INVESTIGATION OF LAYERED SEDIMENTS AT A PROPOSED FUTURE MARS LANDING SITE IN LADON VALLES. C.M. Weitz[1] and J.L. Bishop[2], [1]Planetary Science Institute, 1700 E Fort Lowell, Suite 106, Tucson, AZ 85719 (weitz@psi.edu); [2]The SETI Institute&NASA-Ames Research Center, Mountain View, CA 94043.

Introduction: We have identified candidate rover traverses and scientific targets within two proposed 15x15 km landing ellipses at the distal end of Ladon Valles. The prime science targets include layered sediments of possible fluvial origin seen in HiRISE images, and clays identified in CRISM data. Both sites would enable potential access to multiple sedimentary units of diverse morphologies and mineralogies, including possible Noachian water-lain sediments that were transported through Ladon Valles and deposited at these distal sites within Ladon basin. The layered sediments resemble in morphology light-toned layered deposits (LLDs) seen at other proposed Mars landing sites to the southwest (Fig. 1a), including Holden crater [1] and Eberswalde [2,3], as well as those along the Valles Marineris plateau [4]. A landing site at either ellipse could potentially address questions concerning the evolution of the Uzboi-Ladon-Margaritifer (ULM) system, the ages, setting, and formation of clays within this fluvial system, and evaluate the potential habitability of this region in the martian past.

The LLDs are exposed along the distal floor of Ladon Valles where the channels intersect Ladon basin, and could represent fluvial sediments from initial infilling of the basin that were subsequently incised by later flooding through Ladon Valles. Ladon Valles is the middle segment in the ULM system that formed in the Noachian [5]. Ladon Basin is thought to preserve a record of fluvial and lacustrine sediments from the Noachian, including clays [6].

Engineering Constraints: Both landing ellipses were selected on relatively flat regions, although site A has several large craters where the crater walls could pose slope hazards (Fig. 1b). Ellipse A cannot be moved further south because of deep and wide fractures along Ladon Valles floor. The ellipse cannot be moved further east because of steep slopes along the LLDs, but could be moved further north and west, although this will move the rover futher away from the primary science targets located to the southeast.

Ellipse B can be moved further north and west if needed for engineering constraints and is currently located directly on LLDs that would be easily accessible to a rover within the landing ellipse (Fig. 1b).

Science Merit of this Site: The targeted materials are meter-scale finely layered light- and dark-toned beds exposed along the floor of Ladon Valles (Figs 1,2). At Ellipse A, the rover would need to drive eastward ~ 7 km to the edge of the ellipse in order to access strata that contain these likely fluvial sediments. We note that CTX images show small exposures of LLDs in the southern portion of the ellipse, and new HiRISE images to be acquired of the center of the ellipse may reveal these LLD outcrops closer to the center of the ellipse as well. At Site B, the LLDs are exposed within the landing ellipse (Fig. 1b). At this time, there are no CRISM FRTs taken within ellipse B so the mineralogy of the LLDs within the ellipse remains unknown.

CRISM images taken outside the ellipses and further to the southeast (Fig. 1) have been used to identify two mineralogies within the finely layered strata. One material has both 1.9 and 2.3 μm absorptions (Fig. 2). A comparison to laboratory spectra suggests the material contains a Fe-smectite, such as nontronite, or a Mg-smectite like saponite, or a mixed-layer clay like corrensite [6]. The second material only has an absorption at 2.3 μm but is either lacking or exhibits a very weak absorption around 1.9 μm (Fig. 2). This material could represent a dehydrated smectite. Because the beds are thin and have limited spatial exposure, each CRISM spectrum likely represents a mixture of multiple rock types from several beds rather than any individual bed.

Although CRISM images only exist for these LLDs to the east of ellipse A, we can trace these same beds further west in both HiRISE and CTX images towards the landing ellipse, indicating that a rover could drive within ellipse A and have access to these materials.

A HiRISE-derived DTM reveals many details about the ~55 m thick sequence of exposed layered beds (Figure 2d). All beds are less than ~5 meters thick. Beds appear nearly horizontal as they can be traced across the same elevation for several kms. In general, the clay material that exhibits both the 1.9 and 2.3 μm features occurs stratigraphically lower relative to the brighter material above that only exhibits the 2.3 μm feature.

References: [1] Grant J.A. et al. (2008) *Geology* 36, 195–198. [2] Malin, M.C. and K.S. Edgett (2003) *Science* 302, 1931–1934. [3] Moore J.M. et al. (2003) *Geophys. Res. Lett.* 30, doi:10.1029/2003GL019002. [4] Weitz C.M. et al. *Icarus* (2009), doi:10.1016/j.icarus.2009.04.017. [5] Grant J.A. and T.J. Parker (2002) *JGR* 107, doi: 10.1029/2001JE001678. [6] Milliken R.E. and D.L. Bish (2010) *Philosophical Magazine*, 1-16, doi: 10.1080/14786430903575132.

