PRELIMINARY EXAMINATION OF LAYER TEXTURE WITHIN THE SOUTH POLAR LAYERED DEPOSITS, MARS. S. M. Milkovich and J. J. Plaut, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA, 91108, sarah.m.milkovich@jpl.nasa.gov.

Introduction: The south polar layered deposits (SPLD) of Mars have been studied extensively for decades in low-to-medium resolution images [e.g., 1-6]. The arrival of subsurface sounding radar such as SHARAD (SHallow RADar) onboard Mars Reconnaisance Orbiter allow us to see into the interior of the SPLD [7, 8]. The High Resolution Imaging Science Experiment (HiRISE), also onboard MRO, provides images of layer exposures at very high resolution (up to 25 cm/pxl), allowing us to look for patterns in the erosional styles of individual layers that may correlate with radar reflections.

Efforts to relate surface exposures of layers at the north and south polar regions to radar reflections observed by SHARAD [e.g., 9, 10] have highlighted the need to better understand what an individual layer is as seen at the surface. In the SPLD, layers are expressed as variations in topography and surface texture. If we assume that surface texture represents the way that a layer within a scarp wall has responded to the same erosional processes affecting the other layers within the same wall, then the varying textures down the scarp wall may be a result of variations of composition (including dust content and ice grain size) of the layer sequence. Building a layer stratigraphy on the basis of significant texture changes may therefore be a better basis for comparison with SHARAD reflections (thought to be due to varying compositions of groups of layers [e.g. 9]). The first step in building such a sequence is to determine what is a significant change in layer surface texure.

This project is part of an ongoing effort to relate what is observed in images to what is observed by the radar with the goal of understanding the variations in physical properties between individual layers. This will in turn provide insights into the formation and history of these deposits.

Two HiRISE images were selected in Promethei Lingula for the initial analysis (Figure 1). Previous stratigraphic analysis by [5] found that the same layer sequence can be identified throughout this region; thus the same layers are likely exposed in both images albeit at different slope angles and sun angles. Observing the variations in texture of the same layer under different viewing conditions will provide insight into what can be considered the actual surface texture and what is an effect of the viewing condition.

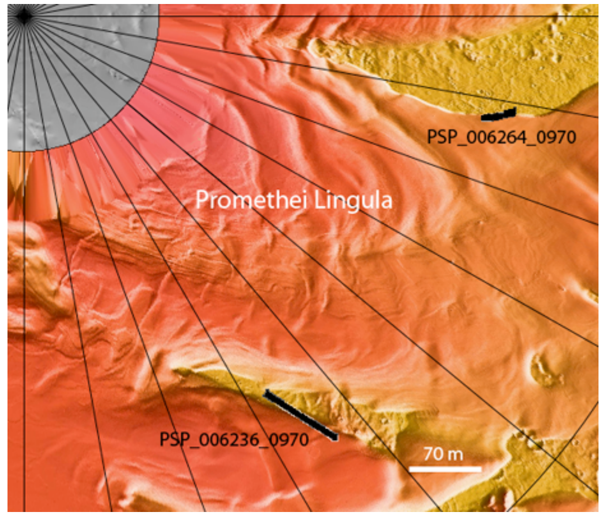

Figure 1. The Promethei Lingula region of the SPLD. Two HiRISE images (PSP_006264_0970 and PSP_006236_0970) plotted in black were examined for variations in layer surface texture.

Definition of a layer: Here a "layer" is defined as an assemblage or package of multiple sub-layers which exhibit similar surface expression on scarp walls. These packages frequently appear to be individual layers in lower-resolution images such as MOC or THEMIS, but in HiRISE images the detailed stratigraphy is visible to the limit of resolution. Distinguishing individual sub-layers in HiRISE is a time-consuming process and highly dependent on lighting, slope angle, and personal interpretation. Thus the HiRISE images are used to classify surface textures of groupings of sub-layers rather than of the sub-layers themselves.

Studies of the north polar layered deposits in high resolution using HiRISE images and digital elevation models by Fishbaugh et al [11] highlighted the importance of very high resolution topography in determining what an individual layer. In order to truly measure the thickness of a layer, whether that layer be a group of sub-layers as considered here or finer scale sub-layering as in [11], topographic information on the scale of HiRISE is required. Unfortunately, there are not yet any HiRISE digital elevation models for the Promethei Lingula region; for this reason, MOLA gridded 512 m/pxl data was used. Stereo targets are being added to the HiRISE targeting database, and it is hoped that suitable stereo data for this region will be acquired in the upcoming southern summer imaging campaign.

Layer texture classifications: Five basic layer classifications were chosen as follows:

Finely sublayered. The layer is made up of multiple regular, parallel sublayers that can be easily traced along the entire exposure within the image. A single layer with the fine sublayers texture can contain anywhere from three to tens of sublayers.

