CLOSE-UP IMAGING SIMULATION IN THE MARSLABOR OF THE UNIVERSITY OF BASEL, SWITZRELAND

Nikolaus J. Kuhn [1], Jean-Luc Josset[2], Tomaso Bontognali [1, 2], and Beda Hofmann[3]

[1]University of Basel, Physical Geography, Environmental Sciences, Basel, Switzerland (nikolaus.kuhn@unibas.ch), [2]Space Exploration Institute, Neuchatel, Switzerland (jean-luc.josset@space-x.ch, tomaso.bontognali@space-x.ch), [3]Natural History Museum, Bern, Switzerland (beda.hofmann@geo.unibe.ch)

Introduction: Close-up imagers such as MAHLI or CLUPI are often described as the equivalent of a geoscientist's hand lense mounted on a rover. Compared to the use of a hand lense by a geoscientist in the field, the use of such imagers for extracting information, e.g. on rock properties, rock formation or their potential to contain biosignatures, is biased. The difference between is caused by the resolution and spectral recording capacity of the imager, as well as the environmental conditions when an image is taken. During rover missions, ideal conditions to take close-up images are rare or require extra time, energy and data transmission volume. Preparing the use of close-up imagers during a mission is therefore essential for maximizing the scientific output of rover operations.

Close-Up imaging simulation: The Marslabor of the University of Basel aims at providing the opportunity to test the operations of close-up imagers in situations that resemble those during a rover mission to another planetary body. The main elements of the Marslabor are a Marsyard with variable surface conditions, in particular surface color and roughness, lighting conditions simulating different positions of the sun shining at various degrees of intensity and atmospheric diffusion, and a small rover carrying a commercial camera with macro-lense offering a field of view similar to the ExoMars Close-up Imager (CLUPI). Figure 1 shows a scene from a simulation session in the Marslabor. The aims of the tests conducted in the University of Basel's Marslabor are (i) the identification of the best lighting for the recognition of biosignatures, (ii) rock identification from the furthest possible distance during rover drives, and (iii) integration of close-up imagers in rover exploration cascades.

Results: Figure 2 shows two images of the same rock under different lighting conditions. The layered structures left by the stromatolites are easier to detect in sideways lighting, while colors show a wider range in direct light.

Conclusions A good understanding of the best lighting conditions for a given rock type and their incorporation in mission planning are essential for the optimal use of close-up images such as CLUPI.

Figure 1: Close-up imaging simulation in the Marslabor of the University of Basel, Switzerland, using a Turtle rover and a camera with a macro-lense generating images of similar dimensions and resolution than the ExoMars Close-Up imager CLUPI

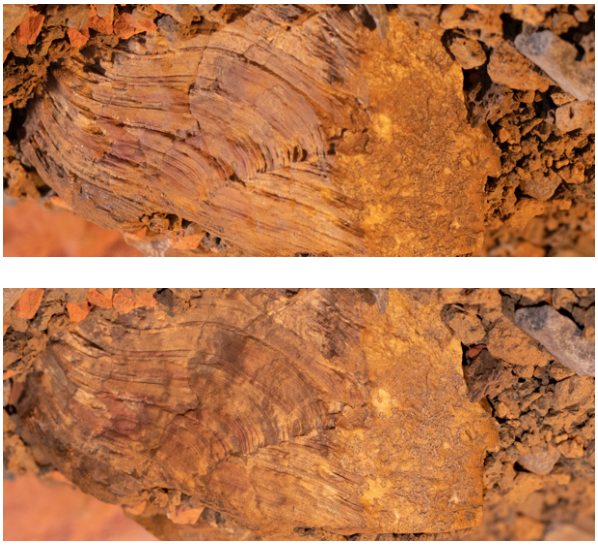

Figure 2: Close-up image of stromatolite-generated rock structures taken at 1.2. distance with lighting perpendicular to line of sight (above) and from behind the camera (below). The structures generated by the stromatolites captured in this scene are more easily visible when shadows from sideways lighting are present. However, direct light offers a better range of colors.