

## PALEO-LAKE IN MELAS CHASMA (VALLES MARINERIS) AS A POTENTIAL LANDING SITE FOR MSL.

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**Explanation of Landing Site:** We propose a potential landing site for the Mars Science Laboratory (MSL) in a relatively flat 20x30 km basin in the southwestern wallrock of Melas Chasma (center latitude 9.8°S, center longitude 283.6°E, elevation is -1900 m). THEMIS (IR and VIS) and MOC images show this region has one of the most recent dense valley networks on the surface of Mars incised into layered rocks [1,2]. We propose a landing site in the enclosed basin at the outlet of the valleys, a location postulated to be a paleolake site [2] (Fig. 1A). Within the basin, MSL could explore exposures of light- and dark-toned layered rock outcrops over a stratigraphic section of 500 m, as well as fan deposits located at the termination of the valley networks. The chemical and physical properties of the rocks determined by MSL instruments will be crucial to unraveling the geological history preserved in southwest Melas basin, which likely included volcanic episodes as well as fluvial and lacustrine environments. Consequently, Melas basin is a unique place on Mars with a diversity of sedimentary features that make it an ideal landing site to investigate the past habitability of Mars, one of the science objectives for the MSL mission.

**Engineering criteria:** The Melas basin landing site (Fig. 1B) meets most of the current engineering criteria defined by the MSL project. The major exceptions are the north and south portions of the landing ellipse where there are steep slopes (~20°) along exposures of wallrock. The floor of the basin is almost flat with slopes <3° except for a small area. The winds along the canyon walls could be a major concern that needs to be studied in more detail should this location be selected as a high priority landing site for MSL.

### Scientific interests of the area:

- **Origin of Valley networks:** The landing site is located in a basin related to the Melas valley networks. Many of the associated features (e.g., drainage density, topography, morphology, etc.) suggest that they were likely created by precipitation.

- **The ILD's of Valles Marineris:** MOC images reveal that the valleys eroded layered material that is possibly remnant of Valles Marineris Interior Layered Deposit (ILD)'s [2] partially composed of sulfates as determined by OMEGA [3]. A part of the rim of the basin exposes these layers and could be explored by MSL.

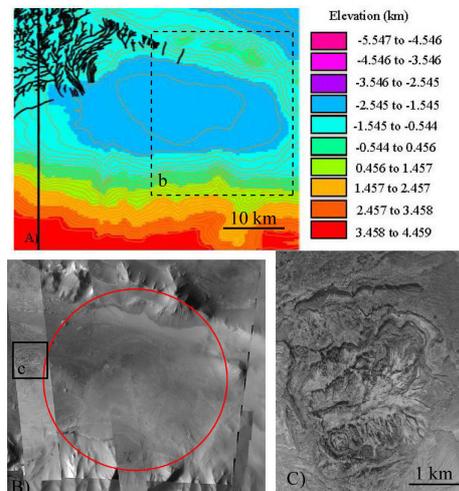
- **Possible lacustrine layers:** The basin is a completely enclosed depression (Fig. 1A). Many outcrops of light-toned layered deposit are present in the depression that could be sedimentary deposits from a lake [2].

One of the outcrops exposes layered rocks that could represent long-lived, sub-lacustrine depositional systems of a fan delta and a giant channel-levee system [4]. This environment could have once been a habitable zone for former life and, therefore, a prime location for MSL to search for the chemical and physical evidence of any past life.

- **Rounded deposits:** The basin exposes rounded blocks like those described on the main floor of Melas Chasma by Weitz et al. [5] and once considered a high-priority landing site for MER[5].

- **Fan deposits:** High resolution images show the presence of fans at three distinct convergences of valley networks in the enclosed depression. At one of the outlets, we can observe a stack of fans implying a very rich and polyphased water-rated activity (Figure 1c).

In summary, we favor Southern Melas basin as a MSL landing site because it is a unique place to provide insight into fluvial dynamics, sedimentary structures, climatic evolution, and the search for past life on Mars.



**Figure 1:** A) Digital Elevation Model (DEM) of Melas basin at the outlet of valley networks, B) 10 km radius circle superimposed on THEMIS/MOC visible images mosaic, C) MOC close up of one of the sedimentary features in the enclosed basin. This erosional window exposes a possible paleo-fan which is at the base of the exposed stratigraphy in the basin.

**References:** [1] Mangold N. et al. (2004), *Science*, 305, 78-81. [2] Quantin et al., (2005), *JGR*, 110. [3] Gendrin et al., (2005), *Science*, 307, 1587-1591. [4] Dromart et al., (2006) submitted. [5] Weitz et al., (2003), *JGR*, 108, 8082.