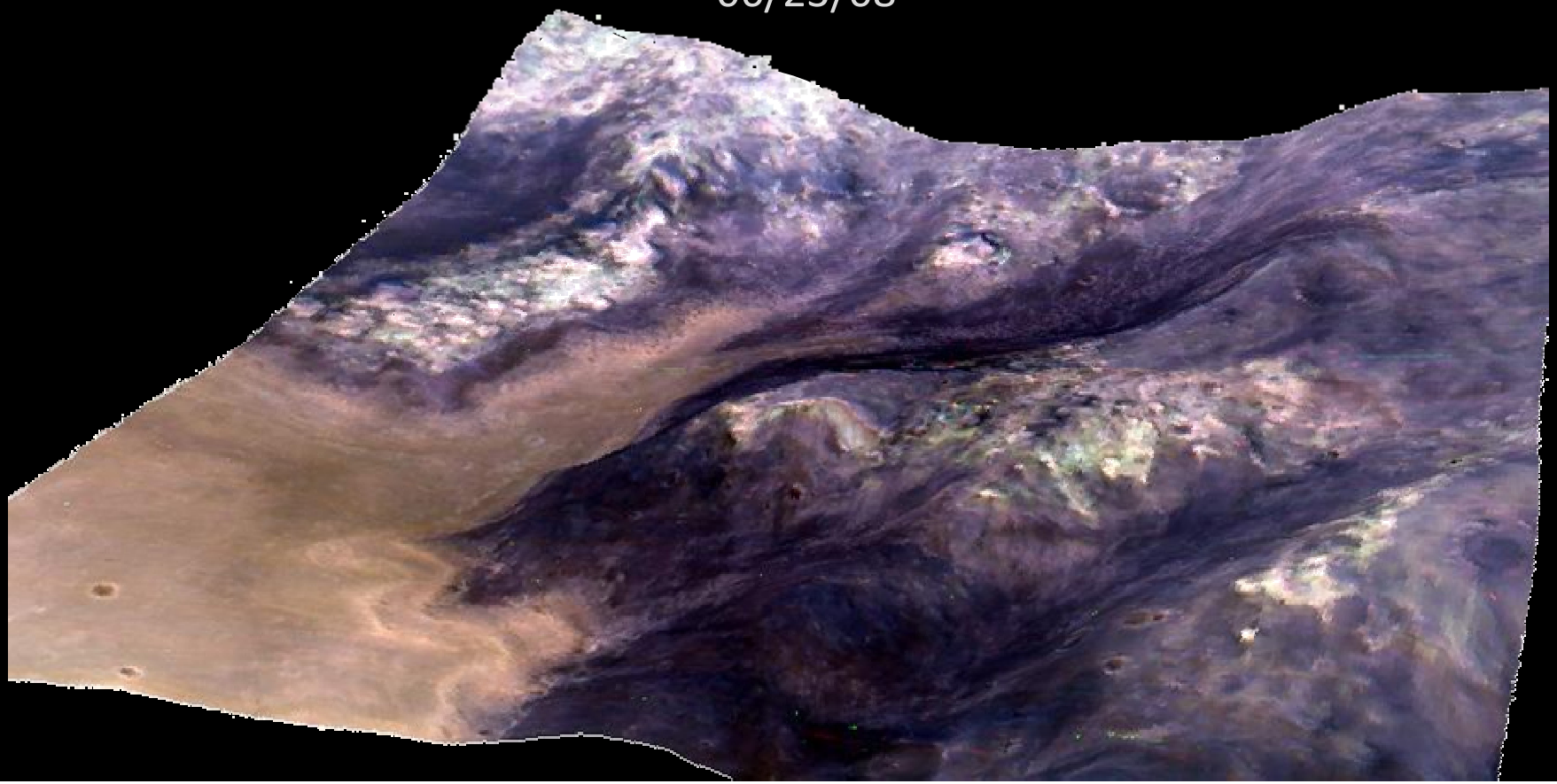
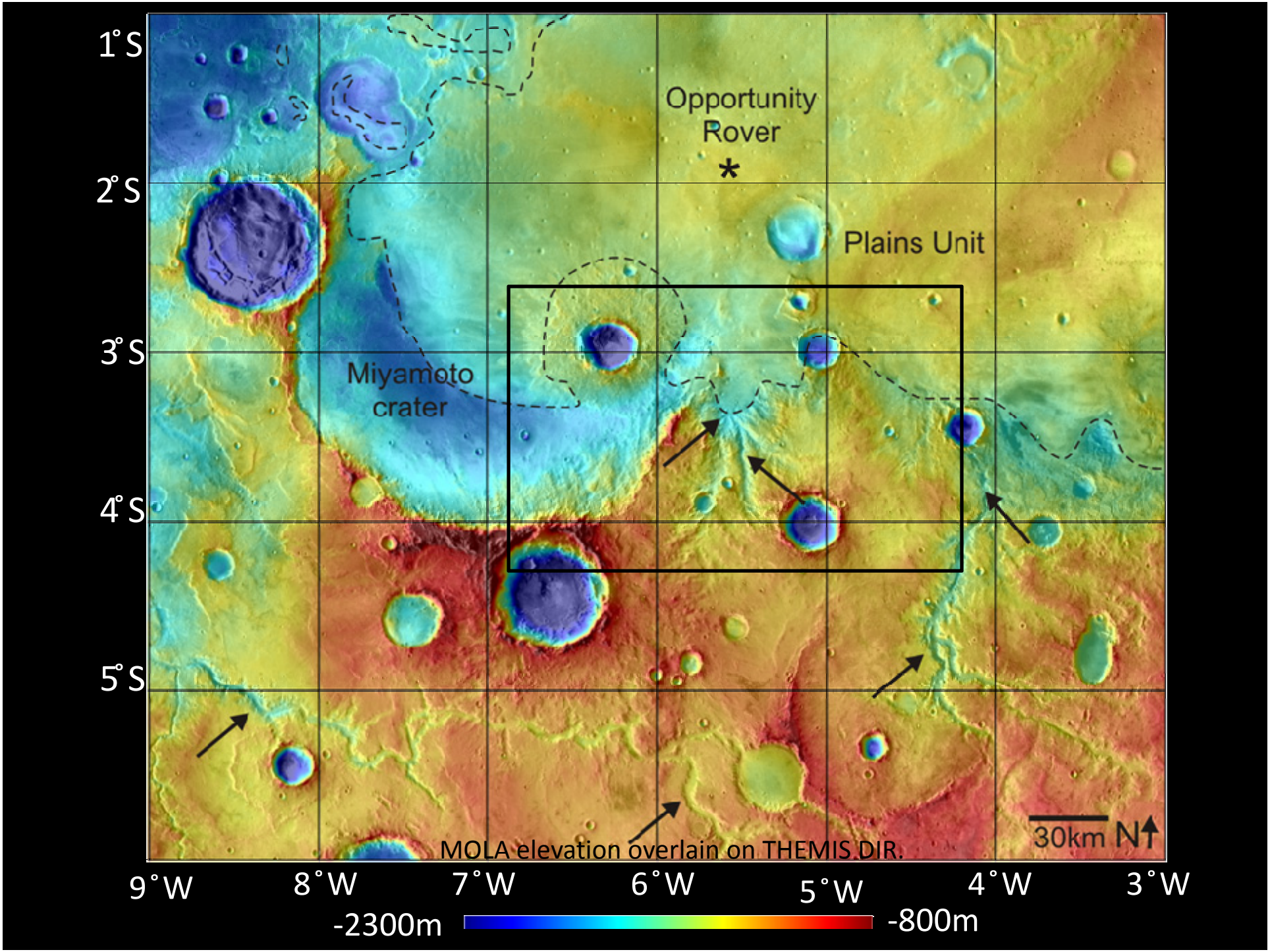
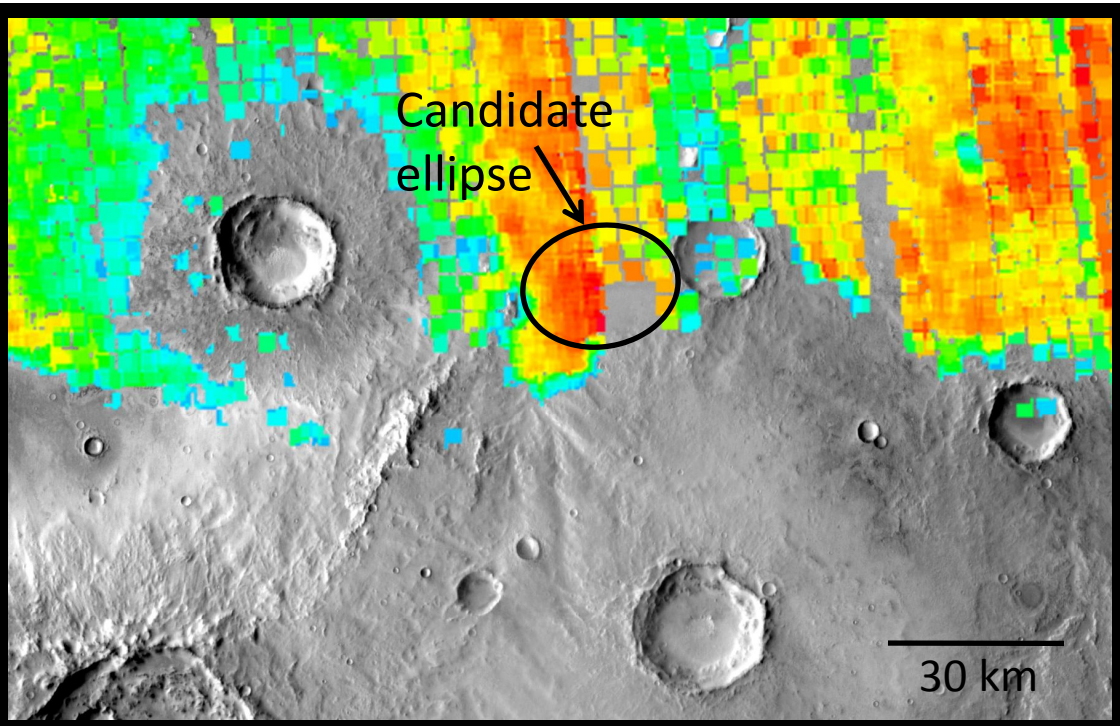
Candidate MSL Landing Site: Southern Meridiani Phyllosilicate / Sulfate Contact

