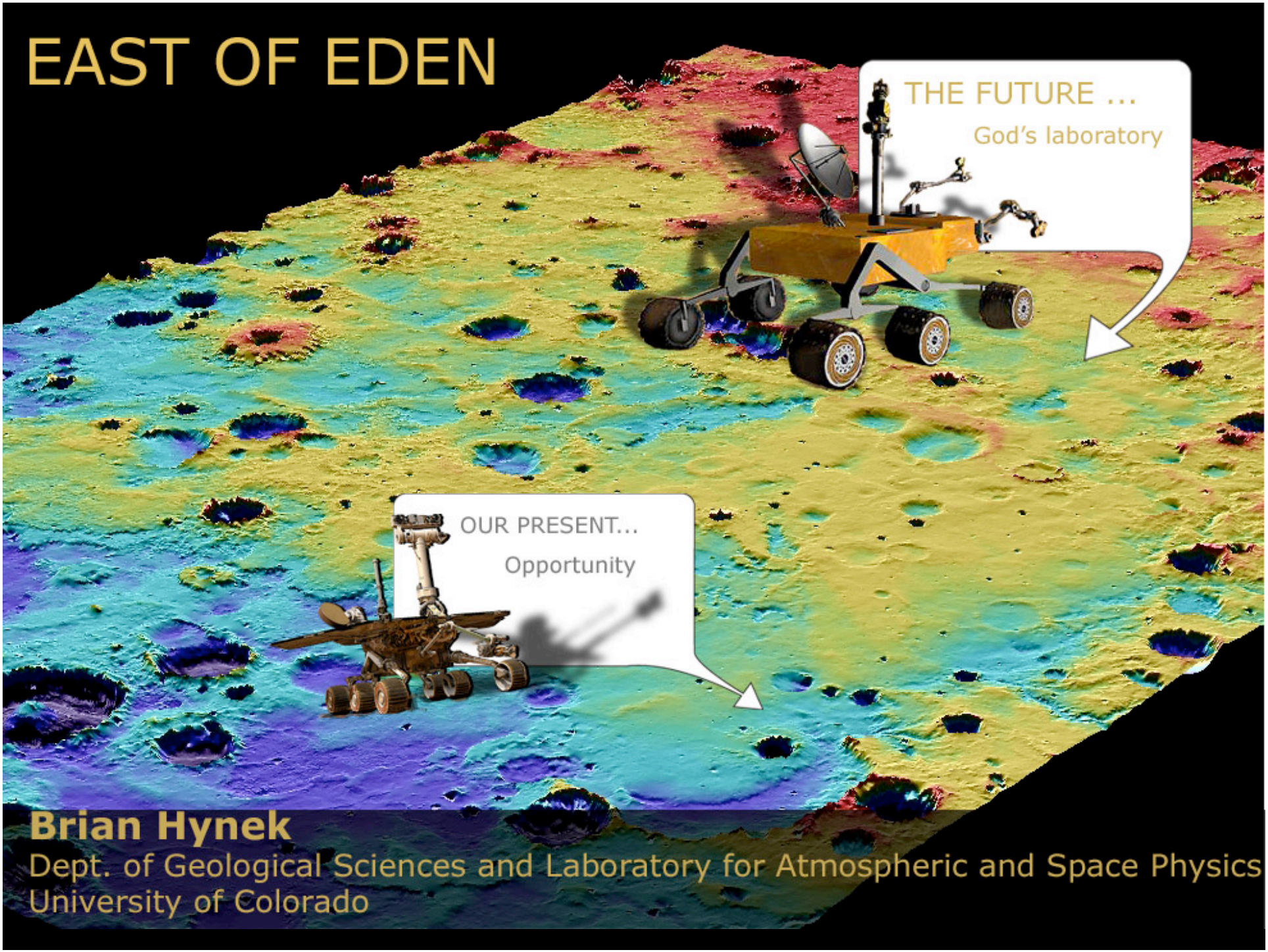
EAST OF EDEN



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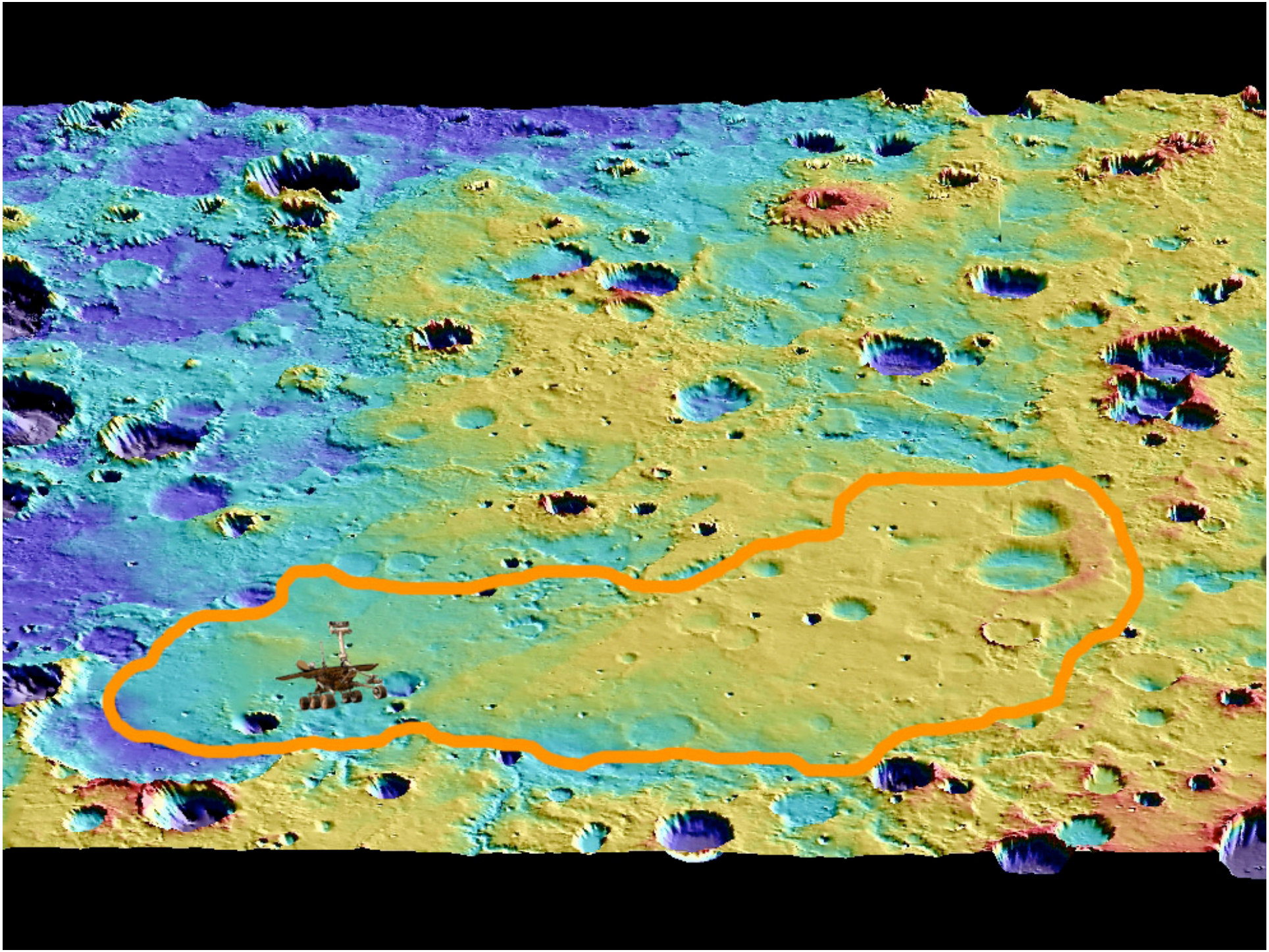
A Wealth of Opportunities

- The signature of water is pervasive in and around the proposed ellipse, which resides ~600 km ENE of Opportunity
  - Ellipse:
    - Over a dozen diverse layers rich in sulfates/hydrated minerals are seen from orbit
    - Many small craters have excavated underlying material in this flat, navigable site.
