INVESTIGATING THE PHYLLOSILICATE BEARING MICOUD CRATER IN THE NORTHERN PLAINS OF MARS. C. Gross[1], L. Wendt[1], J.-Ph. Combe[2], P. Jodlowski[1], G. A. Marzo[3], T. L. Roush[4], T. McCord[2], P. Halbach[1] and G. Neukum[1]. [1]Freie Universität Berlin, Inst. of Geological Sciences, Malteserstr. 74-100, 12249 Berlin, Germany, christoph.gross@fu-berlin.de. [2]Bear Fight Institute, P.O. Box 667, Winthrop WA 98862, USA. [3]ENEA, Rome, Italy, [4]NASA Ames Research Center, Moffett Field, CA, USA 94035-1000

Introduction: Micoud crater, investigated in our previous study [1, 2] was named on November 2nd, 2011 by the International Astronomical Union (IAU) (Feature ID 14890). The ~50 km wide, complex impact crater is located in the northern hemisphere, roughly 400–500 km north of the dichotomy boundary, in the Vastitas Borealis Formation (Northern Plains) at 50°33'5,08"N 16°20'20,37"E, east of Acidalia Planitia and ca. 500 km to the west of the double–ringed Lyot crater. Since detailed maps are needed to correlate hyperspectral data obtained by the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) with geologic and geomorphologic units, a geologic and geomorphologic mapping of the unnamed crater was carried out at a scale of 1: 30.000 (Figure 1). The objective is to identify several types of phyllosilicates and other hydrated minerals in order to test the hypothesis of impact induced hydrothermalism versus excavation models. Our special focus is on prehnite because it is the only phyllosilicate mineral that forms in the presence of water at high temperatures. In this study, we calculate absorption band depths at wavelengths that are characteristic for minerals in a similar way to [3], and we test their simultaneous existence (such as in [4] and [5]) and correlate the results with the observed morphology.

Data Sets and Methods: We used Mars Express High-Resolution Stereo Camera (HRSC) data from orbit 3304 with 12.5 m/px and Mars Reconnaissance Orbiter Context Camera (CTX) image B01_009997_2308_XN_ 50N343W with 6.1 m/px as mapping basis. In addition, High Resolution Imaging Science Experiment (HiRISE) image ESP_016577_2310 was used for the identification of particular textural properties of the surface units. Image processing was conducted in ISIS3 environment and the mapping in ESRI's ArcGIS 9.3.

CRISM full resolution target data (FRT0009C3C at ~20-30 m/pixel ~604 pixels wide) and half-resolution long data (HRL0000C75D at ~40-60 m/ pixel and 301 pixels wide) were used for this study. Spectral Mixing Analysis (SMA) was used for the mapping of mafic minerals olivine, clinopyroxene (CPx) and orthopyroxene (OPx). We performed SMA of CRISM data by using the Multiple-Endmember Linear Spectral Unmixing Model (MELSUM) [6] (see Fig. 2B). The phyllosilicates were mapped performing an expert-system based spectral identification tool similar to [4, 5] including continuum removal on narrow ranges of wavelengths around each absorption band of interest.

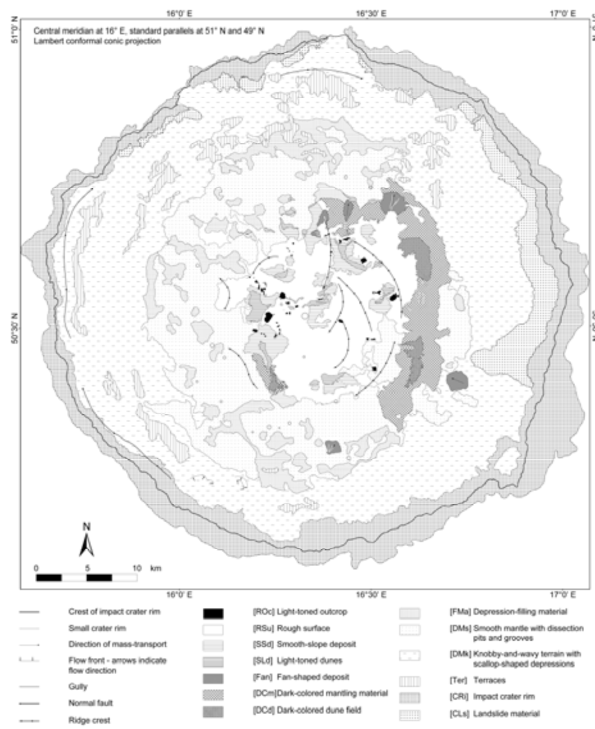

Figure 1: Geologic/geomorphologic map of Micoud crater. Mapping was carried out at a scale of 1:30.000.

