Candidate MSL Landing Site:
Southern Meridiani Phyllosilicate / Sulfate Contact

R. E. Arvidson, S. M. Wiseman, and The CRISM Team
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TES hematite map on a THEMIS day time infrared mosaic [Christensen and Ruff, 2004]

THEMIS day time infrared mosaic with CRISM high resolution and HiRISE footprints overlain (have full CTX coverage)
CRISM FRT 91c5 and FRT a063

Plains unit, hematite-bearing

False color composite:
$R = 2.5, \ G = 1.5, \ B = 1.08 \ \mu m$

$R = D_{2300}, \ G = B_{2200}, \ B = BD_{1900}$ overlain on 1.08 $\mu m$ albedo

Al phyllosilicates
Fe/Mg phyllosilicates
Hydrated phases
CRISM FRT 91c5 and FRT a063

False color composite:
R = 2.5, G = 1.5, B = 1.08 µm
Phyllosilicate detections overlain

Spectral Library Spectra

Fe/Mg smectite
Montmorillonite
kaolinite

Relative reflectance* = (CRISM I/F spectrum of interest) / (CRISM I/F ‘bland’ spectrum)
CRISM phyllosilicate spectral signatures correlate with polygonally fractured bedrock in HiRISE → phyllosilicates are ‘in place.’
Geologic context of phyllosilicate-bearing deposits

• Older, phyllosilicate-bearing terrain cut by fluvial features
• Plains deposits unconformably overlain

CRISM FRT 91c5 and a063

CTX P16_007348_1768 draped on MOLA topography, vertical exaggeration = 10
• Plains material embays phyllosilicate-bearing terrain
→ Phyllosilicates predate formation of plains unit explored by Opportunity rover ~75 km to the north

CRISM FRT 91c5 draped on MOLA topography, vertical exag = 10

Plains, hematite-bearing

Al phyllosilicates
Fe/Mg phyllosilicates
• Initial ellipse placement, within plains unit \( \rightarrow \) phyllosilicates to the south
• Candidate landing ellipse appears safe in terms of slopes (MOLA 128 ppd)
• Average elevation of landing ellipse = -1575 m
Candidate landing ellipse is safe at length scales of 200m (slopes ≤ 12°). Most slopes are < 8°. Slopes along traverse to phyllosilicate deposits south of the ellipse appear benign in current data.
Candidate landing site appears safe in current HiRISE coverage

MER B (between Endurance and Victoria craters)  

Candidate site

PSP_001414_1780 40 meters  
PSP_007348_1765 40 meters
Discussion

Context of Deposits
• Good stratigraphic framework
  ➔ Phyllosilicate alteration/deposition
  ➔ Period of fluvial erosion
  ➔ Accumulation of sulfate-rich sediments

• Two distinct geochemical environments accessible to MSL, characterized by phyllosilicate alteration, likely in an open hydrologic regime, and deposition of dirty, sulfate-rich evaporites in a ground water dominated system

Phase One
• Plains unit explored by the Opportunity rover ~75 km to the north
  • Sulfate rich bedrock overlain by thin, hematite-bearing sand sheet
  • CRISM spectra of plains deposits are similar
• Analyze new strata of sulfate-rich bedrock with MSL assets ➔ synergy with MER
Discussion

• Access habitability potential of sedimentary evaporitic deposits
  • Sulfate-rich deposits cover large areas on Mars
• Known to be safe and relatively easy to traverse

Phase 2

• Traverse south from landing site to phyllosilicate-bearing deposits (~10 km traverse from center of ellipse)
  • Al-rich phyllosilicates $\rightarrow$ montmorillonite + kaolinite
  • Fe/Mg smectite
• Characterize boundary between plains deposits and older, phyllosilicate-bearing terrain
• Establish detailed stratigraphic sequence of ancient deposits
  • HiRISE shows in place bedrock
• Geochemical variations $\rightarrow$ multiple phyllosilicate phases present
• Habitability
  • Phyllosilicates, especially Al-rich, imply prolonged aqueous environment
  • Smectites provide good preservation potential for organics