TRANSPORT AND THERMAL METAMORPHISM OF WATER ICE IN THE MARTIAN NORTH POLAR SPRINGTIME. A. J. Brown[1] and W.M. Calvin[2]. [1]SETI Institute, 189 Bernardo Ave, Mountain View, CA 94043, abrown@seti.org., [2]Geological Sci. & Eng., University of Nevada, Reno, NV, 89557. Author website: http://abrown.seti.org

Introduction: The seasonal evolution of the north polar cap is of great importance for the energy balanace of the planet. Here we report on our ongoing investigation using CRISM and MARCI of the seasonal changes in the north [1-3] and south [4] polar region.

The albedo of the north polar cap has recently been investigated by Kiefer and Titus [5], Bass et al. [6], James et al. [7], Hale et al. [8], Byrne et al. [9] and Cantor et al. [10] and grain size of the cap has been reported using OMEGA for L_s=93-127 by Langevin et al. [11] and L_s=280-95 by Appere et al. [12].

CRISM: The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) is a visible to near-infrared spectrometer sensitive to photons with wavelengths from ~0.4 to ~4.0µm. We used CRISM mapping observations which are 10x binned to create a set of mosaics covering the MY28 and MY30 spring recessions. MARCI daily mosaics in north polar stereo are used to look for dust storms or ice clouds.

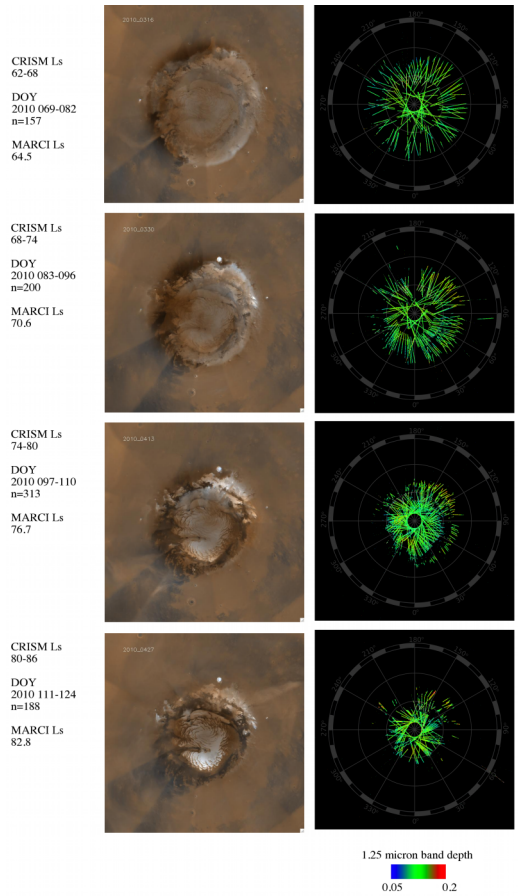

Figure 1 – MY30 northern late spring 1.25 µm band depth index mosaics. Note red pixels on cap periphery in the bottom 3 images on right column.

Late springtime grain size increase: In Figure 1 we show MARCI and CRISM maps covering MY30 L_s=62-86 (late spring). The 1.25 and 1.5 µm band (water ice) maps are presented as columns 4 and 2 respectively. The 1.25 µm band depth in the periphery of the cap (particularly in outlying water ice deposits off the cap) shows an increase that is not matched by the 1.5 µm band, because it is saturated. We posit that the 1.25 µm band is a better measure of water ice grain size under these conditions.

We suggest that the increase in 1.25 µm H_2O band is indicative of an increase in water ice grain size at the periphery of the cap in late spring, in some cases up to 1.2 mm in size (at Korolev crater, for example).

Evolution: Two scenarios predominate in our minds on this water ice grain size increase – the first is that small water ice grains exposed at the surface are being heated and thermally metamorphosed. The second scenario is that mature water ice is being exposed as the fine grains of the yung cap are being stripped away. We favour the first possibility due to the istribution of the water ice patches over time – 1. the effect is limited to the equatorward ice only and 2. The increase in grain size depth is gradual and continues over at least two Earth months.

Mid-springtime asymmetric distribution of water ice: We would also like to highlight the asymmetric retreat of the CO_2 ice cap from L_s=25-40. Brown et al [3] suggested this was due to water ice sourced from the water ice outliers – we will expand on this further at the workshop.

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