STUDIES OF MARTIAN SEDIMENTOLOGICAL HISTORY THROUGH IN-SITU STUDY OF GALE AND OUDEMANS CRATERS: TWO LANDING SITE PROPOSALS FOR THE MARS SCIENCE LABORATORY

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Introduction

The Mars Science Laboratory is designed to investigate paleo environments that may have supported biological processes on Mars. This constrains the myriad possibilities for landing sites to locations containing rocks formed by or that interacted with water. This abstract presents two landing sites that meet these criteria and therefore should be considered by the MSL project. Both are within the interior or wall rocks of impact craters, but are not chosen for investigation of impact processes per se. Rather, Gale Crater preserves sedimentary, probably fluvial, sediments that filled the crater and are preserved today as remnant materials exposed in exhumed interior layered deposits. The central peak materials of Oudemans Crater are overturned, exposing steeply-dipping stratigraphic sections of the Valles Marineris region.

Gale Crater

Gale was a semi-finalist for MER before being eliminated because the 3-σ landing ellipse could not, at the time of disqualification, be fit within the crater (ironically, the ellipses later shrunk, such that Gale could have been a MER landing site). With the smaller landing ellipse and "drive-to" capability, this is an ideal site for MSL strictly on engineering grounds. Gale contains a suite of layered deposits and more recent fluvial features [1-5] (Figure 1). The basal layers are finely bedded, and as described by [1,3], may represent deposits from a lake that filled the crater. Above this is a mound of massive material that is higher than the crater walls, indicating a pervasive mantling over Gale and surrounding areas that was later stripped and partially exhumed, probably by wind. Advantages of a Gale site include:

1. In situ layers that probably formed by lake sediments
2. Enigmatic massive mantle material that is also found in many regions of Mars. Mantling and exhumation is an important, yet poorly understood process on the planet [6,7].
3. Fluvial channels which probably formed after the lake sediments.

Central Peak of Oudemans Crater

As reported in Malin Space Science Systems MOC Press Release MOC2-1263, the central peak deposits of Oudemans crater just south of Noctis Labryinthus are overturned. As shown in Figure 2, the dips of the layers appear very steep. Sending MSL here will provide the opportunity to sample the stratigraphy of the Valles Marineris region by simply driving up section over relatively flat terrain. Many of the strata could be sedimentary in nature.

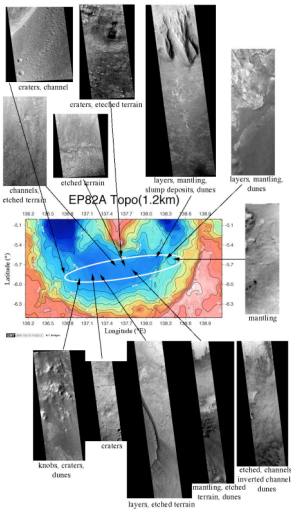

Figure 1: Gale Crater map (with old MER ellipse) and MOC images.

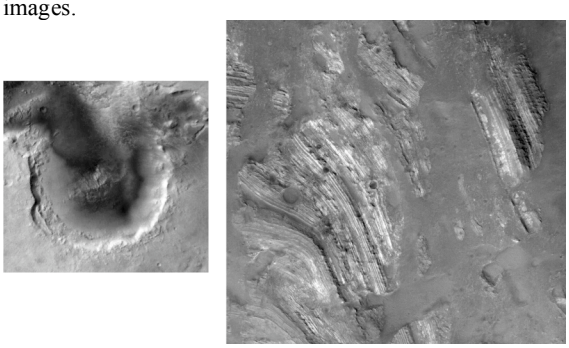

Figure 2: Oudemans Crater. Left: THEMIS VIS mosaic. Right: Close up of dipping layers in the central peak.

Summary

Both the Gale and Oudemans sites offer promising terrain for investigation by MSL. They exhibit layering and other geologic characteristics that offer high science yield to the MSL payload focused on determining paleo-environments that could have been conducive to life. If these landing sites get preliminary approval, future work will focus on detailed analysis of landing safety for MSL and science investigation scenarios.

Acknowledgements: MOC images are credited to NASA/JPL/MSSS. The THEMIS image is a screen capture from www.google.com/mars.

References

[1] Malin, M.C. and K.S. Edgett, *Science, 290*, 1927-1937, 2000. [2] Bridges, N.T., 1st MER Landing Site Workshop, 20:8, 2001 [3] Edgett, K.S. and M.C. Malin, *LPSC XXXII*, 1005, 2001. [4] Pelkey, S.M. and B.M. Jakosky, *Icarus, 160*, 228-257, 2002. [5] Pelkey, S.M. et al., *Icarus, 167*, 244-270, 2004. [6] Malin, M.C. and K.S. Edgett, *J. Geophys. Res., 106*, 23,429-23,570, 2001. [7] Edgett, K.S., *Mars,1*, 5-58, 2005.