**A PROPOSED FUTURE MARS LANDING SITE IN NOCTIS LABYRINTHUS.** 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 studied the geologic setting and identified candidate rover traverses and scientific targets within a proposed landing ellipse in one of the troughs of Noctis Labyrinthus (Figure 1). A stereo pair of HiRISE images covering a portion of the trough was used to produce a Digital Terrain Model (DTM). CRISM spectral parameter maps were then co-registered and overlain on the DTM to aide in the interpretation of stratigraphic relationships. The prime science targets are not within the 15x10 km landing ellipse but rather a few kms southwest of the ellipse and include possible Al-smectites, Ca-sulfates (gypsum or bassanite), and hydrated silica (opal) [1,2]. A landing site within this trough could potentially address questions concerning the ages, setting, and formation of clays and sulfates, including the potential habitability of this region in the martian past.

**Geologic setting of the landing ellipse:** The landing ellipse (Figure 1) has been selected to fit within the smooth plains and avoid mesas closer to the pit walls. Previous studies by [3] suggest the floor of the trough is covered by 50-100 My old volcanic plains. Upon landing at location 1, the rover would have the opportunity to analyze lava flows and linear vents along the trough floor. The rover would then traverse to the southwest to reach location 2 where there are exposures of Light-toned Deposits (LTDs). Small outcrops of LTDs are seen where erosion has removed the overlying volcanic plains (Fig. 2a). These LTDs have spectra consistent with Al-smectites (Fig. 2c). The presence of smectites indicates aqueous activity but the duration and abundance of water remains unconstrained.

Other LTDs are present to the southeast as <1 km exposures within a mass wasting deposit along the wallrock (Fig. 3a). Gypsum and bassanite are possible matches to the CRISM spectra of some of these deposits, while opal is consistent with other outcrops (Fig. 3b). The presence of gypsum or other Ca-sulfates such as bassanite or glauberite could indicate aqueous alteration of basalt under acidic conditions and has been suggested to result from young (<100 My) volcanic activity in the trough [2]. These Ca-sulfates are typically formed on Earth as evaporates or as fumarole deposits. Opal has been detected elsewhere in and around Valles Marineris [4,5] and likely formed as an alteration product or by aqueous precipitation of chemically weathered basaltic lava flows, ash or impact glass. The opal in this trough only appears as a patchy material on upper sloped surfaces, suggesting alteration of pre-existing material or an ash unit that has been obscured and buried elsewhere along this portion of the trough. Unfortunately, most of these exposures are located upslope along rugged terrain and are unaccesible to any rover. Location 3 is an outcrop of gypsum/bassanite material that could possibly be reached by a rover. Location 4 (Figure 1b) is a large hill that also appears to contain gypsum/bassanite material and could be accessible to a rover. Finally, location 5 is the distal end of a valley that emanates from a circular depression upslope. This valley is most consistent with a volcanic origin rather than fluvial because there are lava flows that emanate from the distal end of the valley.

**Table 1:** Noctis Labyrinthus Landing Site

| Site Name | Noctis Labyrinthus |
|---|---|
| Center Coordinates Latitude, longitude | 261.03E, -6.86N |
| Elevation | 2.22 km wrt MOLA |
| Ellipse Size | 15 km by 10 km |
| Prime Science Targets | Smectites, Gypsum, Opal [Highest Priority],<br>Other light-toned units of uncertain composition, valleys, mesas, and Amazonian volcanics [Lower Priority] |
| Distance of Science Targets from Ellipse Center | Smectites – 8 km to SW<br>Gypsum, Opal – 12 km to S<br>Valley – 12 km to S |

**References:** [1] Weitz, C. M et al. (2010) LPSC XLI, Abstract 2240; [2] Thollot et al. (2010) Lunar Planetary Science Conference XLI, Abstract 1873. [3] Mangold et al. (2009) Icarus doi:10.1016/j.icarus.2009.10.015. [4] Milliken et al. (2008) Geology, 36, 847-7580, doi:10.1130/G24967A.1; [5] Weitz et al. (2010) Icarus doi:10.1016/j.icarus.2009.04.017.

