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Remote and in-situ reflectance spectroscopy of Mars-analogue hydrothermal alteration

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Abstract

Results will be presented from the deployment of a prototype of the ExoMars PanCam and a visible and near infrared field spectrometer at a Mars-analogue site in Iceland. This project will test the ability of these instruments to identify and characterise extreme habitable environments specific to volcanic regions. Aerial hyperspectral data is used in conjunction with the field instruments to develop best practice techniques for combining spectral data of different spectral and spatial scales.

1. Motivation

Remote Sensing and visible and near infrared (VNIR) spectroscopy are crucial tools in the exploration of isolated environments here on Earth and of our neighbouring planetary bodies, in particular Mars. One of the current objectives of the Mars science community is to identify regions of the planet that may have previously been habitable. This search is primarily focused on mineral assemblages and lithologies that form in the presence of liquid water. Key instruments that have already been utilised for this purpose include the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), and the multispectral cameras on both the Spirit and Opportunity rovers (Pancam) and MSL Curiosity (MastCam). The upcoming ESA 2018 ExoMars mission will continue to use orbital and in-situ reflectance spectroscopy for geological target selection at the Martian surface, to search for signs of life.

Volcanogenic hydrothermal environments are a particular type of habitat proposed to have existed on Mars [1]. The Krafla volcano and fissure swarm in Iceland is characterised by such conditions. The environment here is dominated by a recent eruption event (1975-1984) and a series of acidic - neutral hydrothermal fields including boiling mudpools, acidic fumaroles, and extensive alteration of the surrounding basaltic lavas resulting in the deposition of hydrated mineral species. Such deposits are typically on a centimetre to metre scale, making remote identification and detailed examination challenging. Finding evidence of such an environment on Mars would be of extreme interest to the astrobiology community, however we are limited to using orbital remote sensing instruments and rover cameras in our search. It is crucial that we establish if we could identify this type of environment using these types of instruments, and if so how best to combine the different spatial and spectral scales of data available in order to achieve the best scientific outcome.

2. Field Work

We will present the results of the deployment, at Krafla in June 2013, of the Aberystwyth University PanCam Emulator (AUPE) and a NERC FSF VNIR (0.35 – 2.5μm) field spectrometer. The AUPE is a prototype PanCam for the ExoMars rover that has already been successfully deployed on a number of Mars-analogue research campaigns [2], but has not yet been tested in combination with in situ field spectroscopy and aerial hyperspectral data. Our field test will focus on the utility of AUPE to characterise this specific type of habitable environments present using the new geological filter set [3]. In addition to the two field instruments, aerial hyperspectral data obtained from the Natural Environment Research Council's Airborne Research and Science Facility's Eagle and Hawk instruments in September 2008 (ARSF Flight IPY07/09) (Fig. 1) will be used to guide the selection of field targets.

Acknowledgements

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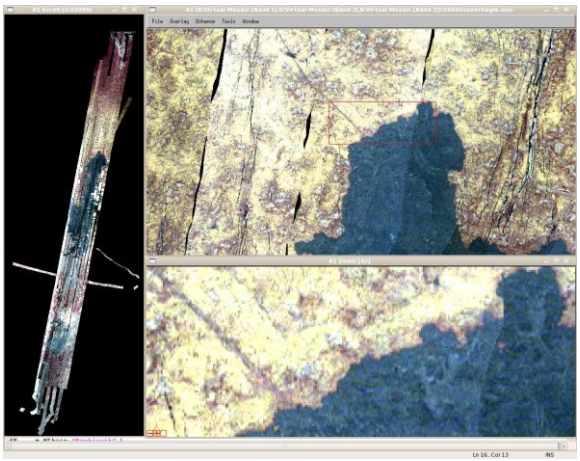

Figure 1: ARSF Eagle data covering Krafla lava fields and hydrothermal areas.

References

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