CORRELATING IMAGES AND RADAR AT THE SURFACE OF PROMETHEI LINGULA IN THE SOUTH POLAR LAYERED DEPOSITS OF MARS. S. M. Milkovich, Jet Propulsion Laboratory, California Institute of Technology, M/S 230-205, 4800 Oak Grove Dr, Pasadena, CA 91109, USA. Sarah.M.Milkovich@jpl.nasa.gov

Introduction: The south polar layered deposits (SPLD) of Mars have been studied extensively for decades in 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]. Milkovich et al [9] demonstrated that a single SHARAD radar reflection can correspond to multiple layers at images of 6 m/pxl. By examining these layers in very high resolution HiRISE images (30 cm/pxl), we can look for patterns in the erosional styles of individual layers that may correlate with radar reflections.

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.

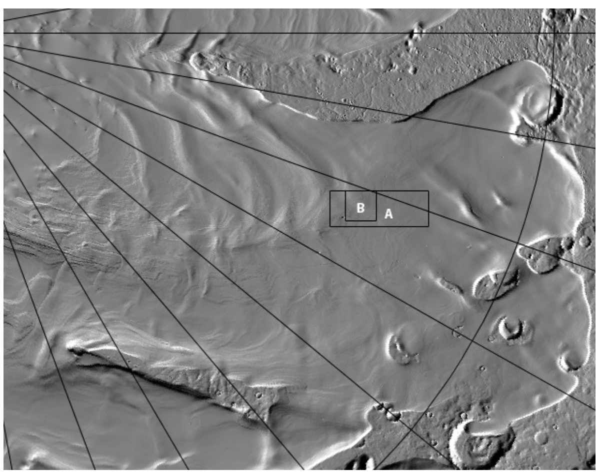

Figure 1: Promethei Lingula region of the South Polar Layered Deposits. Boxes indicate locations of figures 3 (A) and 4 (B).

Promethei Lingula: The Promethei Lingula region is a lobe of the SPLD located approximately between 90˚E to 150˚E, where the SPLD extend into the Prometheus Basin [Fig. 1]. It is bounded by Chasma Australe on the west and Promethei Chasma on the east, and contains the canyon system Australe Sulci in its southern region, in which layers are exposed at the surface of the SPLD. Previous stratigraphic analysis of this area found evidence for multiple episodes of deposition separated by significant erosion in both images and radar [4, 5, 9].

Promethei Lingula is unusual within the SPLD due to the presence of many clear subsurface radar reflections directly below the surface [10], including ones that can be traced to the polar surface itself (Fig 2).

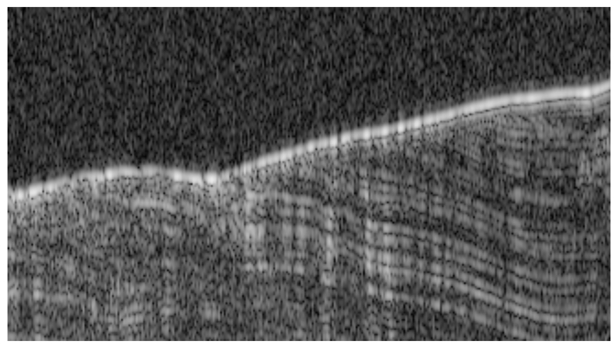
Figure 2: Portion of SHARAD radargram where reflections intersect with the surface of Promethei Lingula UPA_45230100_1_Mode_001.

Radar-Image comparisons: Radar reflections that are truncated at the surface of the SPLD allow direct comparison between the layers exposed in images and the radar reflections. In a previous study, Milkovich et al [9] compared several radargrams with THEMIS 35 m/pxl images and MOC 6 m/pxl images, and found that an individual reflection in SHARAD corresponds to single layers at THEMIS scales and multiple (3-7) layers eroding in groups at MOC scales.

In this study, the locations of where SHARAD reflections intersect with the polar surface are measured and compared the results with imaging data. Currently this analysis includes CTX images (6 m/pxl) but it will be extended to include HiRISE images (0.3 m/pxl).

