HIGH RESOLUTION OBSERVATIONS OF KOROLEV CRATER AND MRS CHIPPYS RING DURING SUMMER BY CRISM AND HIRISE.

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Introduction: Since commencing its primary science phase in November 2006, the Mars Reconnaisance Orbiter (MRO) spacecraft has carried out coordinated observations of the northern polar region of Mars during summer. Here we report on high resolution observations of Northern polar features by two instruments – the Compact Reconnaissance Infrared Spectrometer for Mars (CRISM, [1]) and the High Resolution Imaging Science Experiment (HiRISE, [2]).

CRISM and HiRISE: CRISM is a Visible to Near Infrared Spectrometer sensitive to photons with wavelengths from 0.4 to 4.0 μm [1]. It is well suited to observing water ice due to the strong H_2O water ice bands at 1.0, 1.2 and 1.5 μm. In highest resolution mode, CRISM has a pixel size of ~20m and a swath width of 12km. HiRISE is a high resolution camera capable of providing detailed images of 0.25-1.3m/pixel [2]. It is capable of collecting color data (red, green and near-IR) and stereo pairs.

Korolev Crater: Korolev Crater is the largest well preserved crater in the northern polar region at ~80km diameter. It is located at 73°N, 163°E and covered by perrenial water ice mound with over 1km of relief [3]. It has been suggested that Korolev experiences late summer 'brightening' as water vapour recondenses on the water ice deposit [3].

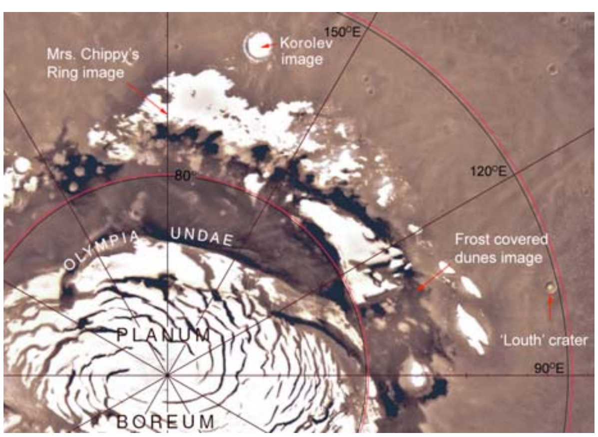

Figure 1. Context image of Martian north polar region showing Korolev, Mrs. Chippy's and barchan dunes regions. 'Louth' Crater is discussed elsewhere [6]. Adapted from USGS 25m Viking MDIM.

Mrs. Chippy's Ring: Mrs. Chippy's Ring is an informal name for patchy ice deposits outlying from the main north polar cap between 90-270°E, 75-80°N (Figure 1) [4].

Observations: The following observations were made on inspection of images from three regions.

Water ice deposit in Korolev. CRISM observation HRS0000330A_07 captured the interior of Korolev Crater. It showed the presence of bands at 1.25, 1.5 and 2.0 μm throughout the scene, indicating the presence of H_2O ice (Figure 2). Variations in spectra are apparent in the CRISM image, suggesting not just water ice but mixing with an unknown component. HiRISE observation PSP_001592_2530 of this region reveals the brightness changes are linked to textural differences - material with strong water ice bands is smooth and has ripples, and material with weaker bands displays a rough and somewhat darker texture (Figure 3).

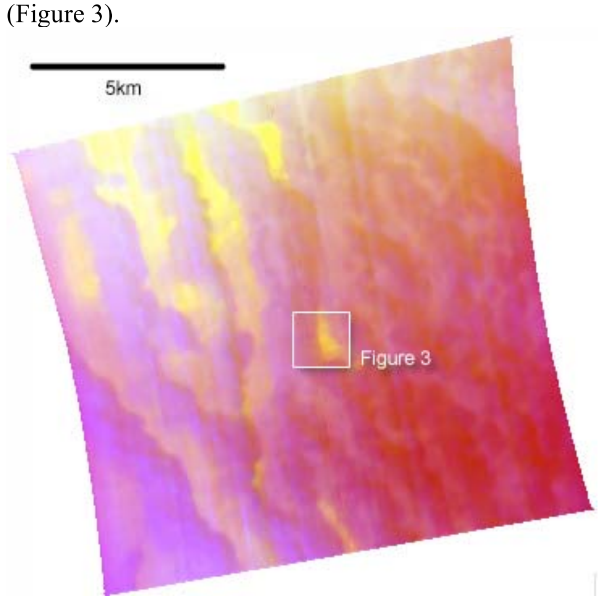

Figure 2. CRISM Half Resolution Short false color image HRS0000330A_07 of water ice within Korolev Crater at 72.82°N, 164.46°E. Yellow regions display weaker H_2O ice bands due to mixing with a spectrally neutral component. Red-pink areas display strong water ice bands.

