

TESTING A LACUSTRINE HYPOTHESIS: AN MSL LANDING SITE CANDIDATE IN SOUTH HOLDEN CRATER. M. C. Malin and K. S. Edgett, Malin Space Science Systems, PO Box 910148, San Diego, CA 92191-0148 USA.

Light-toned, layered, sedimentary rocks have been exposed by erosion in southern Holden Crater [1]. In some areas, alternating layers (or groups of layers) have differing albedos and/or erosional expression, indicating that some diversity of materials is present. These rock outcrops present a straight-forward and relatively simple opportunity to test a key hypothesis about the nature and habitability of early Mars: Did Mars once have lacustrine environments?

The objective of an MSL mission to south Holden Crater is to examine the stratigraphy and document the depositional settings represented in the strata of the sedimentary rock outcrops exposed in the basin. For similar reasons centered on the notion that these rocks may represent the remains of sediment deposited in an early martian lake, others have also considered that the site would be key for a post-MER landing site [e.g., 2].

The bedding in the majority of martian light-toned, layered rock outcrop settings has been expressed by erosion in the form of cliffs, benches, or stairsteps, in which individual layers (or, more likely, packages of layers) have thicknesses > 5 m [1]. Such a surface would be challenging for a rover to drive across. Although some of the outcrops in south Holden have a cliff-bench expression, the majority exhibit fairly shallow, smooth, continuous (not stepped), dust-free slopes. In Holden, a rover will be able to drive up or down a stratigraphic section, examining the fine geologic details along the way.

The outcrops of interest are located in terrain too rugged for a safe landing, but a 20 km diameter “ellipse” can be located on a nearby surface at elevation

near -2.25 km. The landing ellipse is on a fan of debris (an alluvial fan) north/northwest of the rock outcrops; our initial assessment is that its surface isn’t any more hazardous to landing than was the MER-A site.

The sedimentary rocks exposed in south Holden have been protected from erosion by virtue of being capped by alluvial fan sediments. The best exposures occur at the point where Uzboi Vallis enters the basin. This fact suggests that the rocks were already lithified when the fluids that flowed through Uzboi reached the basin floor, thus implying a great age and incredible story involving sedimentation, lithification, and erosion by fluvial processes. In other words, and perhaps most importantly, Uzboi Vallis cut into the light-toned layered rocks, implying that there had been sufficient time for sediment to be deposited, lithified, and eroded by a down-cutting valley-forming process, all while conditions in the martian environment still permitted water (or a fluid with the rheologic properties of water) to flow across the planet’s surface.

An MSL investigation of southern Holden would focus on the stratigraphy and geologic history recorded in the sedimentary rocks preserved there, characterizing bedding properties, sedimentary structures and textures, the nature of clasts and cementing agents, and the mineralogy and diagenetic processes that affected these materials.

References: [1] Malin, M. C. and K. S. Edgett (2000) *Science*, 290, 1927–1937. [2] Parker, T. J. and J. A. Grant (2001) *Workshop on Martian Highlands and Mojave Desert Analogs*, Lunar Planet. Inst., Abstract #4026.

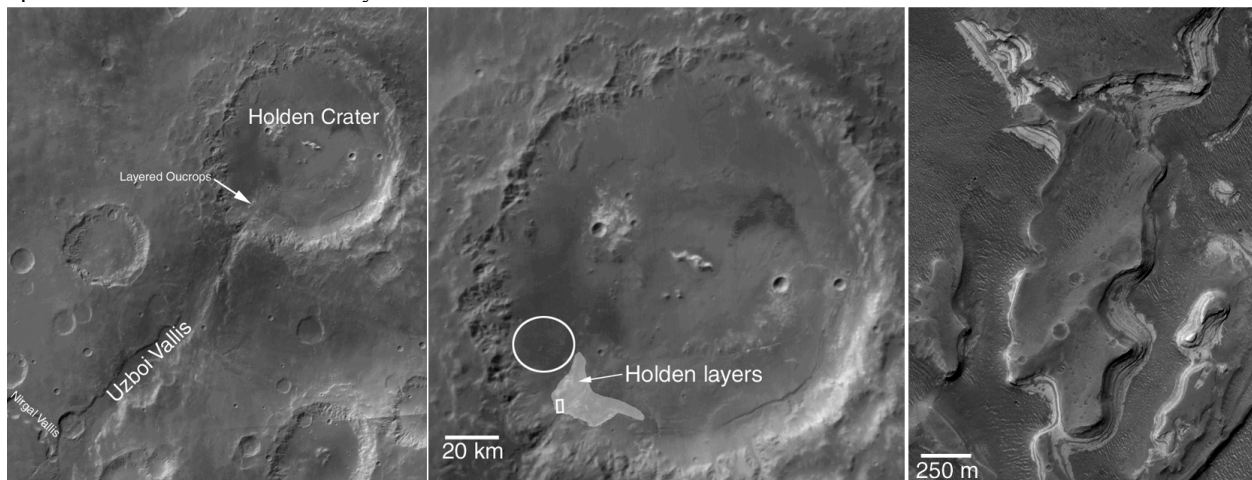


Figure 1. Holden Crater and proposed MSL landing site near 26.7°S , 334.9°W , -2.25 km elevation.