Is Recent Mars A Habitable Planet? - Microorganisms From New Terrestrial Mars Analog Habitat Sites In The Permafrost Of Continental Antarctica Survive Mars Simulation Experiments In The Lab And In Space

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1. Introduction

Astrobiological investigations were performed in the Transantarctic Mountains within the study sites located in the Northern Helliwell Hills, Sothern Helliwell Hills (Boggs Valley) and in the Morozumi Range in North Victoria Land (~71.73°S/161.38°E) and were visited in the framework of the 10th and 11th German Antarctic North Victoria Land Expedition (GANOVEX X and XI) during the austral summer of 2009/2010 and 2015/2016. The local bedrock consists mostly of sedimentary rocks (sandstones) of the Beacon Supergroup and mafic igneous intrusions (Ferrar Dolerites). Within these rocks a variety of micro-niches such as fissures, cracks and some structural micro-cavities within the fine-grained sedimentary rocks are colonized by a diversity of microorganisms. These micro-niches are protecting the organisms against extreme desiccation and UV-irradiation. Collected microorganisms of these Mars-analogue field sites are checked if they are able to survive or to be metabolically active under simulated Mars-like conditions in the lab and in space.

2. Mars analogues and Mars simulation experiments

Through comparison to structures on the surface of Mars the geologically and geomorphologically well-defined macro- and micro-habitats can be classified as Mars-analogs. The Mars-analogy can also be confirmed particularly due to the presence of liquid water at an air temperature below zero and the presence of perchlorates. A test series on collected and isolated microorganisms from these potential Mars analog field sites started for checks on the ability to survive or even to live under simulated Mars-like conditions both in the laboratories and in space [1], [2]. Metabolic activity and vitality tests were performed (e.g. CFU, CLSM, protein synthesis and photosynthetic activity tests). Some of the samples which were tested for 1.5 years on the International Space Station (ISS) in the frame of the ESA/DLR-space experiment BIOMEX (BIOlogy and Mars EXperiment, 2014-2016, [3]) show the high resistance of polar microorganisms to Mars-like environmental conditions simulated by Mars-like space exposure on the ISS. They mainly survive the conditions of simulated Mars environment either in the lab or in space.

3. Conclusions

The simulation experiments in the laboratory and the space tests performed by ESA, NASA and DLR additionally highlight how important the collaboration between Polar Research and Space Research is as a prerequisite to investigate the habitability of Mars in a very extreme environment. The cooperation of these disciplines is also mandatory to find out if new investigated field sites are from a biological point of view real Mars-analogues and if microorganisms in these areas might have relevance to survival or to be metabolic active on Mars.

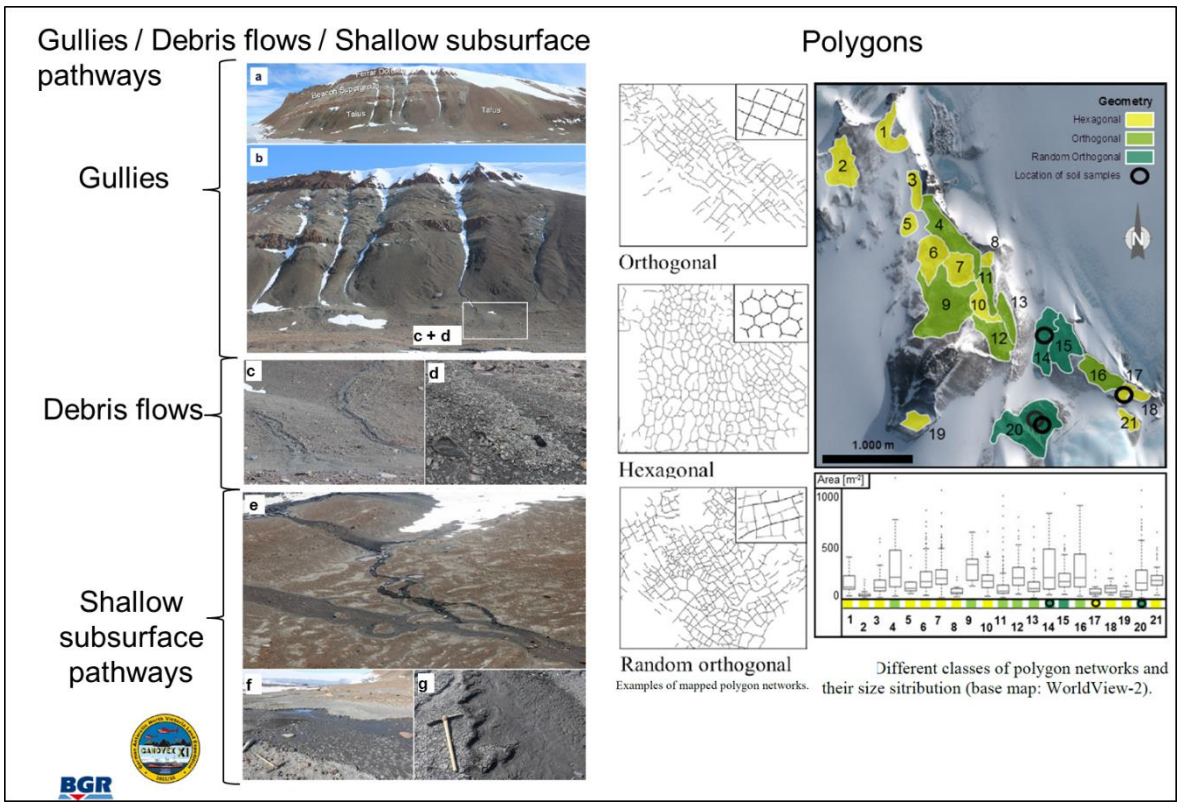

Figure 1: Geomorphological structures with Mars-analogy. (a) overview on slopes with gullies, (b) zoom into a section of (a). (c) water tracks and (d) debris flows, (e), (f), (g) shallow subsurface pathways at different locations.

4. References

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Short Summary

Microorganisms from polar Mars-analog field sites are able to be active and survive simulated Mars-like conditions in the lab and in space. Recent Mars could be still a habitable planet, at least in some niches.