  - Beyond the Ellipse:
    - Large water-related features
- MSL is well-equipped to assess this potential habitat for past life and it can answer many questions raised from the Opportunity Rover data.

Great Science In a Safe Haven!

- Only safe haven site of the original candidates.
  - New sites lack data necessary to assess safety.
- Smooth at all scales needed for successful EDL.
- The only “yellow dot” was at 2-5 m roughness.
  - Roughness is spatially coherent and a slight ellipse shift north alleviates most problematic slopes.



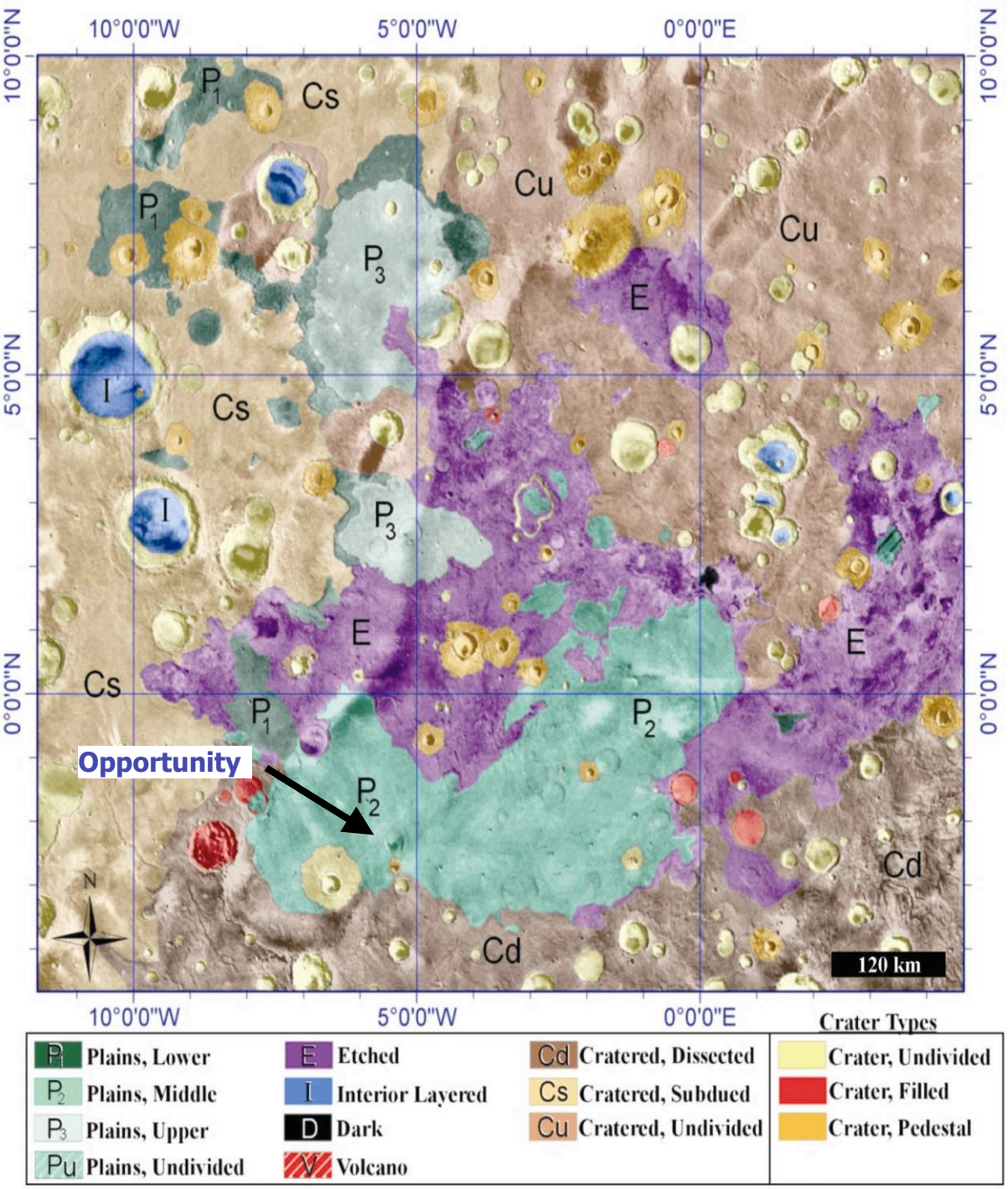
Light toned, differentially eroded "etched" terrain was identified outcropping from under the hematite-bearing unit.

