SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 1 (3A)

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HABITABILITY STUDIES IN PREPARATION FOR FUTURE MARS MISSIONS

Abstract

The search for organic material and biosignatures on Mars is a highly complex endeavor. Oxidative and radiation processes on the Martian surface are destructive to any organic and biological compound. However, the cold and dry climate on Mars may preserve organic matter in the subsurface, even in old terrain when spared from regional metamorphism. An interdisciplinary preparation phase for future Mars missions is crucial to better understand the processes that may alter organic matter. Mars simulations that take into account the effects of UV and ionizing radiation, atmospheric reactions, aridity, temperature conditions, surface oxidation, salinity and acidity and aeolian processes need to be undertaken and compiled in a database to determine how the preservation potential of molecules influences the record that can be observed. Instruments on future Mars missions are limited in their capabilities to search for signs of life that conform to our preconceived notions of biomarkers. Field research conducted during the EuroGeoMars 2009 campaign shows the need to further optimize extraction procedures to analyze biomarkers and organic molecules in future sampling campaigns. Methods have to be developed that can release adsorbed biological compounds such as amino acids and DNA during the extraction process

from soils. The successful hunt for extant biosignatures will be a tradeoff between multiple parameters, including accessibility, biomarker concentration, the preservation potential, extractability, and instrument performance. When deploying organic detection instruments on Mars, consideration only of the geological context and the history of regional aqueous processes for landing site selection may be insufficient. The host microenvironment of organics and putative microbes on Mars must be compatible with the capabilities of the instrumentation payload.