R. E. Arvidson, S. M. Wiseman, and The CRISM Team

06/23/08

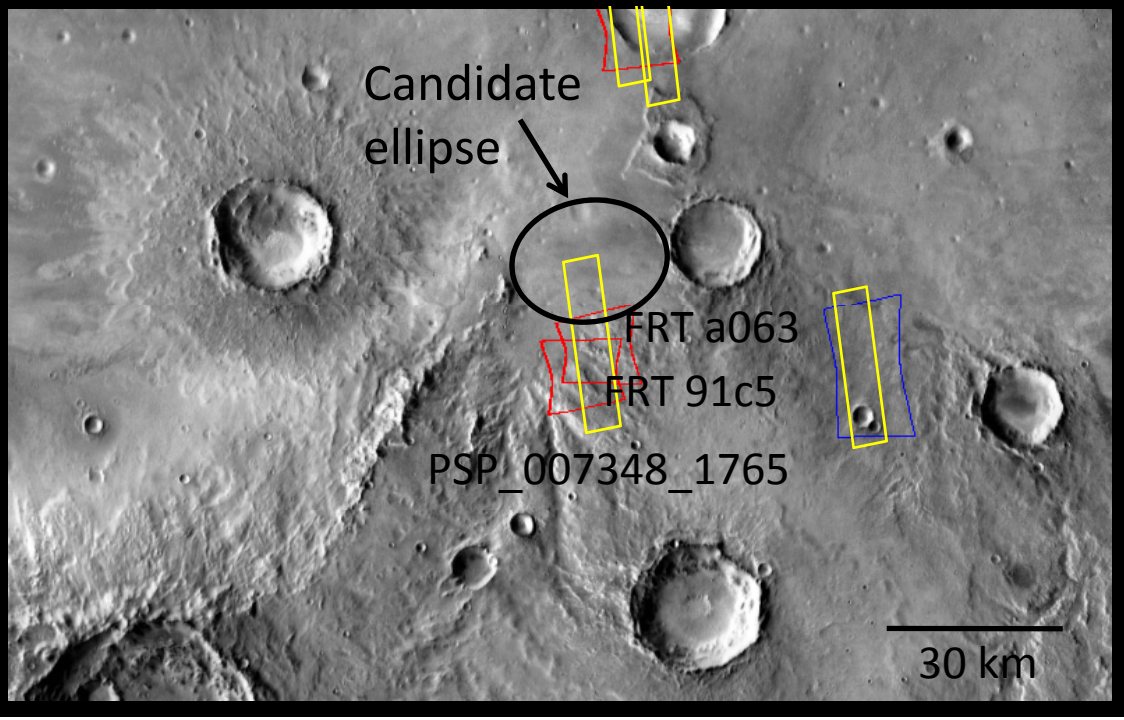



1°S
2°S
3°S
4°S
5°S
Opportunity Rover
Plains Unit
Miyamoto crater
30km
N
MOLA elevation overlain on THEMIS DIR.
9°W
8°W
7°W
6°W
5°W
4°W
3°W
-2300m
-800m