ETCH = Easy To Call a safe Haven

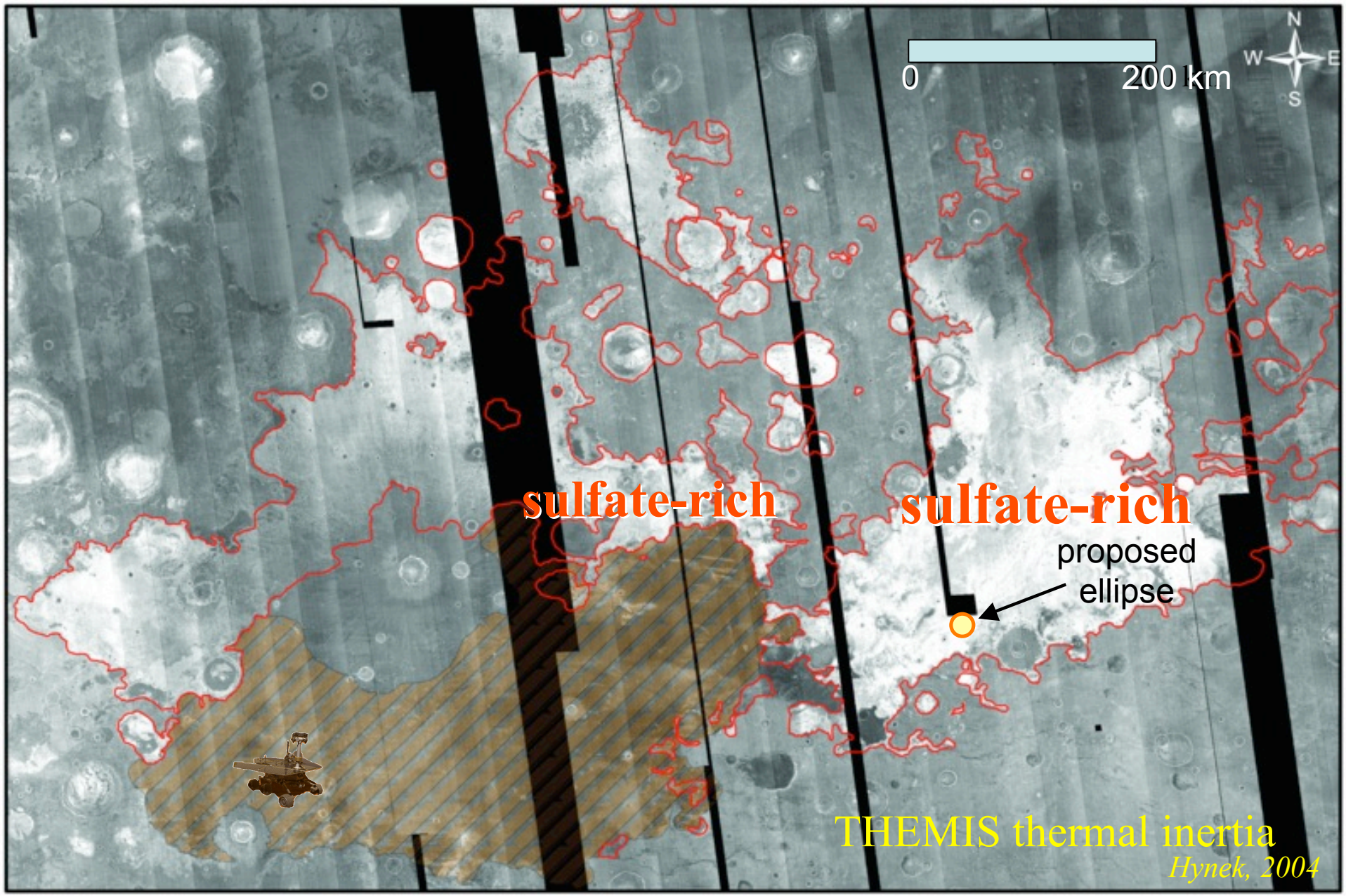
The unit was noted for the "many complex strata contained within"

> 800-m-thick unit is both high in albedo and thermal inertia.

