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Impact of simulated Martian conditions on bacterial strains from Mars analogue sites

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During the project “Mars Analogues for Space Exploration” (MASE) several microbial isolates were obtained from extreme terrestrial environments. Some of these strains were subjected to Mars relevant environmental stress factors in the laboratory under controlled conditions; e.g. radiation, low water activity, high salt concentrations, or oxidizing compounds. All sampling, isolation, and cultivation steps, as well as the stress tests were performed under anoxic conditions.

So far, five only distantly related microorganisms are under detailed investigation: *Buttiauxella* sp. MASE-IM-9, *Clostridium* sp. MASE-IM-4, *Halanaerobium* sp. MASE-BB-1, *Trichococcus* sp. MASE-IM-5, and *Yersinia intermedia* MASE-LG-1. It was shown that tolerance to desiccation and to ionizing radiation, applied separately, was not correlated as it is known for example for deinococcal representatives. If desiccation and exposure to radiation were applied together

typical additive effects as well as an enhanced radiation tolerance could be observed. The survival after addition of oxidizing compounds (hydrogen peroxide; perchlorates) for dedicated time points (15 minutes; 24 hours) was very diverse. The comparison of the five microorganisms revealed that *Trichococcus* sp. MASE-IM-5 was the most sensitive strain and survived only 20 mM hydrogen peroxide for 15 minutes and 24 hours, respectively. The most tolerant organism was *Buttiauxella* sp. MASE-IM-9 which was able to survive 230 mM hydrogen peroxide for both tested time points. In between, the other Bacteria were arranged with different tolerances against hydrogen peroxide (*Buttiauxella* sp. MASE-IM-9 > *Yersinia intermedia* MASE-LG-1 > *Halanaerobium* sp. BB-1 > *Clostridium* sp. MASE-IM-4 > *Trichococcus* sp. MASE-IM-5). Comparable species specific results were obtained after the addition of different perchlorates.

In general, the strategy of the MASE project has proven to be useful to gain new model organisms. The isolated and characterized MASE strains have so far unknown high tolerances against cell damaging treatments and may serve as model organisms for future space exposure experiments.