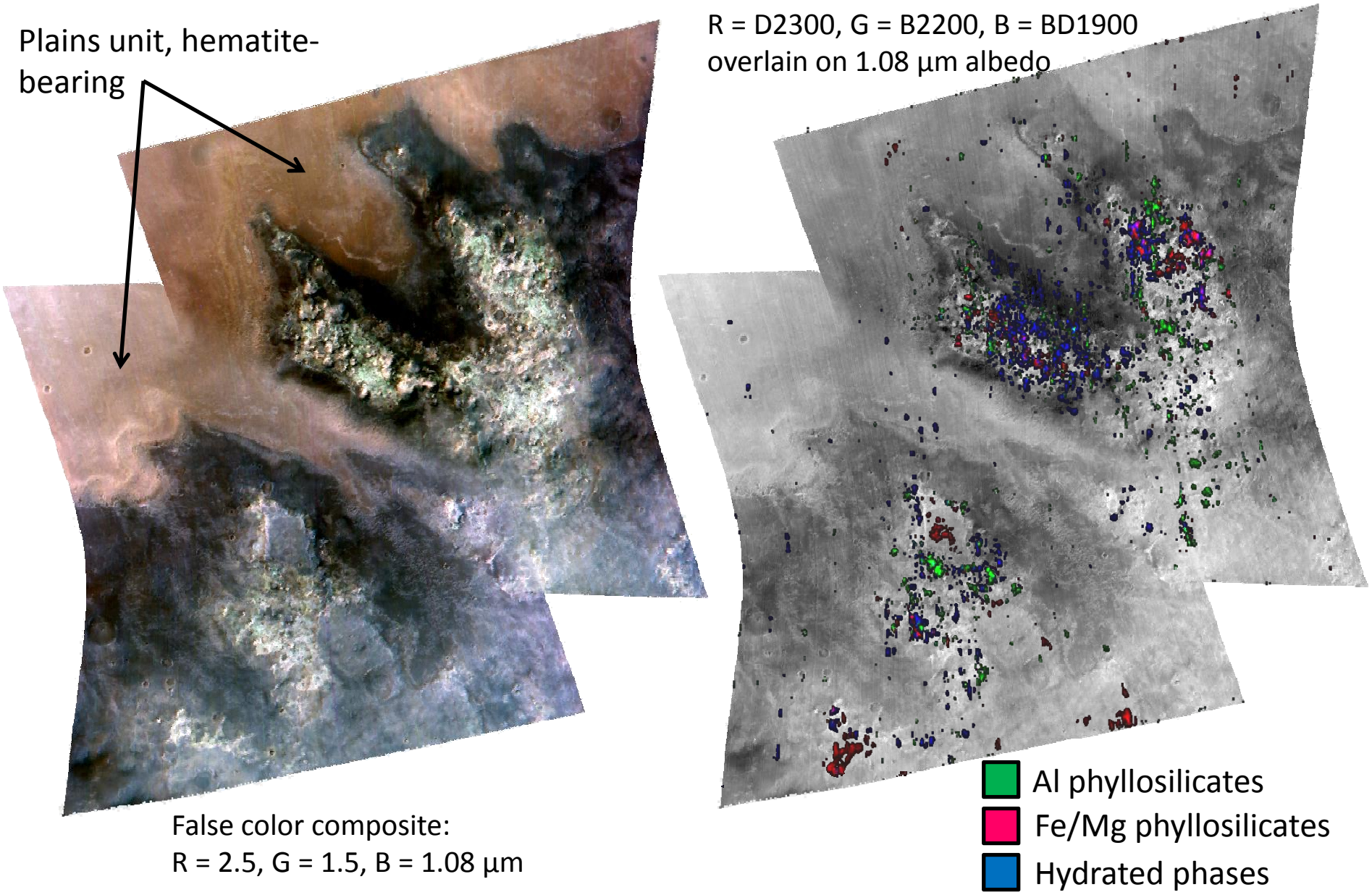


TES hematite map on a THEMIS day time infrared mosaic [Christensen and Ruff, 2004]