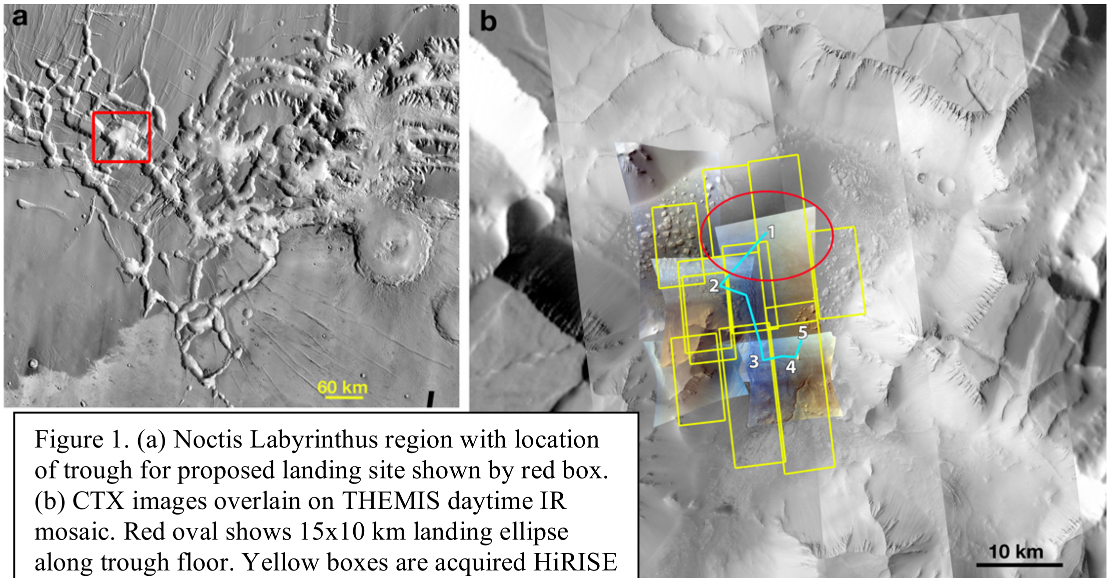


Figure 1. (a) Noctis Labyrinthus region with location of trough for proposed landing site shown by red box. (b) CTX images overlain on THEMIS daytime IR mosaic. Red oval shows 15x10 km landing ellipse along trough floor. Yellow boxes are acquired HiRISE images. Color is from CRISM FRT images. Numbers are features of interest during rover traverses.

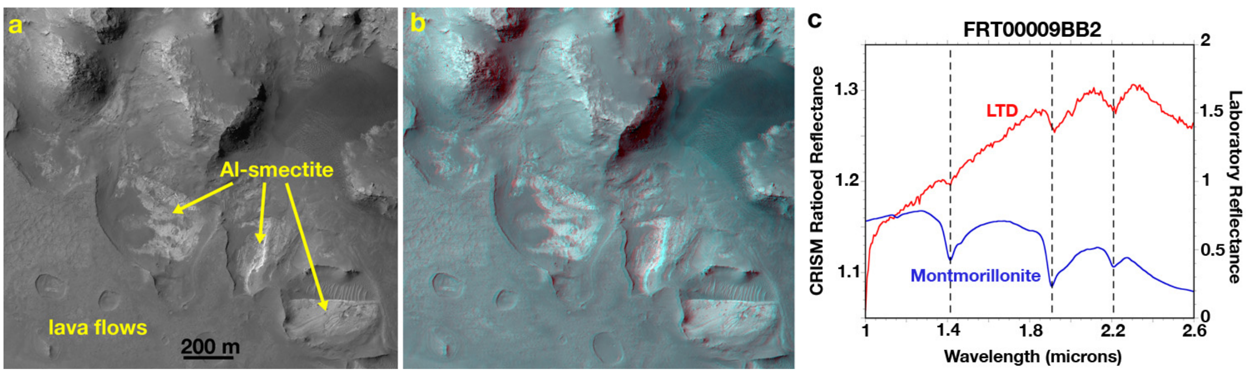


Figure 2. (a) HiRISE image of Al-smectite-bearing LTDs along SW region of trough floor (rover location 2 in Fig 1b). (b) Stereo anaglyph. (c) Spectrum of LTD that is consistent with an Al-smectite such as montmorillonite.

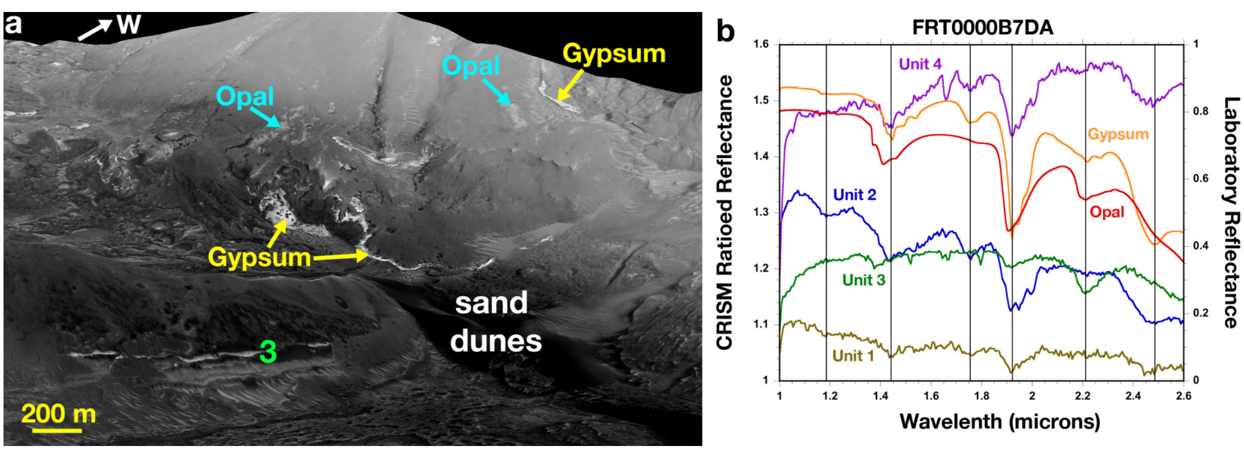


Figure 3. (a) HiRISE DTM at 7x vertical exaggeration. Location 3 (green number) would potentially be accessible to the rover and appears to contain gypsum/bassinite material (Unit 1 in CRISM spectra shown in Fig. 3b). The opal exposures are patchy and occur along upper surfaces of wallrock material. (b) CRISM and laboratory spectra of selected units. Unit 2 represents typical gypsum-bearing units. Unit 3 was extracted from an opal-bearing unit. Unit 4 was taken from the large hill (rover location 4 in Fig. 1b) and appears to contain gypsum/bassanite.