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GEOLOGICAL METHODOLOGY FOR THE EXTRAVEHICULAR ACTIVITY IN ASTRONAUT ANALOGUE SIMULATIONS

Abstract

Geological study of the surface and interior of rocky celestial bodies is becoming increasingly relevant to in-situ human and robotic exploration. In particular, laboratory- and field-based terrestrial analogue studies can inform potential rover and astronaut investigations in future missions to planetary surfaces. An important part of planning for future human missions will be to prepare astronauts for the exploration of planetary surfaces with the aim of characterizing the soil, rock materials and resources as well as possible, in order to ensure valid scientific interpretation of geologic evidence. Planetary geology can include research elements from a wide range of fields, and interpretation of geologic evidence is required at macro- to micro-scales. In this paper I have highlighted the fundamental aspects of geology that relate to Extravehicular Activity (EVA) performed during astronaut analogue simulations, with the objective to prepare candidates for future exploration of extra-terrestrial surfaces. In this regard I divided the geological study for the EVA into 8 key points and I simplified geological concepts that astronauts will learn before attending simulations. The 8 points can be studied through the material in this paper and / or following the video lessons, which were produced for the Modular Analog Research Station (M.A.R.S.) project in order to explain step-by-step various geological analyses and how to perform them through practical examples. The research interests include: descriptions of the different kind of rocks and outcrops with a specific attention to igneous and volcanic material, Steno's principles and Stratigraphy, sedimentology, geomorphology and glacial structures, how to perform geological analysis on the field and how to choose the characteristic samples, geological mapping, structural geology and geophysics studies. The lessons are designed to allow the astronauts who take part in the simulations to acquire basic knowledge to carry out field analysis with three main objectives: being able to select characteristic samples for return, being able to provide a first classification and description of analysed materials, and to produce the interpretation required for a detailed geological map. In this work some demonstration boards are proposed, which are intended to facilitate the execution of geological analysis. Astronauts are required to fill in various cards during simulations, following the procedures that are specified in the boards themselves. The proposed method will be applied during simulations in M.A.R.S. to evaluate its effectiveness and highlight possible improvements for future simulations.