TEXTURES AND MORPHOLOGIES OF PHYLLOSILICATE-BEARING UNITS AT MAWRTH VALLIS. N. K. McKeown[1], J. L. Bishop[2], J. J. Wray[3], E. Z. Noe Dobrea[4], and E. A. Silver[1], [1]Earth and Planetary Sciences, UC Santa Cruz (Santa Cuz, CA 95064, nmckeown@pmc.ucsc.edu), [2]SETI Institute (Mountain View, CA 94043), [3]Cornell University (Ithaca, NY 14853), [4]CalTech/JPL (Pasadena, CA 91109).

Introduction: The clay units at Mawrth Vallis are the most extensive phyllosilicate exposures on Mars [1, 2], with outcrops spanning a 1×10^6 km^2 area [3]. Nontronite, montmorillonite, hydrated silica, kaolinite, and a ferrous component have all been identified [4-6]. The nontronite-bearing unit occurs at the bottom, overlain by a unit containing a mixture of montmorillonite and hydrated silica. At the top of this unit is a kaolinite-bearing layer also containing hydrated silica. The ferrous component occurs near the boundary of the nontronite and Al-phyllosilicate units and has been identified in spectra that also contain features due to nontronite or montmorillonite [3-4, 6-7]. These deposits have been suggested to have distinct morphologies [4, 7]. In this study, we confirm this hypothesis and examine in detail the HiRISE images over potential MSL landing site 2 in Mawrth Vallis to determine what the rover might see and how it may be able to visually distinguish between the mineralogies identified by CRISM.

Data: The CRISM hyperspectral data used in this study have a spatial resolution of ~18 m/pixel. The HiRISE false-color and red channel data have a spatial resolution of ~0.25 m/pixel (fig. 1, left). CRISM data were processed for instrumental effects, converted to I/F and the atmosphere is removed as in [8]. The data are then cleaned and de-noised through an algorithm that deals with striping as well as speckling due to cosmic rays [9]. The HiRISE data are processed for instrumental effects, converted to I/F, and noise-reduced via high-pass filtering [10].

Results and Discussion: Comparison between CRISM and HiRISE data has revealed that morphology/ texture correlates to mineralogy.

Nontronite. Nontronite has been identified in multiple outcrops in CRISM images by diagnostic absorption features at 1.42, 1.91, 2.29 and 2.41 µm. At the same locations in the HiRISE data, large polygons (~2-4 m across) are observed that appear tan in the false-color image (fig. 1A).

Montmorillonite. Montmorillonite was identified in CRISM images by diagnostic absorptions at 1.41, 1.91 and 2.21 µm. In HiRISE data, smaller polygons (0.5-1 m across) are observed for regions dominated by montmorillonite features in the CRISM images and these regions typically appear bluish in color (fig. 1B). However, sometimes the same polygonal pattern is observed with yellow or tan tones and more investigation is needed to determine what is causing this color difference.

Hydrated Silica. In CRISM data, hydrated silica is distinguished from montmorillonite by band width and shape: the 2.21 µm feature is much broader in hydrated silica, extending out to ~2.3 µm and the H_2O band depth near 1.9 µm is decreased in intensity for hydrated silica-rich regions compared to montmorillonite-rich regions [11]. In HiRISE data, areas dominated by CRISM hydrated silica features have a smooth, almost feathery texture (fig. 1C) and typically appear tan in color.

Ferrous component. The ferrous component is identified by a strong positive slope from 1-2 µm. Preliminary investigations of this ferrous-bearing unit in HiRISE images suggest that the ferrous component may be contained in a bright fill between polygons of nontronite or montmorillonite in some locations. However, in these locations, the nontronite polygons in particular appear darker than nontronite-only polygons and the ferrous component may be part of this darker material (fig. 1B). More work is needed to characterize the texture of this component.

Kaolinite. Kaolinite is identified in small outcrops in CRISM images by a characteristic doublet at 2.16 and 2.21 µm. Initial searches for kaolinite outcrops in regions covered by HiRISE images at landing site 2 have not yet identified sufficiently large units to detect with CRISM, although strong kaolinite features have been found elsewhere at Mawrth Vallis, including landing site 2. HiRISE imagery of kaolinite-bearing deposits in western Mawrth Vallis indicate a partially fractured rough texture, but no polygonal features.

Conclusions: The different phyllosilicate mineralogies identified by CRISM are also distinguishable by texture in HiRISE images. It is likely these differences are due to physical properties, such as mineral structure, and the exposure and weathering history of the units. Therefore, a future lander such as MSL may be able to use texture initially to identify distinct units in Mawrth Vallis, and then confirm the identifications through spectral and/or chemical analyses.