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

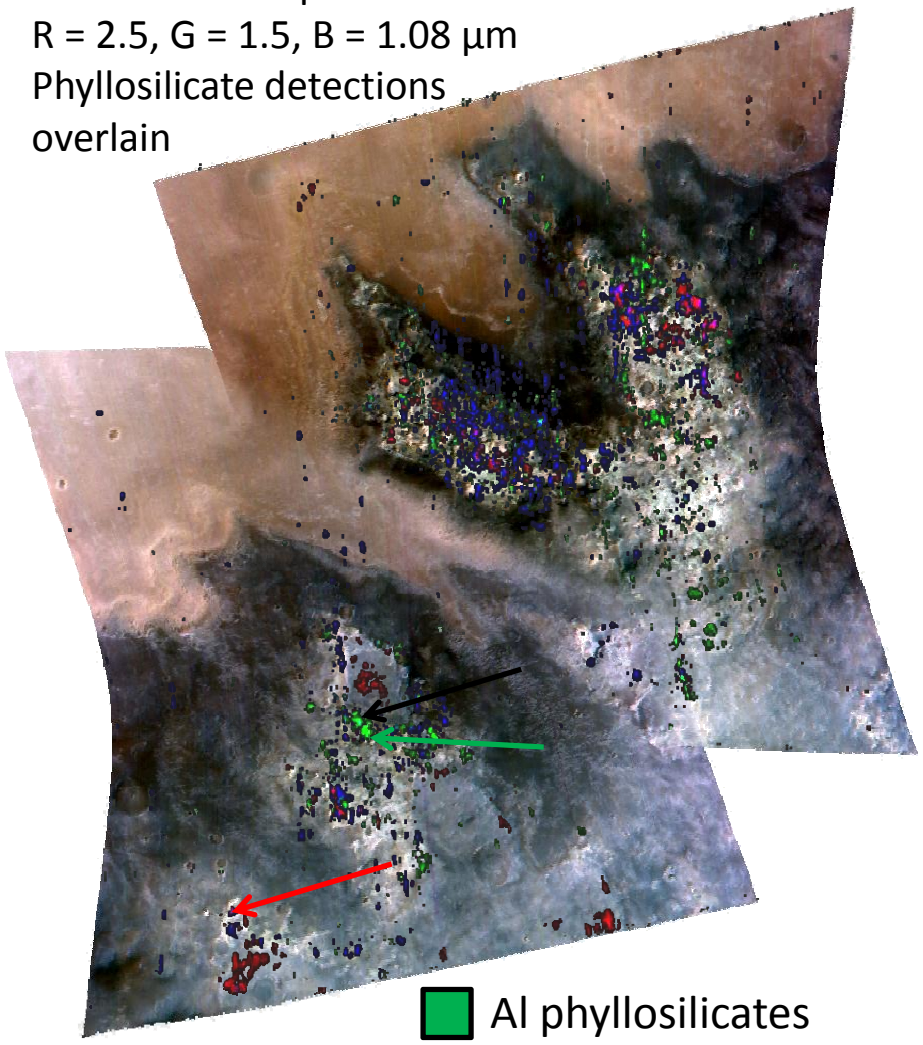


CRISM FRT 91c5 and FRT a063



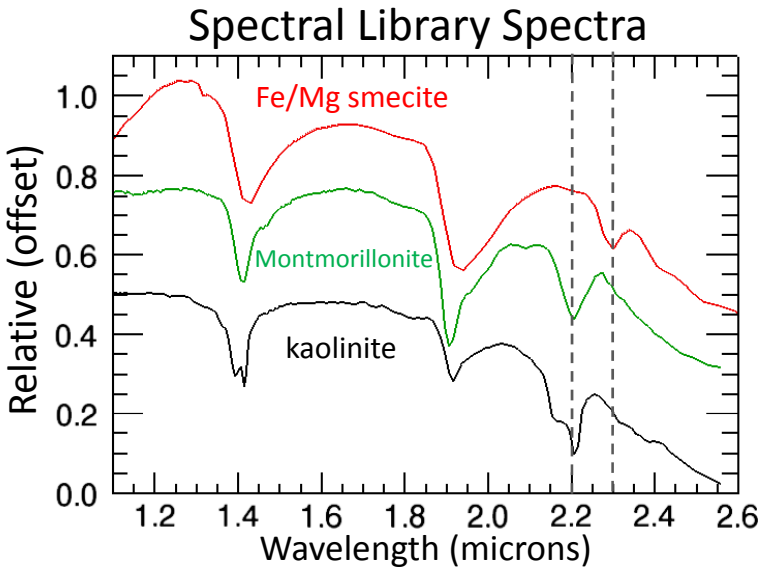
CRISM FRT 91c5 and FRT a063

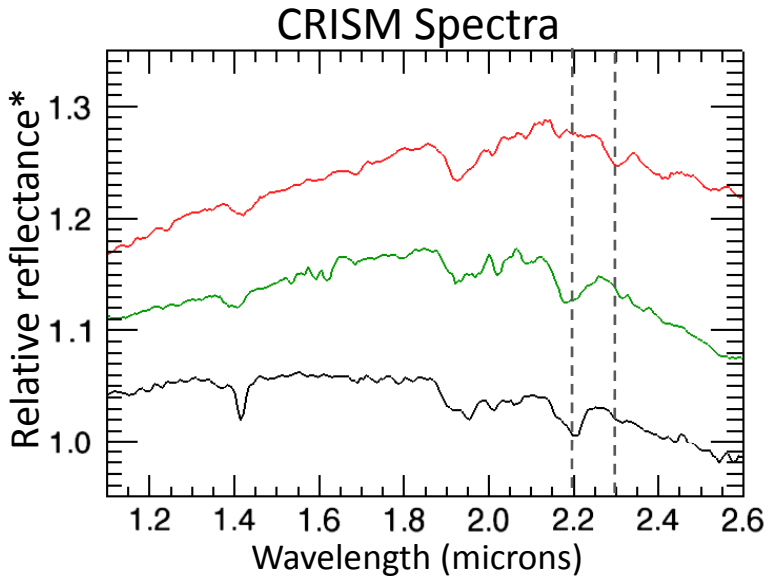
False color composite:
R = 2.5, G = 1.5, B = 1.08 µm
Phyllosilicate detections overlain