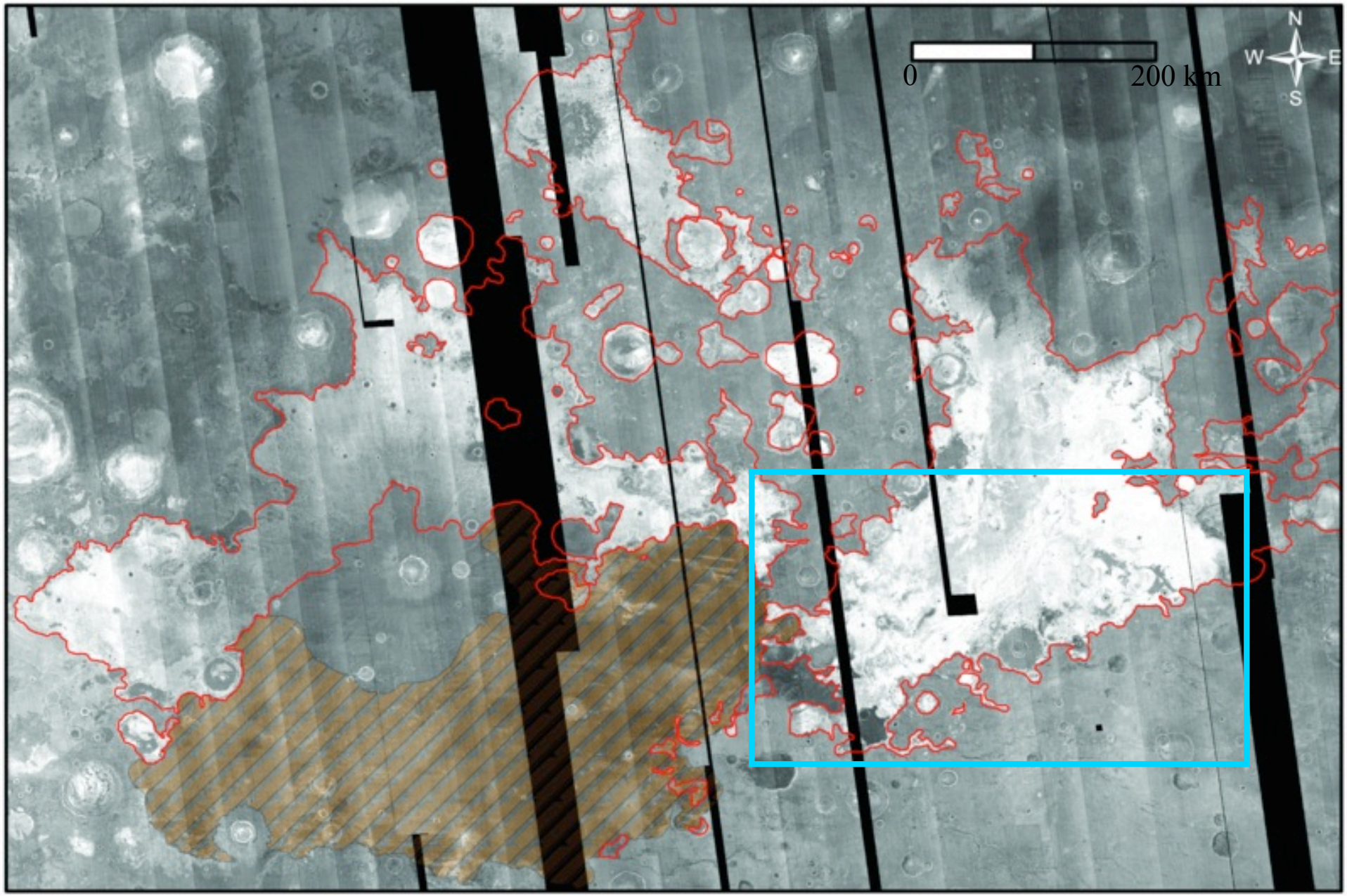
Hynek et al., 2002



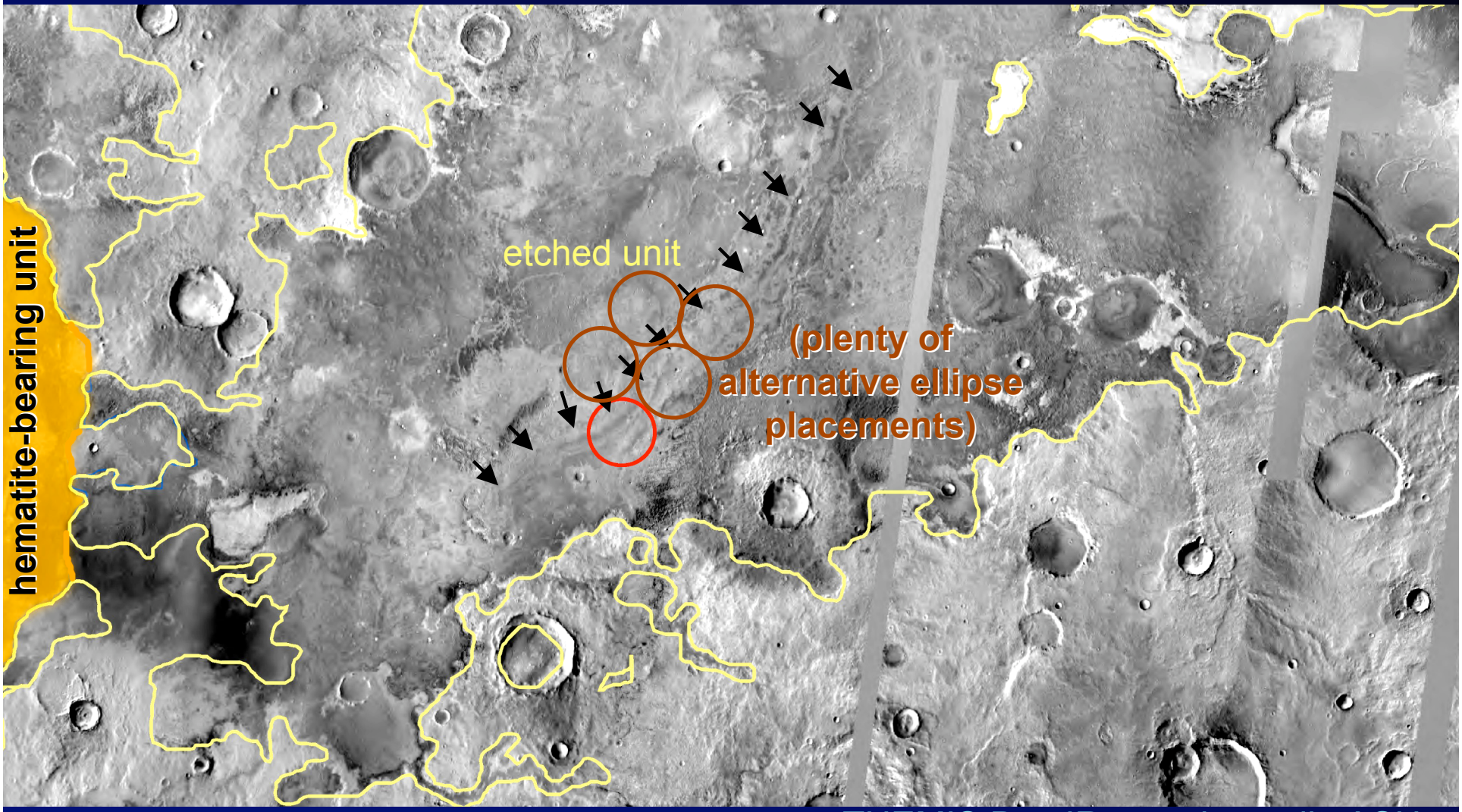
