

Fine-layered Meridiani Crater for the MSL Landing Site

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Strong evidence exists, such as fans or deltas, that indicate some craters and basins were once lakes, e.g., Eberswalde Delta (24.2°S, 33.7°W)

However, such fans are *extremely* rare.





More commonly found on Mars are craters and basins in which occur lighttoned, layered, sedimentary rocks that exhibit a repeated character indicative of periodic or at least episodic deposition. Often these layers (or packages of finer, unresolved layers) have repeated thickness and physical properties. These are very common in regions where sedimentary rocks are exposed.

Unnamed crater at 8°N 7°W has hundreds of repeated layers of similar thickness and erosional expression.



Unnamed crater in Schiaparelli with several dozen repeated layers.





The layers of sedimentary rock inside the crater exhibit a different bedding character and erosional expression than the rocks exposed by erosion outside the crater.





The differences between rocks inside the crater and outside the crater indicate that the depositional setting within the crater was different than outside the crater.



Relatively thin, repeated beds of sedimentary rock exposed in craters—and differing from the properties of rock outside the crater—is a common theme across Mars.

If the depositional setting inside and outside of the crater differs, then the subaerial sedimentation hypothesis is suspect.

Leaving subaqueous deposition as a more likely explanation.

Sending MSL to such a crater would allow to test this hypothesis, and it would have broader application to our understanding of sedimentation processes across Mars.

Our objective is to identify a crater that:

- a) exhibits thin repeated layering
- b) safe for MSL landing
- c) provides ingress passages to the interior layers



- Landing in northern Sinus Meridiani provides access to a great diversity of light-toned, layered rock
- These rocks are lower in the stratigraphic column than at MER-B site





Proposed Site: Meridiani Crater Lake



- Interior of crater fine layering
- Exterior to crater depositional settings differ
- Ingress at northern and southern ends













HiRISE image showing egress points from N and S ellipses



NASA/JPL/University of Arizona

MRO/HiRISE







HiRISE Close-ups of Crater Floor

All from HiRISE PSP_002179_1855_RED





Regional Observations from OMEGA Data





Regional and Local CRISM Observations

CRISM 200m/pixel multispectral strips overlain on THEMIS DIR



NOTES

The latest CRISM calibration hasn't been applied to most CRISM data. Results may change (most likely to include more mineral detections) with newer calibration.

> Enhanced Hydration (bound water) Much of the etched terrain has this (in OMEGA data).

> > Possible Hydrated Sulfates

Hydrated sulfates





Possible subtle hydrated sulfate signature



Major Questions/Criteria Ability to Assess Biological Potential w/MsL Payload		N Meridiani Crater Lake Yes, MSL payload can assess habitability here
	Preservation of Biosignatures	[TBD]
Ability to Characterize		
	Geology/Geochemistry	Yes
	Context, Geologic Timescale	Yes; Late Noachian/Early Hesperian
	Context, Stratigraphic etc.	Yes; well understood stratigraphic placement relative to rocks at MER-B site (these rocks are lower/older than MER-B)
Access	sibility	
	Accessed by Rover/Arm in Ellipse	Yes; some things to be studied occur within the ellipse
	Go To	Most things of high interest are outside/adjacent to ellipse
	Distance/trafficability	a few km of edge of ellipse; trafficability is like MER-B
	Dust obscuration	sharp albedo contrasts, no more dusty than MER-B site
Reduc	ed Performance Thermal Constraints	site is equatorial, like MER-B, meats thermal constraints
Surface Slope/Relief		
	2-10 km slope	[TBD] pretty flat
	1–2 km slope	[TBD] not likely to be a problem
	200–1000 m slope	[TBD] not likely to be a problem
	2–5 m slope	[TBD] can MSL land on bedform/ripply stuff that MER-B drove through?
	relief in HiRISE	some smooth area, some ripples spaced enough to navigate around
Warning Track Slope		
	2-10 km slope	[TBD] pretty flat
Safe Haven?		probably no
Rock Abundance		very low in terms of rocks that would be seen as hazards
	IRTM	< 5° (2° bins)
	TES	Likely very low, based on Nowicki and Christensen (2007)
	Rocks in HiRISE	very few rocks (HiRISE image)
Load-Bearing Surface		Yes, and it is known from MER-B how to navigate this stuff
Dust (DCI, albedo)		Like MER-B, very little dust; DCI \ge 0.97 in Ruff and Christensen (2002) map
Cold Temperatures		Equatorial site. Optimum for year-round operations.
Trafficability		Like MER-B; better on go-to bedrock surfaces
Atmospheric Challenging?		No. Like MER-B;



Additional Material

- Preliminary DTM from CTX Stereo
- Anaglyphs of site
- More HiRISE close-ups of crater interior





based on DTM created from CTX stereo by Larry Edwards





based on DTM created from CTX stereo by Larry Edwards















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