SURFACE EXPRESSION OF RADAR REFLECTIONS WITHIN PROMETHEI LINGULA, SOUTH POLAR LAYERED DEPOSITS, MARS. S. M. Milkovich, M/S 264-535, NASA Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, 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], and more recently in subsurface sounding radar [e.g., 7-9]. 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 (Fig 2), and thus is an excellent location to relate what is observed in images to what is observed by the radar.

Datasets and Method: Three radargrams produced by the SHallow RADar (SHARAD) subsurface sounding radar onboard Mars Reconnaissance Orbiter (MRO) were selected in this region based on the clarity of reflections near the surface. Additional radargrams in this area have been identified as good candidates for analysis. Ten of MRO's Context Camera (CTX) images (6 m/pxl) in the study location were selected based on the visibility of layers exposed on the surface of the SPLD (e.g., haze-free).

For each of the three radargrams, individual reflections were traced to the polar surface and the point at which each reflection intersected the surface was identified (Fig 2). The latitude and longitude of each point was found, and plotted on top of map-projected CTX images rendered in the JMARS GIS program (available at http://jmars.mars.asu.edu). The results can be seen in Fig. 3.

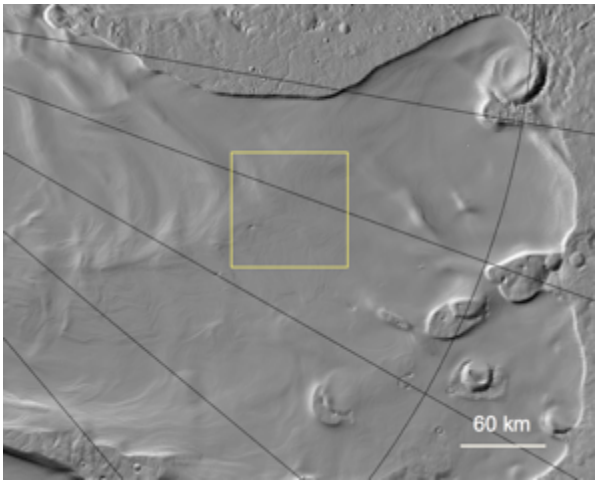

Fig. 1: Study location (yellow box) on Promethei Lingula, south polar layered deposits. Base map is MOLA gridded topography.

Results: One layer visible across multiple CTX images (yellow line in Fig 3) intersects with three SHARAD surface/reflection points, one from each radargram in the analysis. Each of these three SHARAD points were then identified and highlighted in yellow in Fig. 4.

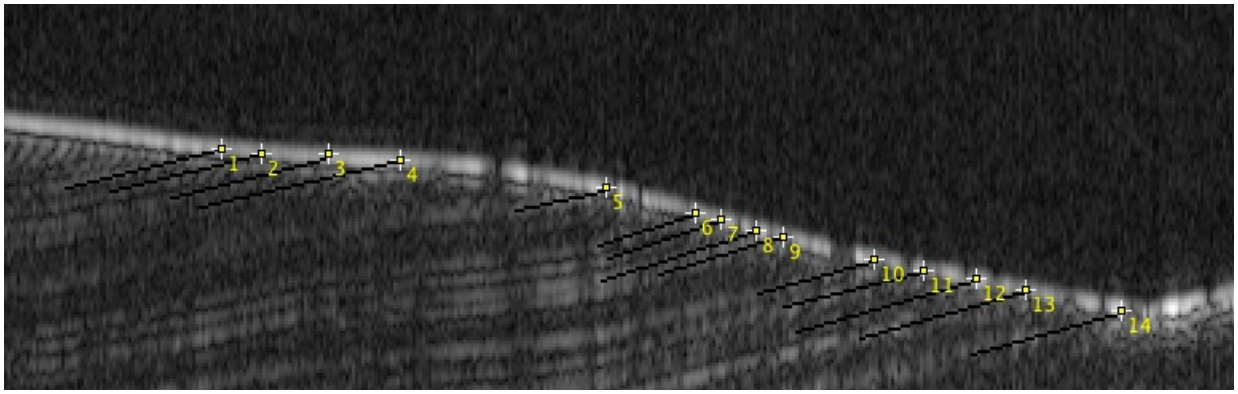

Fig. 2: Subsection of SHARAD radargram from orbit 10633_01_0. Black lines trace layers intersecting with the SPLD surface; numbers identify individual reflections.

