GALE CRATER ANALOGUE GEOLOGY STUDIES AT MULTIPLE SCALES

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Abstract: We give an update on the data analysis relevant to Mars geology at multiple scales from a series of field research campaigns (ILEWG EuroMoonMars) in the extreme environment of the Utah desert and in order to help in the interpretation of Mars missions measurements from orbit (Mars Express, MRO) or from the surface (MSL Curiosity) at Gale crater.

ILEWG EuroMoonMars campaigns

The goal of this ILEWG EuroMoonMars project (February 23rd - March 9th, 2013) was to conduct field studies in order to identify and study environments that are analogous to those that Curiosity has studied and will study at Gale crater. Several field campaigns (EuroGeoMars2009 and DOMMEX/ILEWG EuroMoonMars from November 2009 to March 2010) had been conducted at the Mars Desert Research Station (MDRS) [1-5] near Hanksville, Utah, in the vicinity of the San Rafael swell..

Geology traverse planning using sub-m imagery

Most of the information we have from Moon and Mars surface, comes from satellite observations. During the selection of landing sites and planning of traverses on unfamiliar planetary sites, satellite images of high resolution is crucial. But what information are we missing from these images? We used remote sensing images and multispectral data to recognize areas of intrest (Figs 1-2). During ILEWG EuroMoonMars 2013 campaign at MDRS Utah we made a comparative study where we looked at satellite images with a spatial resolution of 50-60 cm per pixel, something that is comparable to the resolution of MRO HiRise on Mars. We then planned traverses at MDRS that were as similar to geomorphological features seen at the Gale crater as possible. Following this, we explored these traverses with a rover, drone and walked them in a Mars EVA simulation mode, before taking rocks and soil samples. We also tested the usability of a drone for imaging reconnaissance, and assessed experiences and lessons learnt concerning geological traverse planning based on high resolution satellite images.

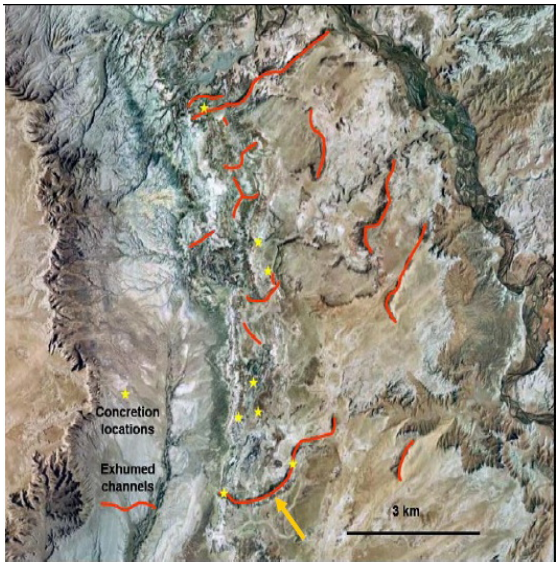

Figure 1: Map of geological features and inverted riverbeds around MDRS, Utah showing areas explored by traverses and EVAs, and through samples.

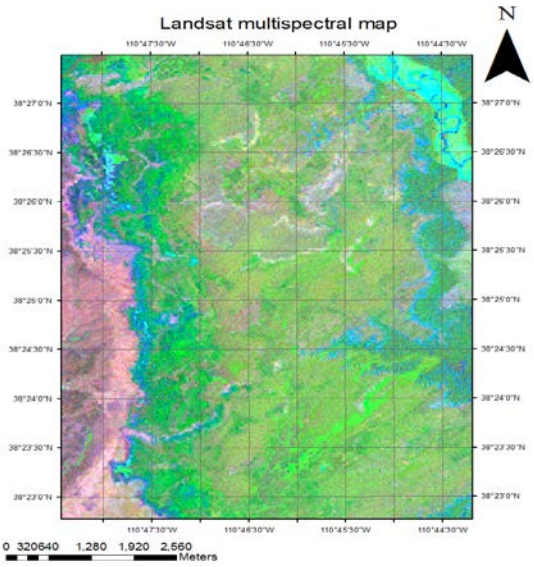

Figure 2 : Landsat multispectral data show the presence of calcite (pink color) along the inverted channels.

Fluvial sediments, concretions, evaporates as analogue field study for Gale crater, Mars

On 6th August 2012, Curiosity landed in Gale crater, Mars. Measurements and pictures showed sedimentary rocks that had been deposited by fluvial activity, e.g., alluvial fan and stream deposits. Such deposits are common in desert environments, and we analysed some near MDRS [1-4].

Figure 3: Concretions in Brushy Basin Member of the Morrison Formation within a cross-bedded sandstone.

Figure 4: Concretions and veins apparent in Curiosity camera colour images

Widespread inverted channels on Mars have been identified through orbiter imagery data, e.g., at Gale crater. Concretions also appear to be common on Mars and have been found by the Opportunity rover at Meridiani Planum and the Curiosity rover at Yellowknife Bay. We compared concretions, cross-bedded features (Figs 3-4). We have analysed the geological context of these features from large scale to close-up imaging, performed and mineral studies in-situ [2-4] or on returned samples using X-ray and infrared spectroscopy, as well as measurements of habitability and organics [5] .
For this ILEWG Euro-MoonMars 2013 project, we characterised the MDRS terrestrial analog sites for Curiosity exploration of Gale crater.

References:

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