Al phyllosilicates

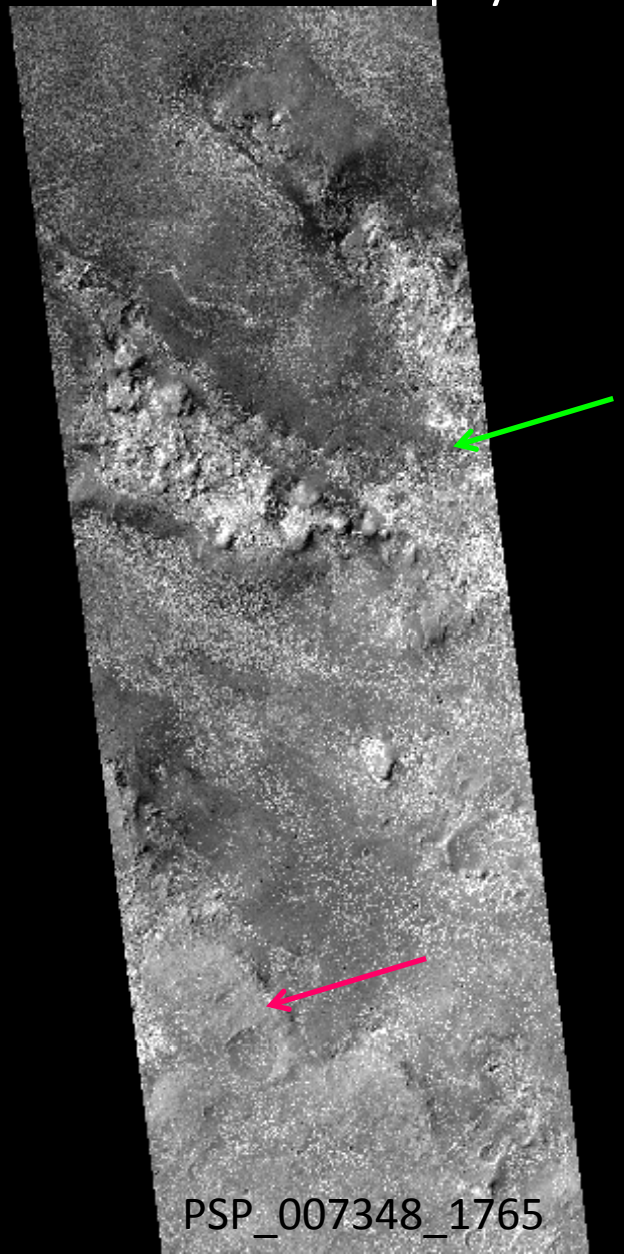
Fe/Mg phyllosilicates

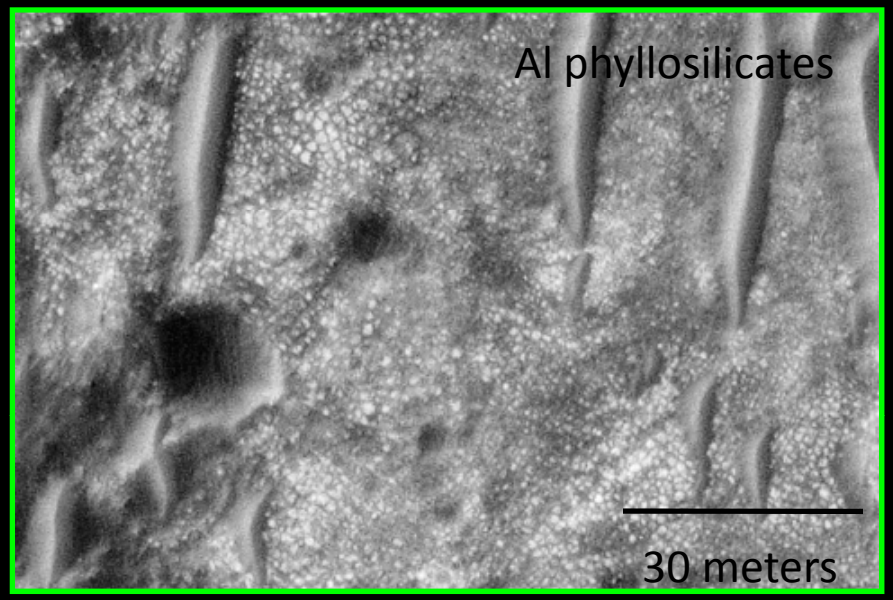


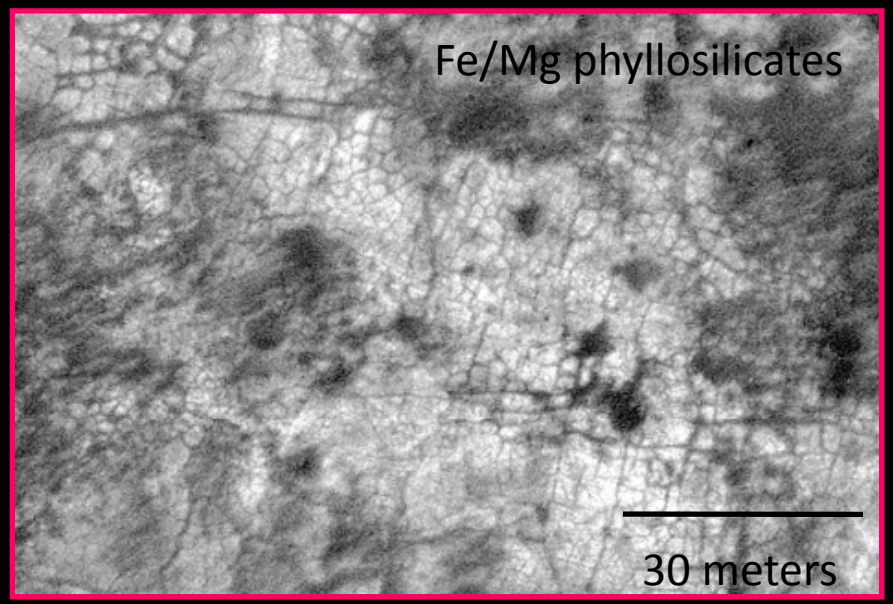


Relative reflectance* = (CRISM I/F spectrum of interest) / (CRISM I/F 'bland' spectrum)

CRISM phyllosilcate spectral signatures correlate with polygonally fractured bedrock in HiRISE → phyllosilicates are 'in place.'

