Mars Analogues for space exploration – A summary of results

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Astrobiology seeks to understand the limits of life and to determine the physiology of organisms in order to be able to better assess the potential habitability of other worlds and improve our ability to assay them for the presence of life. To successfully achieve this we require repre-sentative microorganisms from environments on Earth that in physical and/or chemical condi-tions approximate to extraterrestrial environments. The most challenging of these environ-ments with respect to the sample collection and follow on isolation and cultivation of microor-ganisms are anaerobic environments. Here we describe a systematic approach to this challenge and aim to provide a guideline for future field work and sampling campaigns. We selected a number of anaerobic environments based on characteristics that make them analogous to past and present locations on Mars (Icelandic lakes, sulfidic springs, deep hypersaline environ-ments, acidic iron-rich environments and permafrost). We implemented a culturing approach to enrich organisms from these environments under anaerobic conditions using a defined medium that would allow for all organisms to be grown under identical culturing conditions in future physiological comparisons. We then isolated anaerobic microorganisms, carried out a study of their basic physiology and deposited these organisms in the DSMZ (Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH) culture collection to make them available to astro-biologists and microbiologists. These organisms can them be used for a variety of astrobiology projects. In MASE, the selected organisms are being artifically fossilised and matured and the ensuing biosignatures studied in order to aid the search for in situ biosignatures on Mars and in samples returned from Mars. This project represents the first attempt to implement a coordi-nated effort from the selection of extraterrestrial analog sites through to the isolation and the characterisation of organisms and their deposition within a culture collection.