# Elemental mobilization from a Martian Regolith Simulant by *Parageobacillus thermantarcticus* M1$^T$

Mattia Esposito[1,2,3], Elena Chianese[3], Ida Romano[2], Luca Tonietti[3], Ilaria Finore[2], Annarita Poli[2], Alessandra Rotundi[3], Paola Di Donato[2,3]

[1]*Department of Environmental Sciences, Informatics and Statistics, University of Venice Ca' Foscari, Venice, Italy*

[2]*Istituto di Chimica Biomolecolare Consiglio Nazionale delle Ricerche ICB-CNR, Pozzuoli, Italy*

[3]*Department of Science and Technology, University Parthenope, Naples, Italy*

Biomining is increasingly explored for resource recovery in space applications, but its efficiency depends on microbial physiology, substrate composition, and growth conditions[1]. We investigated the ability of the thermophilic bacterium *Parageobacillus thermantarcticus* M1$^T$ to promote elemental mobilization from a Martian regolith simulant. Experiments were conducted at 60 °C under static conditions for five days. Culture viability, pH, and dissolved elemental concentrations were monitored, and genome mining of the predicted proteome was used to identify functions potentially associated with elemental mobilization. *P. thermantarcticus* remained viable in the presence of the simulant and shifted the medium pH from slightly acidic to mildly alkaline values. Compared with abiotic leaching, the bacterium selectively enhanced the mobilization of several elements, most clearly observed for Fe and Cr. In contrast, Ni, Zn, and Mg showed smaller or more variable responses. Genomic analysis identified functions related to urease activity and amino acid deamination, consistent with moderate alkalinization, together with FeoB-like ferrous iron transporters and Fur-family ferric uptake regulators, supporting active iron acquisition and homeostasis. Screening for chromium-associated functions did not identify a canonical ChrR-type chromate reductase, suggesting that chromium transformation may instead involve nonspecific flavin-dependent redox activity. This study highlights *P. thermantarcticus* as a promising thermophilic model for studying microbe-regolith interactions.

*P. thermantarcticus* M1$^T$ is stored at the extremophilic bacterial collection (CE-ICB) of the Institute of Biomolecular Chemistry, partner of Joint Research Unit MIRRI-IT.

1. Santomartino et al. npj Microgravity (2026).