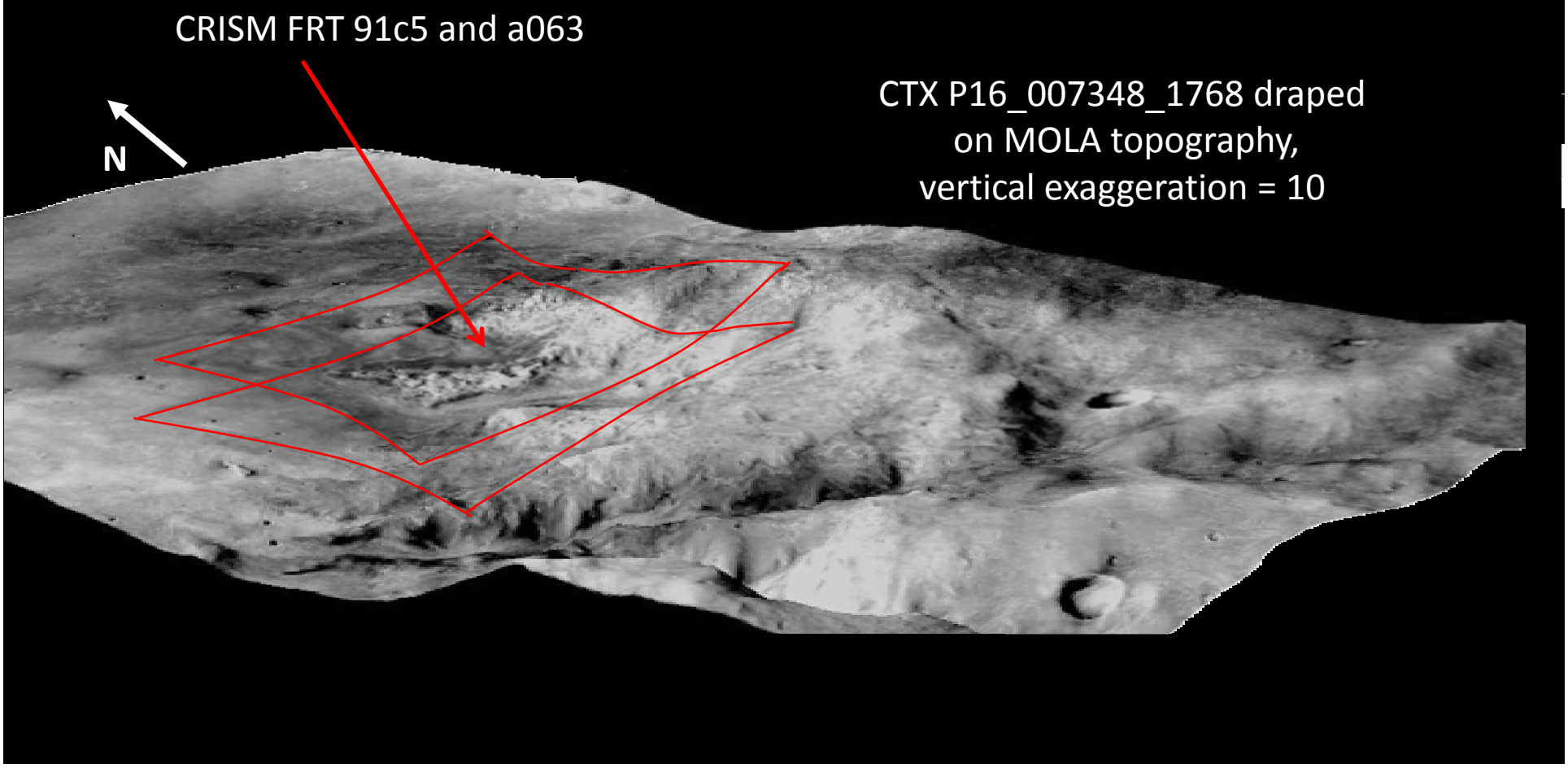






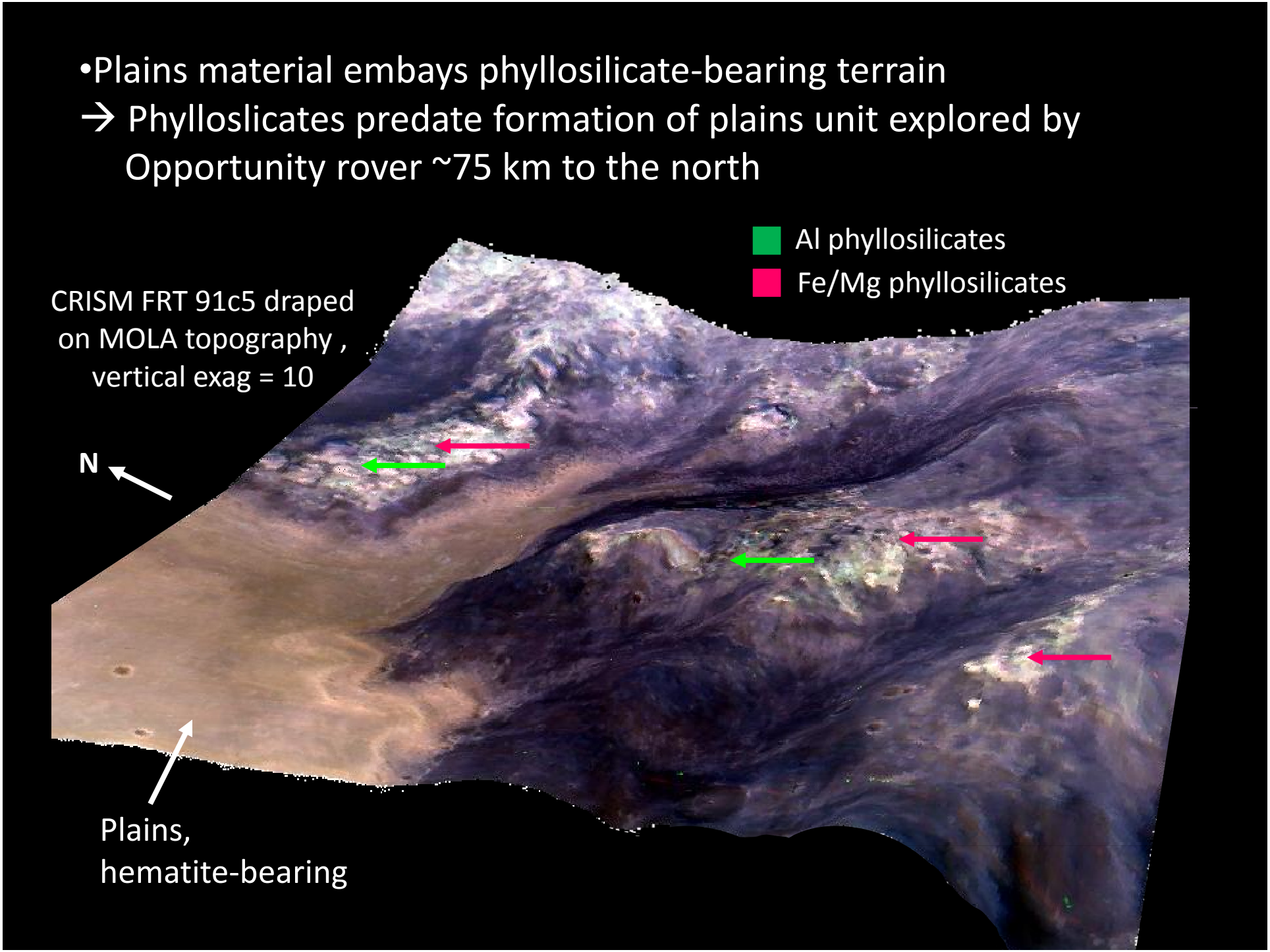
Geologic context of phyllosilicate-bearing deposits

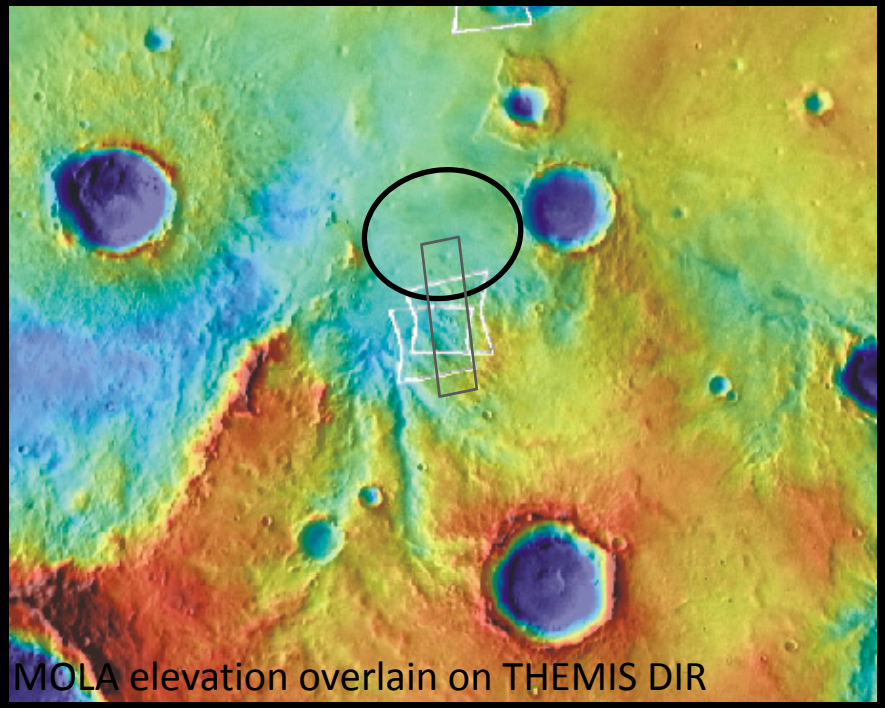
- Older, phyllosilicate-bearing terrain cut by fluvial features
- Plains deposits unconformably overlain



•Plains material embays phyllosilicate-bearing terrain

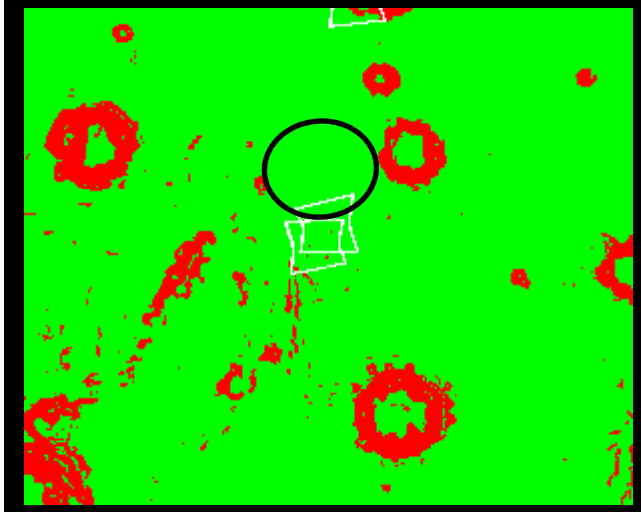
→ Phylloslicates predate formation of plains unit explored by Opportunity rover ~75 km to the north





- Initial ellipse placement, within plains unit → phyllosilicates to the south
- Candidate landing ellipse appears safe in terms of slopes (MOLA 128 ppd)
- Average elevation of landing ellipse = -1575 m

