon are:

- capability of using human synthetic urine (10 mM urea) as nitrogen source (Fig. A)
- lysate suitability as feedstock for *E. coli* (Fig. B)



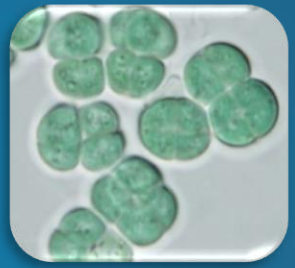


Proof – of – concept in

linking *in-situ* resources to life support systems using **desert cyanobacteria**

Mars regolith analog supplemented with human synthetic urine

Lunar regolith analog supplemented with human synthetic urine



Chroococcidiopsis sp. 029

Lysate used as feedstock

Bacteria

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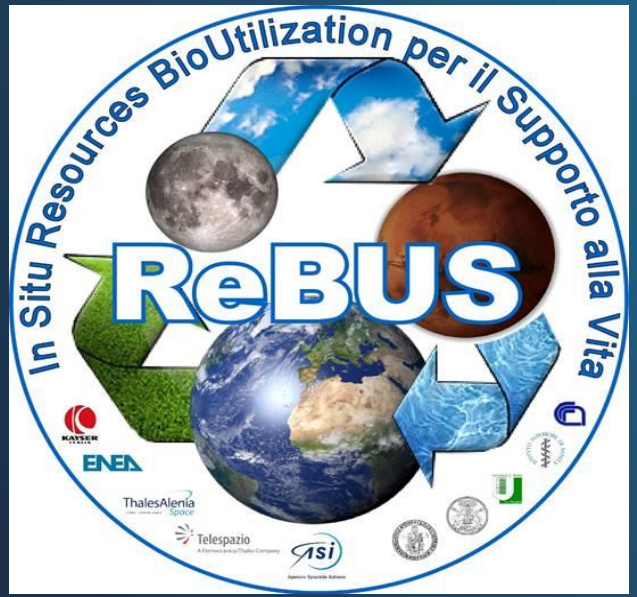

THANK YOU.

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www.**melissafoundation**.org

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