References: [1]Bibring, J.-P., et al. (2005) *Science*, *307*, 1576-1581. [2]Poulet, F., et al. (2008) *A&A*, *487*, L41-L44. [3]Noe Dobrea, E. Z., et al. (2008) *LPS XXXIX* 1077. [4]Bishop, J. L., et al. (2008) *Science*, *321*, 830-833. [5]Bibring, J.-P., et al. (2007) *LPS XXXVIII* Abstract #2160. [6]McKeown, N. K., et al. (submitted) *JGR- Planets*, . [7]Wray, J. J., et al. (2008) *GRL*, *35*, L12202. [8] Mustard, J. et al. (2008) *Nature 454,* pp. 305-309. [9]Parente, M. (2008) *LPI* 2528. [10]McEwen, A. S., et al. (2007) *JGR*, *112*, E05S02 01-40. [11]Milliken, R. E., et al. (2008) *Geology*, *in press*.

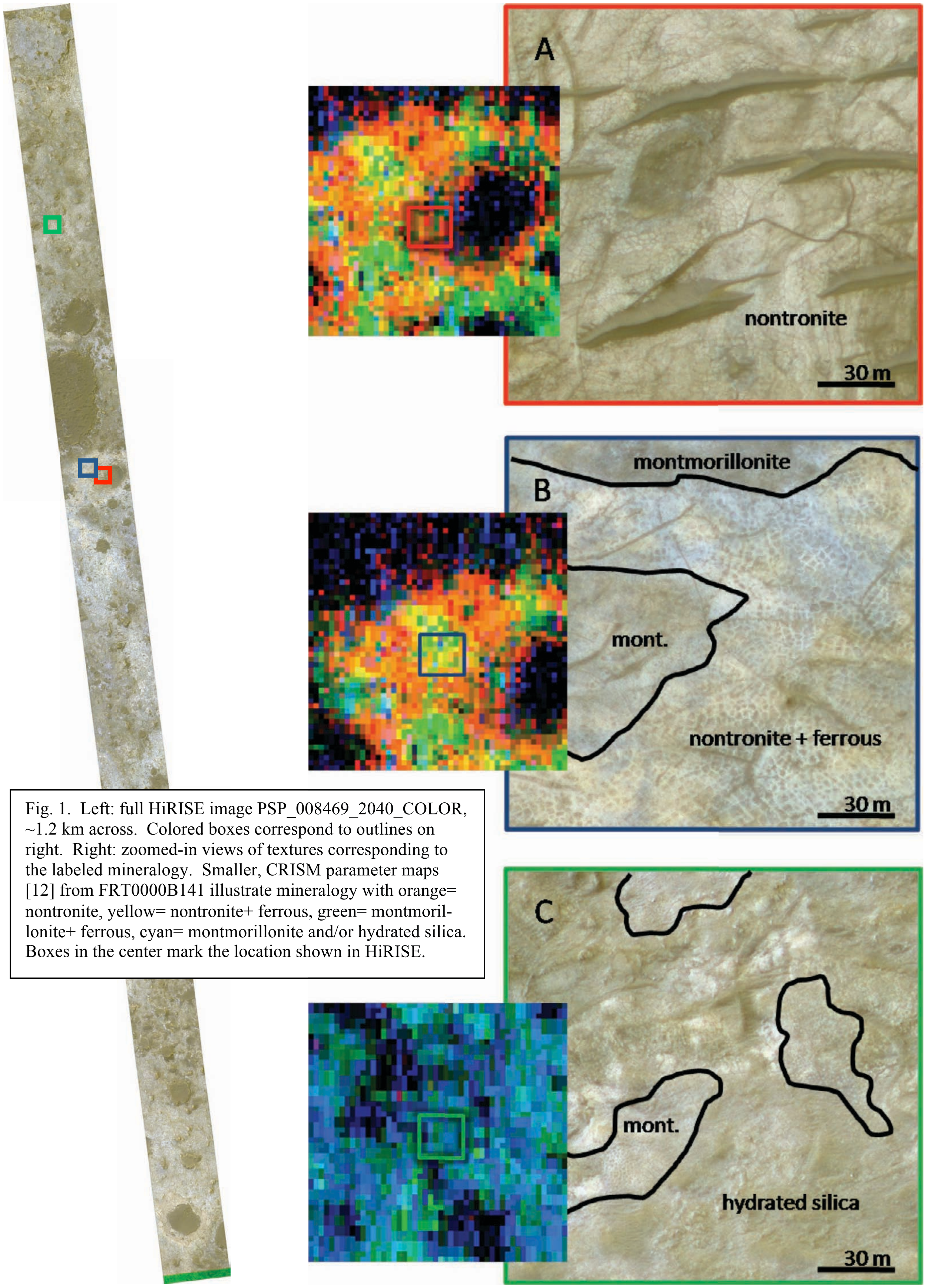

Fig. 1. Left: full HiRISE image PSP_008469_2040_COLOR, ~1.2 km across. Colored boxes correspond to outlines on right. Right: zoomed-in views of textures corresponding to the labeled mineralogy. Smaller, CRISM parameter maps [12] from FRT0000B141 illustrate mineralogy with orange= nontronite, yellow= nontronite+ ferrous, green= montmorillonite+ ferrous, cyan= montmorillonite and/or hydrated silica. Boxes in the center mark the location shown in HiRISE.