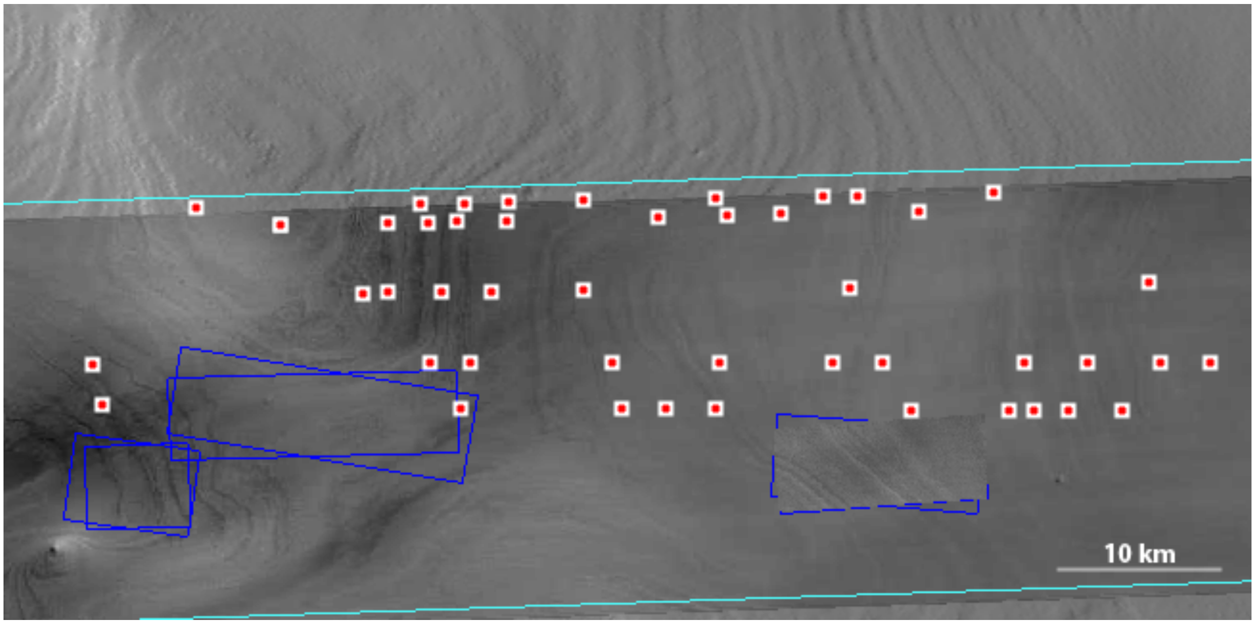

Figure 3: Promethei Lingula surface, with CTX image B11_013832_0984_XN_81S250W overlaid upon MOLA gridded topography. Dark blue boxes indicate locations of HiRISE images (to be used in future analysis). Red dots are locations of SHARAD reflections intersecting with the surface.

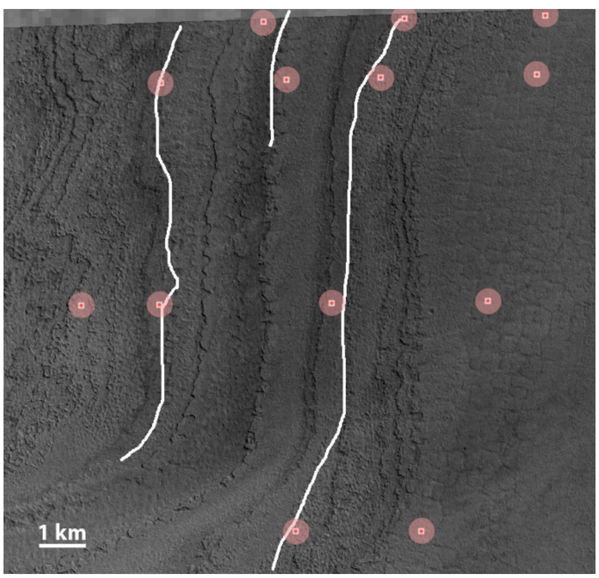

Figure 4: Promethei Lingula surface; CTX image and SHARAD reflection/surface intersections. Pink circles are 0.3 km in diameter, which is the length of the SHARAD footprint. White lines trace layers that may correspond to SHARAD reflections.

Five SHARAD orbits were analyzed and 48 locations where reflections intersected with the surface were measured. These locations are plotted on top of CTX image B11_013832_0984_XN_81S250W in Fig. 3. Fig 4 takes a closer look at a subset of these results.

SHARAD reflectors appear to consistently intersect the polar surface along layer surfaces (indicated by white lines in Figure 4). Furthermore, these layers are at the top or bottom of the "rise" of the local stair-stepped topography (i.e., not the flat surface or "stair"). Thus the underlying physical properties of certain layers (such as dust/ice ratio) that cause this erosional feature may also cause radar reflections.

Future work will include additional SHARAD orbits and extend this result to areas that have HiRISE coverage, allowing investigation of the layers that correspond to radar reflections in more detail.

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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] Phillips, R. et al. (2009) *40th LPSC*, 2007.