Slopes at length scale 460m

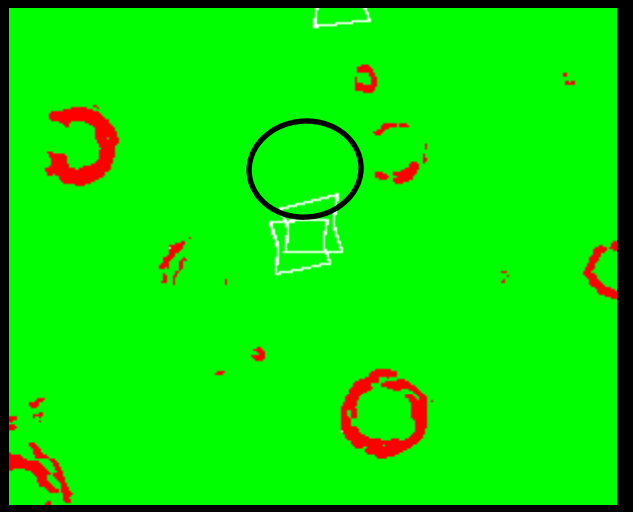


< 5.3° > 5.3°

Slopes at length scale 920m

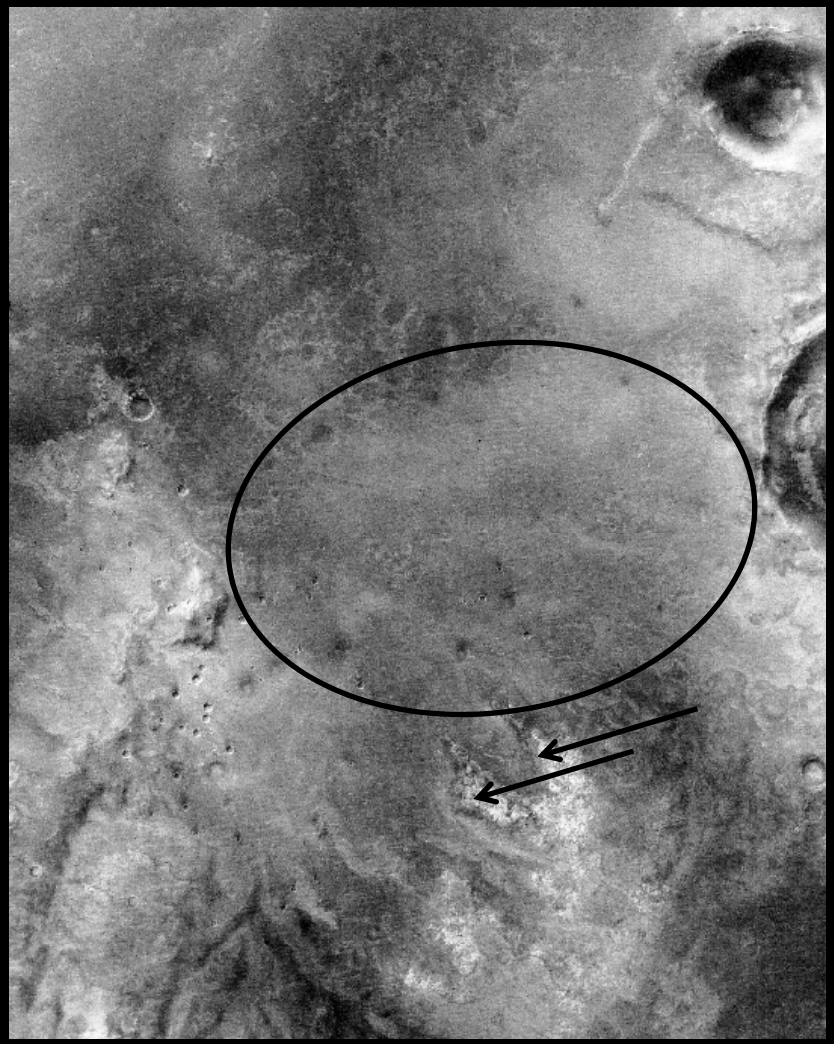
< 2.7° > 2.7°

Slopes at length scale 1380m

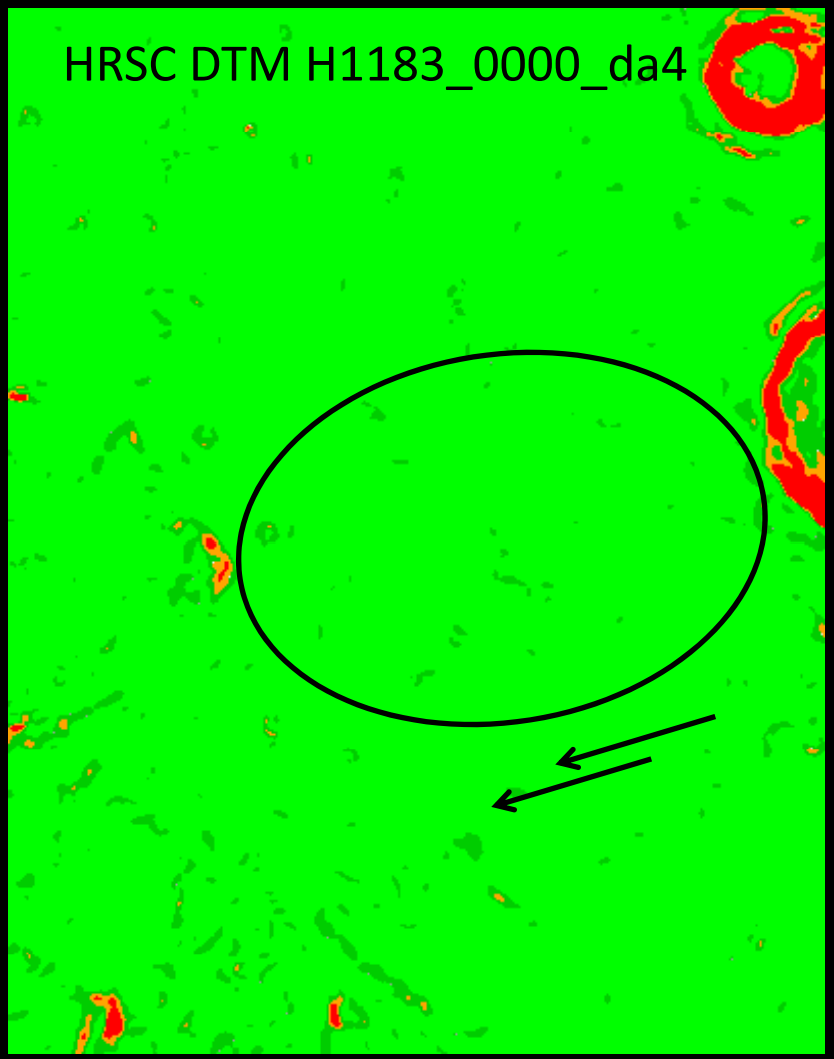


< 10.9° > 10.9°

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.



