GEOMORPHOLOGY AND INFERRED STRATIGRAPHY OF THE GALE CRATER CENTRAL MOUND AND PROPOSED MARS SCIENCE LABORATORY LANDING SITE. R. B. Anderson[1] and J. F. Bell III[1], [1]Cornell University, Department of Astronomy, Ithaca, NY 14850 (randerson@astro.cornell.edu)

Introduction: Gale Crater is located at 5.3°S, 222.3°W and has a diameter of ~150 km. It has been a target of interest due to the >5 km tall mound of sedimentary material that occupies the center of the crater, and its status as one of six possible landing sites for the Mars Science Laboratory (MSL) [1]. Proposed origins for the mound include: aeolian, lacustrine, pyroclastic, and spring mound deposits. [2-7] We have assessed these hypotheses by conducting a study of the proposed Gale Crater landing site and central mound [8], using data products from: CTX, HiRISE, MOC, THEMIS, CRISM, OMEGA, MOLA, and HRSC.

Results: Figure 1 shows an idealized cross-section of the units identified in the proposed landing site and the central mound. The upper mound (UM) exhibits a pattern that we interpret as cross-bedding (Figure 2), suggesting an aeolian origin for that unit. The UM lies unconformably atop the lower dark-toned layered yardang-forming unit (DTY), as shown by a channel in the western mound that ends at the UM. Layers within the DTY are parallel, planar and sometimes traceable for >10 km. This is inconsistent with a spring mound origin, but consistent with both lacustrine and aeolian origins. Volcanic and pyroclastic processes were probably not the dominant depositional processes due to the large distance between Gale and the nearest volcanoes. We interpret polygonal erosion-resistant ridges on the DTY as altered or cemented fractures, suggesting post-depositional aqueous activity. The phyllosilicate-bearing unit (PHY), first identified in CRISM observations [9], occurs in a trough formed by the light-toned ridge unit. PHY may be either altered material trapped in the trough, or the exposed surface of a thin phyllosilicate-bearing mound layer.

The landing site is centered on a fan-shaped unit subdivided into a proximal low-thermal inertia unit (LTIF) and a distal, stratigraphically lower high-thermal inertia unit. The apex of the LTIF occurs at the end of a branching channel extending from the crater rim. Elsewhere, the crater floor comprises hummocky plains (HP) of varying thermal inertia. A mesa-forming pitted or ridged "mound-skirting" unit (MSU) is common and appears to overlie floor units and some lower mound units. Both the HP and MSU preserve sinuous ridges which we interpret as inverted channels.

Conclusion: The UM appears to be aeolian in origin, based on the presence of textures interpreted as crossbeds. The origin of the remaining mound units is less clear, and could be consistent with aeolian and/or lacustrine but not spring mound deposits. The large

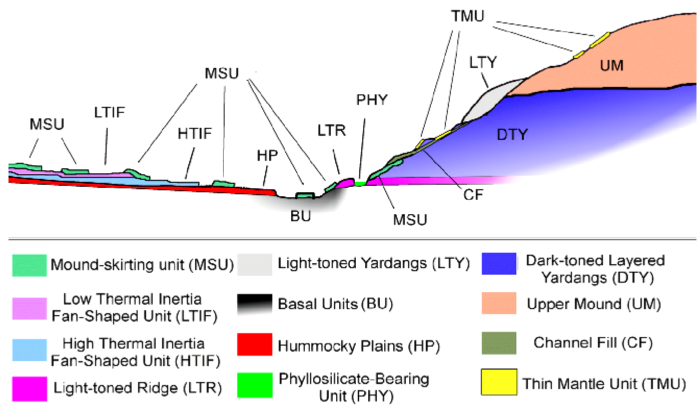

Figure 1: An idealized cross section (not to scale) through the proposed MSL landing site and central mound in Gale Crater.

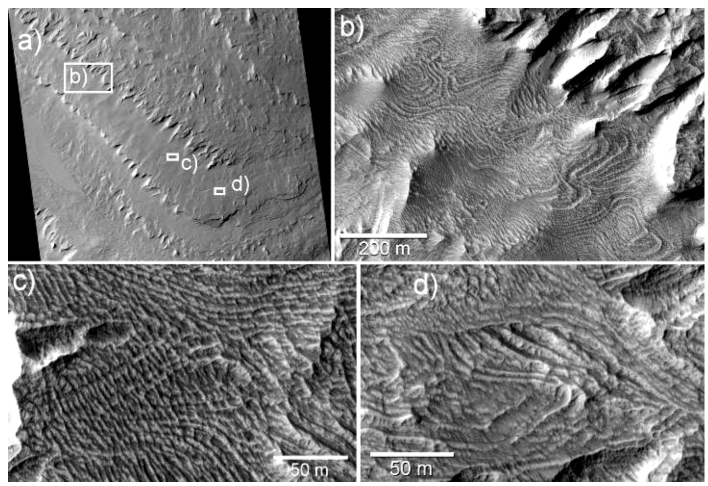

Figure 2: a) Subframe of HiRISE image PSP_001620_1750 of the upper Gale mound. b) An example of the unusual surface texture of the "bench" portion of the upper mound. c) Another location on the bench of an upper mound layer, exhibiting bands that appear to "zig-zag". d) A third location, with curved groups of bands that truncate each other, similar to aeolian crossbeds.

exposed stratigraphic section at Gale crater, and the significant portion of Martian history which that section preserves, would be best understood by in-situ observations by a landed mission such as MSL.

References: [1] http://marsoweb.nas.nasa.gov [2] Scott, D. H., et al. (1978). USGS Misc. Inv. Series Map I-1111. [3] Greeley, R., and J. E. Guest (1987). USGS Misc. Inv. Series Map I-1802-B. [4] Malin, M. C. and Edgett, K. S. (2000), Science 290, 1927-1937. [5] Scott, D. H., and M. G. Chapman (1995) USGS Geol. Series Map I-2397 [6] Cabrol, N. A. et al. (1999), Icarus 139, 235-245. [7] Rossi, A. P. et al. (2008) *JGR*, 113, E08016 [8] Anderson, R. B. and Bell, J. F. III (2010) *Mars* (Submitted). [9] Milliken, R. E. et al. (2009) *GRL* (In Press)