The molecular mechanism behind microbe-mineral interactions, on Earth and in Space

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Microbe-mineral interactions have become of interest for space exploration as microorganisms can biomine elements from rocks, which could be used as nutrients in a life support system. Therefore, this research is aimed at assessing the impact of space flight conditions on the bacterial physiology of *Cupriavidus metallidurans* CH34 and identifying the molecular mechanisms behind microbe-mineral interactions with basalt, a lunar-type rock.

Survival of CH34 in mineral water, with and without basalt, was monitored over several months by flow cytometry, plate counts, ICP-MS, microscopy and proteomics. To study the influence of space conditions, this setup was send as a flight experiment on board the Russian FOTON-M4 capsule, exposing the cells to reduced gravity and increased radiation.

The results obtained from from water survival experiments on ground showed that the viable cell concentration remained stable for several months but that the cultivable fraction dropped to 10%, indicating a transition to a more dormant state. In the presence of basalt, cells started to form a biofilm on the rock after 4 weeks. The space flight experiment indicated more viable cells compared to the ground experiment, both in the absence and presence of basalt, indicating a positive effect of space flight on survival.
Additional physiological and molecular analyses are on-going to confirm these observations and to determine the molecular processes behind.

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