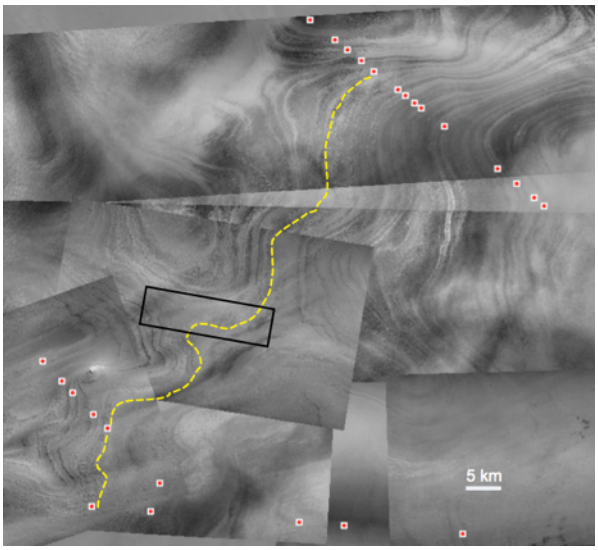

Fig. 3: Red dots are locations where SHARAD reflections intersect the surface of the SPLD (the 0.3 km x 3 km "footprint" of an individual SHARAD pulse is not shown here). The yellow line traces a single layer visible in CTX images. The black box indicates the location of a HiRISE image.

From a comparison of the radargrams, it is concluded that this is indeed the same reflective surface in each radargram: each reflection is the top of a packet of bright layers which is in turn on top of a dark radar-free zone. The pattern of the radar reflections further down the stratigraphic column are also directly comparable between radargrams.

Future Work: There are two avenues along which this analysis will be expanded. In the first, additional radargrams will be analyzed and the locations where their reflections intersect the surface will be compared to the layers in the CTX images. In the second, CTX layers that correspond to SHARAD reflections will be examined in the available HiRISE imagery (e.g., black box in Fig 3) to determine if there are physical differences (e.g., erosion style, groupings of layers) between areas that correlate with SHARAD reflections and areas that do not, as proposed by Milkovich et al [9,10].

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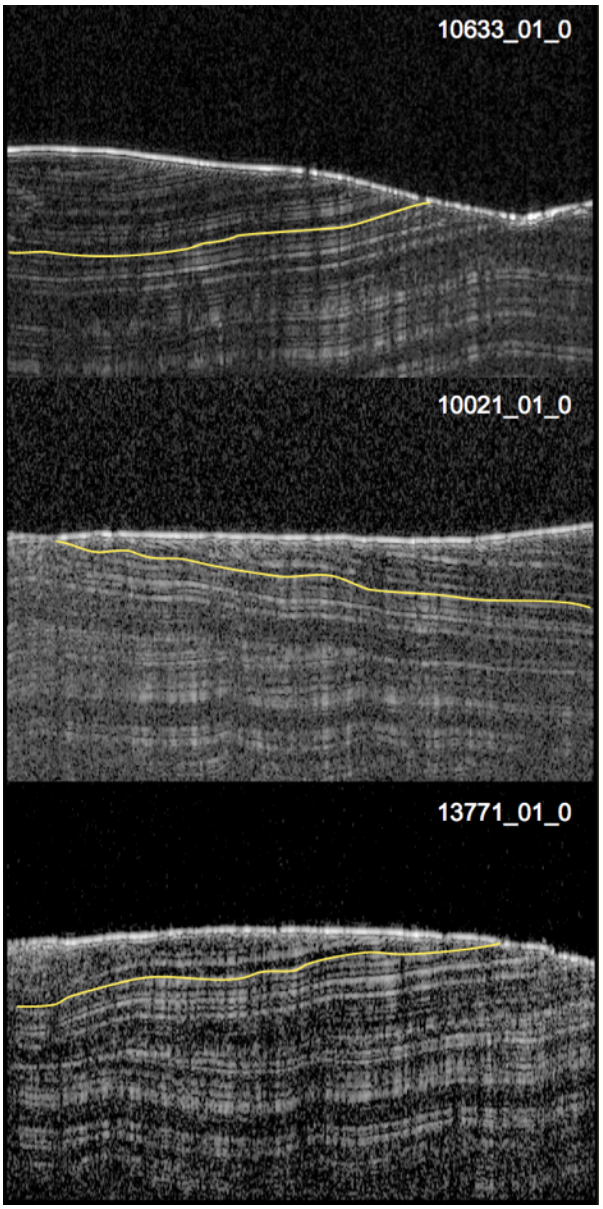

Fig. 4: Reflection corresponding to an individual CTX layer (yellow line) in three SHARAD radargrams.

References: [1] Murray, B. et al. (1972) *Icarus, 17*, 328-345. [2] Thomas, P. et al. (1992) in *Mars, ed. H. Kieffer et al.* pp. 767-798, Univ of AZ Press. [3] Malin, M., Edgett, K. (2001) *JGR 106,* 23429-23570. [4] Kolb, E., Tanaka, K. (2006) *Mars, 2,* 1-9. [5] Milkovich, S, Plaut, J. (2008) *JGR 113,* doi:10.1029/2007JE002987. [6] Herkenhoff, K. 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. et al. (2009) *JGR 114*, doi:10.1029/2008JE003162. [10] Milkovich, S. (2010) *LPSC 41, 1533*