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The adaptation potential of extremophiles to Martian surface conditions and its implication for the habitability of Mars

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Extremophilic microorganisms like lichens and cyanobacteria were collected from tropic deserts and from polar and alpine habitats because of their occurrence in intensely irradiated, very dry and/or cold environments which are supposed to be as close as possible to Martian surface conditions. The collected species were exposed during different experiments either to real space conditions on space exposure platforms like BIOPAN and EXPOSE-E on the International Space Station or to Mars simulation conditions in a Mars simulation chamber. Some of these species were also exposed to both of the extreme environmental conditions. It is a technical challenge to perform Mars simulation experiments with long duration exposure times on microorganisms – the so called extremophiles. One of the challenges is, to take care of measuring and monitoring all environmental parameters including measurements of metabolic activity of the investigated microorganisms. But the first performed one month experiment on the Antarctic lichen Pleopsidium chlorophanum in the Mars simulation facility at the Institute of Planetary Research at the DLR Berlin was successful and shows remarkable results on the adaptation capacity of photosynthetic activity within the simulation time of 34 days. This result will be a starting point to revise the previously analyzed simulation experiments on other lichen species and cyanobacteria and to start new “long duration” experiment series with other polar microorganisms. The outcome of this work might be relevant to classify Mars as a habitable planet by a new experimental and biological approach.