Results: Micoud crater shows a high abundance of mafic minerals. Our modeled mineral maps fit very well with observed outcrops and geomorphologic units. Important phyllosilicate detections are located in the central area of the impact crater, embayed by the central peak ring structure and often in association with sublimation pits and/or small depressions. The center of the peak ring area shows a ~400 m large round (basin- or crater-like) morphology with a slightly elevated rim, interlocked with a second, dark colored round structure towards the North. Close to these structures, the mineral diversity appears higher than in the surroundings. Fe/Mg rich clays were also found [1, 7]. Chlorite detections show a close spatial association with the olivine, suggesting an alteration process as genetic source (see Figure 2). Prehnite was also detected within the crater. Positive prehnite de-

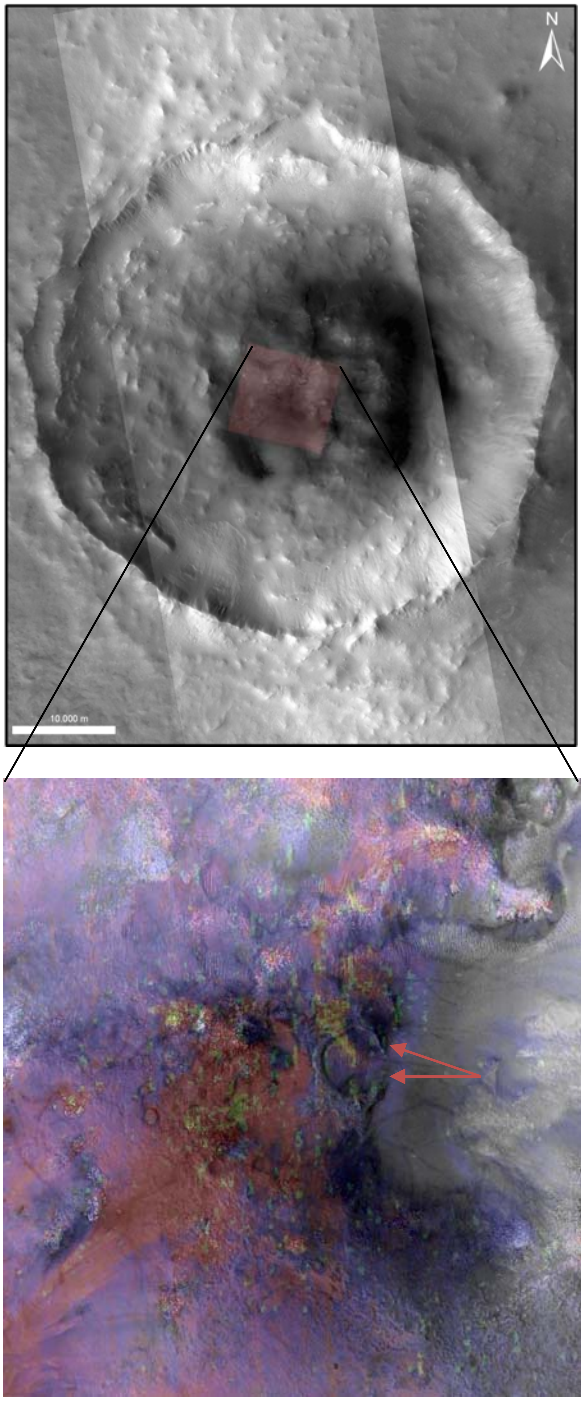

Figure 2: Top: HRSC orbit 3304 with 12.5 m/px and CTX image B01_009997_2308_XN_50N343W with 6.1 m/px. **Bottom:** HiRISE observation ESP_016577_2310 with MELSUM processed mineral map of olivine (red), OPx and CPx (blue), Chlorite (green). Yellow colors indicate Chlorite on Ol. Red arrows indicate position of the round interlocked crater-like structures.

tections cover only few pixels but can be correlated with faint, dark material, cropping out in several locations close to the center of the crater, especially close to the crater-like structures in the center of the peak ring area.

Conclusions: Our observations indicate that the detected chlorites are bound to the olivine rich deposits, suggesting alteration by reworking and weathering. It can be assumed, that the presence of distinctive (volatile rich) surface mantling material could have altered the pre-existing olivine to form chlorite.

On the other hand, the presence of prehnite documents a formation temperature of 200 °C to 400 °C and would therefore point to a hydrothermal formation. The scattered (and minor) detection of prehnite in association with chlorite, found in the central uplift of a peak ring structure however could also represent a case of excavation of pre-existing clay-bearing rocks as described in [7, 8] if the relatively well exposed stratigraphy of the southern highlands also stretched towards the northern lowlands or if comparably old basal impact materials [9, 10] exist in both lands.

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References: [1] Gross, C. et al. (2011) 2011LPI....42.1875G. [2] Jodlowski, P. et al. (2011) 2011LPI....42.1899J. [3] Pelkey, J. et al. (2007) JGR 112, Issue E5, doi: 10.1029/2006JE002682. [4] Clark, R. N. et al (2003) *JGRE* 108/12, E5131. [5] Marzo G. A. et al. (2010) *Icarus*, 208, 667–683. [6] Combe, J.-Ph. et al. (2008) *Planet. and Space Sci.*, 56/7, 951-975. [7] Carter, J. et al. (2010) *Science 328*, 1682. [8] Ehlmann, B. L. et al. (2011) *Nature 479*, 53-60. [9] McEwen, A. et al. (2009) *EPSC, Vol. 4*, EPSC2009-504-2. [10] Grant, J. A. et al. (2008) *Geology, Vol. 36, Issue 3*, p.195-198.