Eroded finely sublayered. Similar to the fine sublayers category, but individual sublayers are difficult to distinguish and harder to trace along the exposure.

Roughly sublayered. Linear to sublinear features are present, but no longer form a coherent sublayer and cannot be traced for any significant distance.

Smooth. No sublayers can be identified. The surface may contain small regular undulations, but no significant

Blocky. Layer surface is dominated by knobs and depressions that do not form linear patterns suggestive of eroded sub-layers.

Neighboring layers may have the same texture classification but be distinguished as separate layers based on knob size, sublayer thickness, and the degree to which eroded sublayers can be traced. Figure 2 shows examples of each type of layer texture.

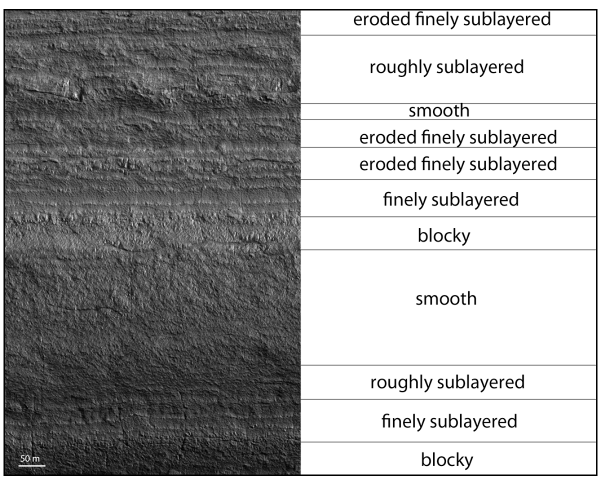

Figure 2. Examples of different surface texture types from a subframe of PSP_006236_0970. The image has been rotated so that the top of the scarp wall is up and the layers are horizontal.

Results: HiRISE images PSP_006264_0970 (centered at -83.0˚, 101.7˚, 50 cm/pxl, incidence angle 83˚) and PSP_006236_0970 (centered at -83.0˚, 145.3˚, 50 cm/pxl, incidence angle 84˚) were analyzed. The average slope of the scarp wall for the first image is ~16 degrees, and for the second is ~9 degrees.

Image PSP_006264_0970, located on the wall of Chasma Australe, contains 28 layers. 6 are classified as smooth, 6 are blocky, 6 are finely sublayered, 5 are eroded finely sublayered, and 5 are roughly sublayered. Image PSP_006236_0970, located on the wall of Chasma Promethei, contains 55 layers. 15 are classified as smooth, 9 are blocky, 12 are finely sublayered, 10 are eroded finely sublayered, and 9 are roughly sublayered.

A direct comparison of the stratigraphic columns in each image indicates that in several cases, the same layer in each image has been classified under a different texture. A layer that is finely sublayered in one image may be considered to be an eroded finely sublayered layer in the other. A similar situation occurs with smooth and blocky layers. The percentage of the stratigraphic column in PSP_006236_0970 that is layers contains sublayers in some form is 56%, and in PSP_006264_0970 is 57%. Therefore, it seems plausible that the division of textures into finely sublayered, eroded finely sublayered, and roughly sublayered is dependent on viewing conditions such as scarp slope, as is the subdivision of textures into smooth and blocky. Sublayered versus not sublayered textures may prove to be a significant texture change. However, additional images taken in these areas under different lighting conditions must be considered in this analysis before any conclusions are drawn.

Discussion: This initial classification of surface texture types in the Promethei Lingula area is limited by the resolution of the topography dataset; stereo data is required for a more thourough analysis. In the meantime, this classification system will be used to classify the layers within the stratigraphy around Promethei Lingula and ultimately the resulting texture-based stratigraphy to be compared to SHARAD profiles of the region.

References: [1] Murray, B.C. et al. (1972) *Icarus, 17*, 328-345. [2] Thomas, P. C. et al. (1992) in *Mars, ed. H. H. Kieffer et al.* pp. 767-798, Univ of AZ Press. [3] Malin, M. C. and Edgett, K. S. (2001) *JGR 106,* 23429-23570. [4] Kolb, E. J., and Tanaka, K. L. (2006) *Mars, 2,* 1-9. [5] Milkovich, S. M., Plaut, J. J. (2008) *JGR 113,* doi:10.1029/2007JE002987. [6] Herkenhoff, K. E. et. al. (2008) *LPSC 39*, 2361. [7] Seu, R. et al. (2004) *Planet Space Sci 52,* 157-166. [8] Seu, R. et al. (2007), *Science 317,* 1715-1718. [9] Milkovich, S. M. et al. (2009) *JGR 114*, doi:10.1029/2008JE003162. [10] S Christian et al. (2010) AGU Fall meeting. [11] Fishbaugh, K. E. et al, (2009) *Icarus* 205, 269-282.

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