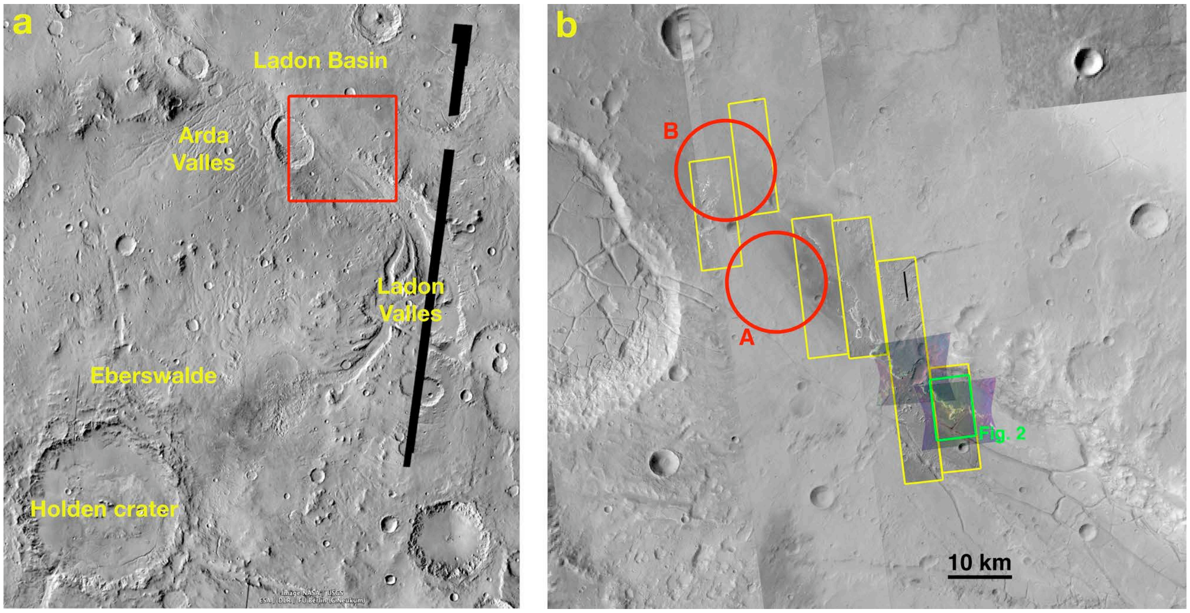
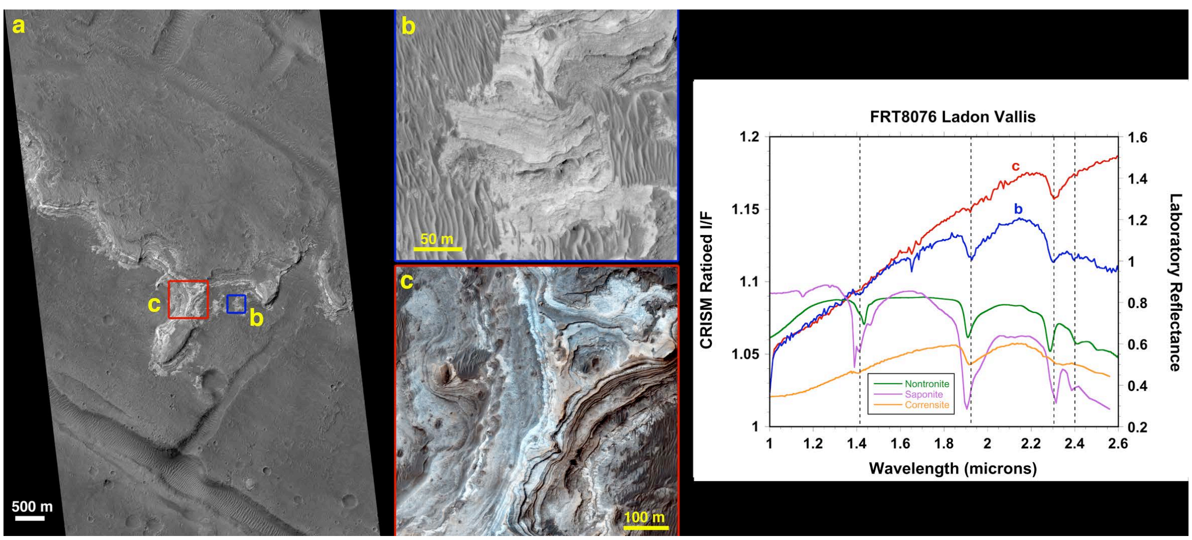


Figure 1. (a) THEMIS daytime mosaic of region around Ladon Valles. Red box shows blowup in (b) and location of proposed landing sites at the distal end of Ladon Valles. (b) Red circles are 15-km diameter proposed landing ellipses. Yellow rectangles represent existing HiRISE images. There are currently two CRISM FRTs wih IR spectra that are shown in color to the SE of the ellipses.



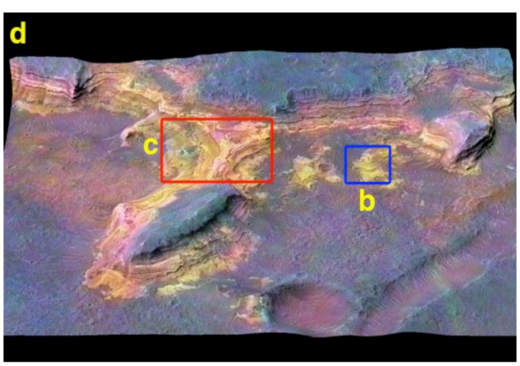


Figure 2. (a) Portion of HiRISE image PSP_006637_1590 showing finely layered beds along Ladon Valles floor. (b) Light-toned layered beds (LLDs) exposed near the lowest portion of the strata. CRISM spectrum (shown in blue) is consistent with smectites like nontronite and saponite. (c) Enhanced color image of layered beds near the upper portion of exposed strata. CRISM spectrum (shown in red) has a strong absorption around 2.3 μm but lacks a hydration absorption around 1.9 μm. (d) DTM at 5x vertical exaggeration with CRISM parameters overlain in color.