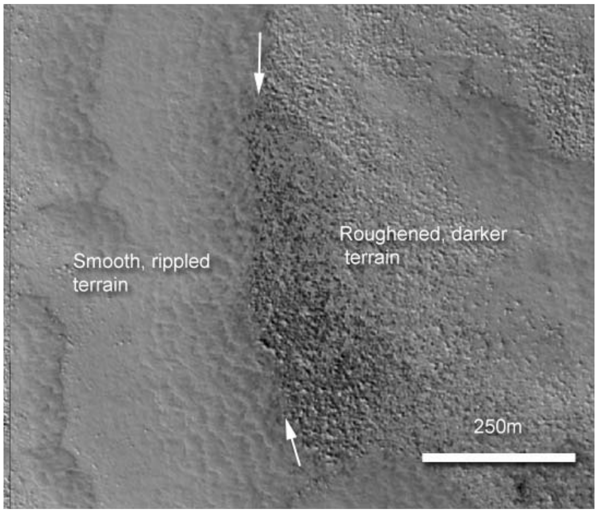

Figure 3. HiRISE image PSP_001592_2530 (red channel) showing contact of smooth terrain (corresponding to red-pink regions in Fig. 2) with roughened terrain (yellow in Fig. 2). Arrows highlight the contact.

Dark Albedo Patches in Mrs. Chippy's Ring. CRISM Full Resolution observation FRT00003482_07 shows a small part of the Mrs. Chippy's Ring structure, Figure 4 is a false color image showing the dark patches in yellow and pure ice in blue. HiRISE image PSP_001697_2570 shows the darker regions are due to uncovering of sand-rich substrate beneath the water ice.

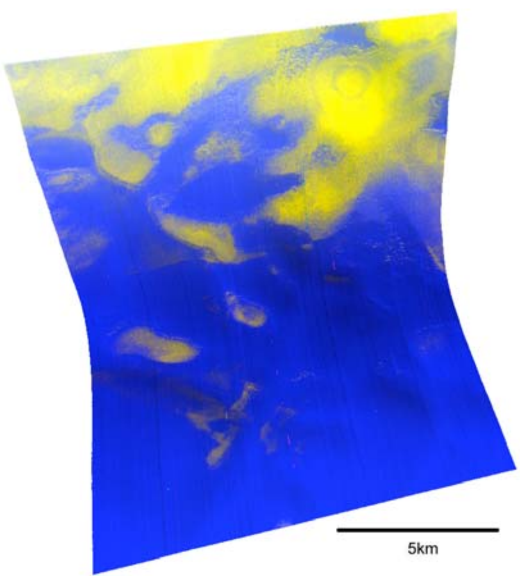

Figure 4. CRISM Full Resolution observation FRT00003482_07 of Mrs. Chippy's Ring at 77°N, 180°E. False color image using bands at 1.0, 1.5 and 2.5 μm. Blue regions display strong water ice bands, while yellow regions show water ice mixed with another component, probably sand suggested by HiRISE image PSP_001697_2570.

Barchan Dunes on the edge of Mrs. Chippy's Ring. CRISM observation FRT00003405_07 captured a series of barchan dunes on the edge of Mrs. Chippy's Ring (Fig. 5). The dunes appear different in character from the linear gypsum rich dunes of Olympia Undae [5]. No water ice or gypsum bands are present in/near these dunes, but the dunes have a 'red continuum' that could be explained by greater Fe abundance. (Fig. 6).

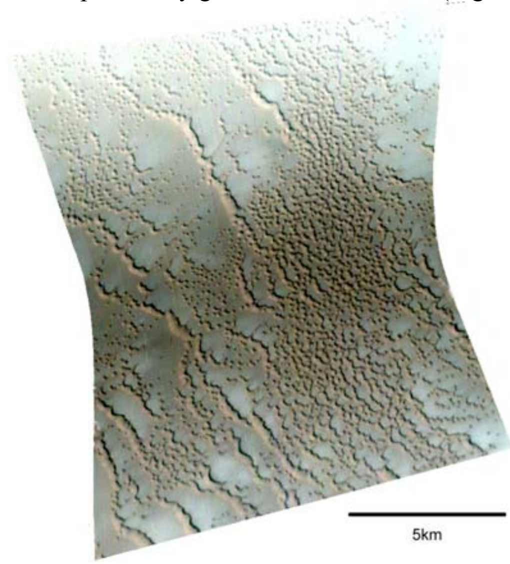

Figure 5. CRISM observation FRT00003405_07 of barchan dunes at 76.7°N, 109.6°E.

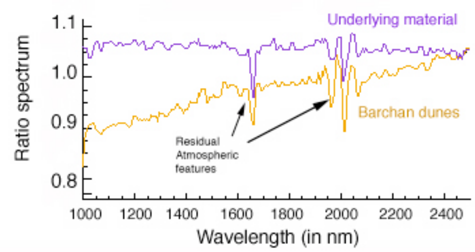

Figure 6. CRISM ratioed spectra of barchan dunes and underlying material. Note the 'red continuum' of the barchan dunes which might be related to Fe content.

Conclusion: These initial observations of Korolev Crater and Mrs. Chippy's Ring show there is a complex history to this region that CRISM and HiRISE can help uncover. We will repeat observations for these localities throughout the Martian year in order to track the seasonal behavior of water ice, and test for reported variations in albedo [3].

References: [1] Murchie S. L. et al. (2005) *Proceedings of SPIE, Volume 5660,* 66–77. [2] McEwen, A. et al. (2005) *Eos Trans. AGU 86(52), Fall Meet. Suppl., Abstract P23A-0171* [3] Kieffer, H.H. and Titus, T.N. (2001) *Icarus 154*, 162-180. [4] Calvin, W.M. and Titus, T.N. (2004) *LPS XXXV* Abstract 1455. [5] Langevin, Y. et al. (2005) *Science 307,* 1581. [6] Brown, A.J. et al. (2007) *this meeting* #2262