

Hydrous alteration of lava flows on Mauna Loa (Hawaii) compared to Mars volcanic soils

A. M. P. Weert¹, B. H. Foing^{1,2,3,4}, H. Rogers⁴, M. Musilova⁴ and Y. Gonzalez⁴, ¹VU University Amsterdam, Faculty of Science, De Boelelaan 1083, 1081HV, Amsterdam (annelotteweert@gmail.com), ²ESA, ESTEC, Keplerlaan 1, 2201AZ, Noordwijk (bernard.foing@essa.int). ³ILEWG, ⁴HISEAS & International Moon Base Alliance.

Introduction: Over the past decades our knowledge about planet Mars experienced an enormous growth, due to a fleet of orbital and landed spacecrafts. Therefore, Mars has become a central object of interest for geology and astrobiology studies [1]. Better insight in the geological processes in the present and past on Mars give information about the evolution of its surface water and habitability. To learn more about these geological processes on Mars and other planetary bodies, comparisons with samples from Earth are frequently made. Therefore, this research focusses on the weathering processes on Mars by looking at samples from Earth.

HI-SEAS: The Hawaii Space Exploration Analog and Simulation (HI-SEAS) is a habitat located on the north-east flank of Mauna Loa, Hawaii, operated by the University of Hawaii, ESA and NASA. The facility has been designed to simulate planetary exploration missions, explicitly to Mars or the Moon. The habitat is positioned in an isolated area where the geology is Mars-like; the Martian regolith is very similar to the weathered basaltic material found on this part of Hawaii. [2, 3]



A younger lava flow (black) covering an altered lava flow (brown), nearby the HI-SEAS habitat, with two analog astronauts for scale. (HI-SEAS 2018 Earth-MoonMars crew, Photo by Bernard Foing)

Research: The comparison of samples from the Earth and deposits from Mars, within this research, focusses on rock samples from Hawaii. In order to provide more insight in the similarities of the effects of

hydrous alteration on volcanic rocks on Mars, in particular frost, samples from Hawaii will be compared to deposits from Mars. Samples for this research will be taken during a fieldwork in February 2019 with a HI-SEAS IMBA EarthMoonMars expedition. The fieldwork shall be conducted on the flank of Mauna Loa where the HI-SEAS analog habitat is located. A crew simulation from HI-SEAS, ILEWG, ESA and VU will carry out the fieldwork.

During the fieldwork, rocks samples from lava flows of Mauna Loa with different age will be collected and analysed. Orbital, aerial and drone images will be analysed for context. Spectrometric measurements on samples from different lava flows on Mauna Loa will be compared with spectrometer measurements of the Mars Exploration Rovers (MER) and the Curiosity rover on volcanic soils on Mars. XRF and XRD measurements of the samples (using TERRA a terrestrial of Chemin at HI-SEAS) from Hawaii will be compared to the APXS and MSL Chemin XRD and XRF measurements.

Looking at surfaces of planetary bodies provides insights into geological processes [4]. Martian lava flows have been compared to Hawaiian lava flows [5]. Therefore, looking at the alteration processes of volcanic rocks on Hawaii that are similar to deposits on Mars, will contribute to the understanding of the surface processes on Mars and how the surface of Mars evolved. The research will provide a better understanding of the influence of water on the basaltic rocks on Mars. Also, looking at the age of the lava flows on Hawaii and the rate of alteration and comparing them to Mars deposits, will give information about the time-scale of weathering on Mars. Furthermore, this project will test the instruments brought to the HI-SEAS habitat that possibly will be taken to space in the future. This is really crucial for the preparation of future robotic and manned missions to the Moon and Mars.

References:

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