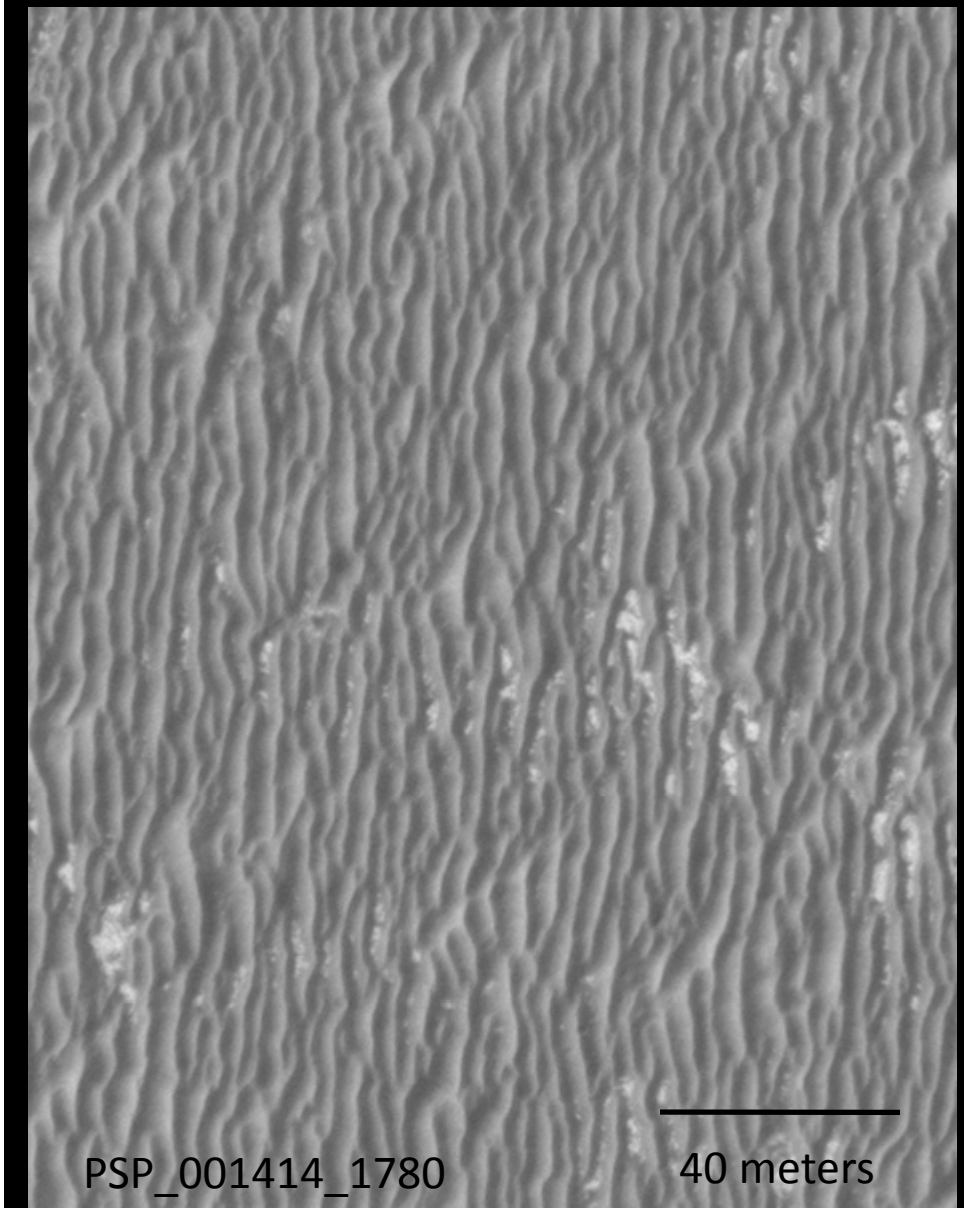
HRSC H1183_0000_nd4



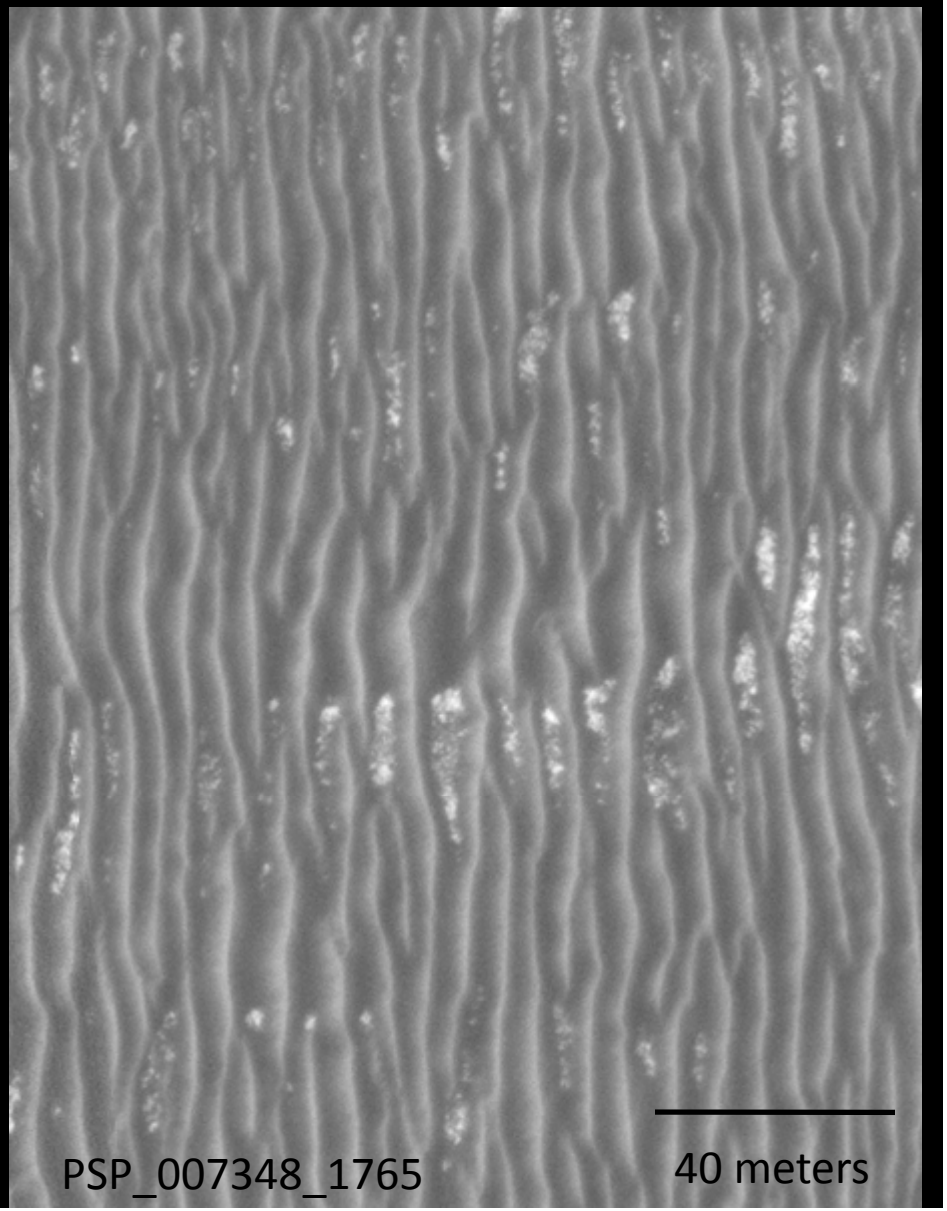
< 8˚ 8˚ to 12˚ 12˚ to 15˚ > 15˚

Candidate landing site appears safe in current HiRISE coverage

MER B (between Endurance and Victoria craters)



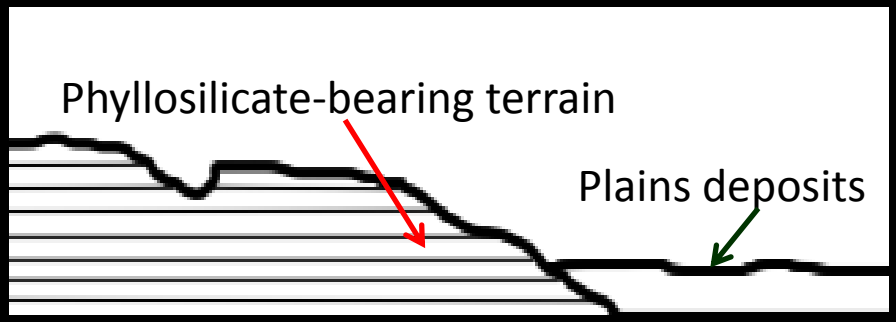
Candidate site



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 → 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 → multiple phyllosilicate phases present
- Habitability
  - Phyllosilicates, especially Al-rich, imply prolonged aqueous environment
  - Smectites provide good preservation potential for organics