HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
Enablers for the Future Human Missions (7)

Author: Ms. Sara Voute
The Netherlands, sara_voute@hotmail.com

Prof. Bernard Foing
European Space Agency (ESA/ESTEC), The Netherlands, Bernard.Foing@esa.int
Dr. Tanja Zegers
The Netherlands, tanja@geo.uu.nl
Dr. Carol Stoker
National Aeronautics and Space Administration (NASA), United States, cstoker@mail.arc.nasa.gov
Ms. Abigail Calzada Diaz
Birkbeck College London, United Kingdom, abigailcalzada@gmail.com

GEOLOGICAL SPACE EXPLORATION; TESTING SAMPLING PROCEDURES IN A MARTIAN-ANALOGUE ENVIRONMENT

Abstract

One of the important goals of solar system exploration is to gain a better understanding of the early planetary evolution. On Earth, plate tectonics and erosion processes have obliterated the rock record of the first billion years. Yet, it is during this early era of Earth's evolution that life emerged. Mars may have experience very similar conditions to Earth (a CO2 atmosphere, magnetic geodynamo, frequent volcanic activity causing basaltic eruption, liquid water at the surface), and life may equally have emerged on Mars. However, in contrast to Earth, the rock record of Early Mars is extremely well preserved, because Mars has seen very little geologic activity since 3.8 billion years ago. To unravel this early planetary history, Martian geological fieldwork, using a combination of robotic and human capabilities, is needed.

The paper aims to present several geological protocols, tested during missions performed in a Mars analogue site. The Mars Desert Research Station (MDRS) is surrounded by the red-coloured Morrison formation of the Colorado plateau in Utah. Iron-oxidized sandstones, endolithic bacteria colonies, volcanic rocks, and water-weathered systems can all be found in near surrounding.

For a period of two weeks, from the 20th of February 2010 to the 6th of March 2010, the group worked and lived together in a closed-system habitat as crew 91 at the MDRS. The crew of six people is a mixed group in gender, age, nationality, and academic background. Each member was appointed a role within the crew, such as commander, executive officer, engineer, health and safety officer, scientist, and journalist. Besides the general role, a personal research was done, such as optimizing the visibility of the NASA Ames rover and far-field communication, facilitating data exchanges between the base and the rover or astronaut by focusing on well-developed timelines and effective communication, documenting and testing best practices for dust reduction inside and outside the habitat, testing performance and habitability with creative sensory stimulation, and developing exploration protocols for different environments and mission objectives, with specific attention to geological sampling procedures.

In order to determine what is necessary in terms of knowledge and equipment for successful future planetary exploration, to perform planetary geological fieldwork efficiently, sampling procedures were tested during Extra-Vehicle Activities (EVA's) in full spacesuit. Traverses and time lines were prepared in ArcGIS. This resulted in a three dimensional dynamic map, in which sample locations and attributes, such as local measurements, could be visualized.