OMEGA shows a strong sulfate/hydrated mineral signal from the etched unit and also phyllosilicates north of ellipse



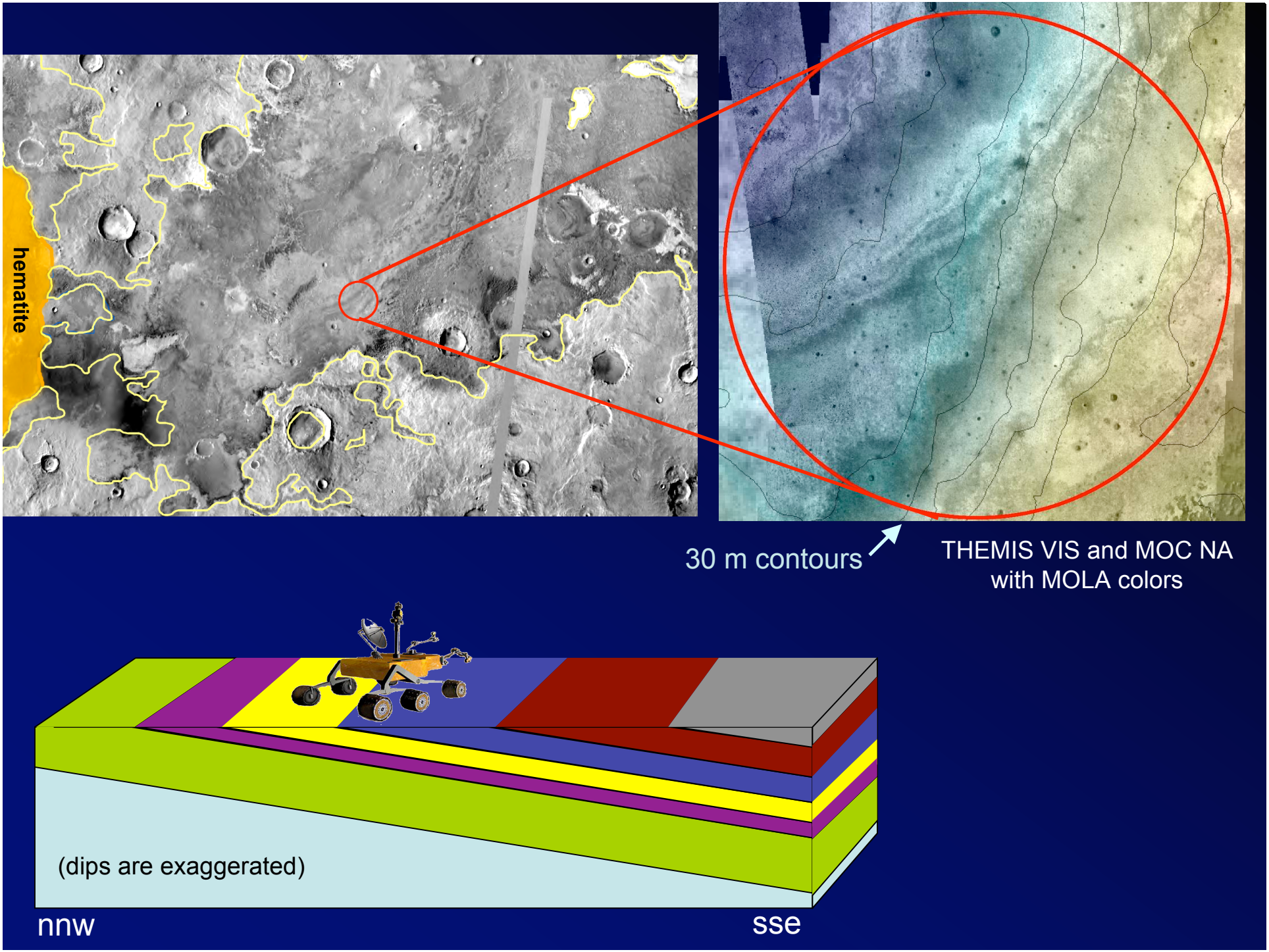
Zooming In



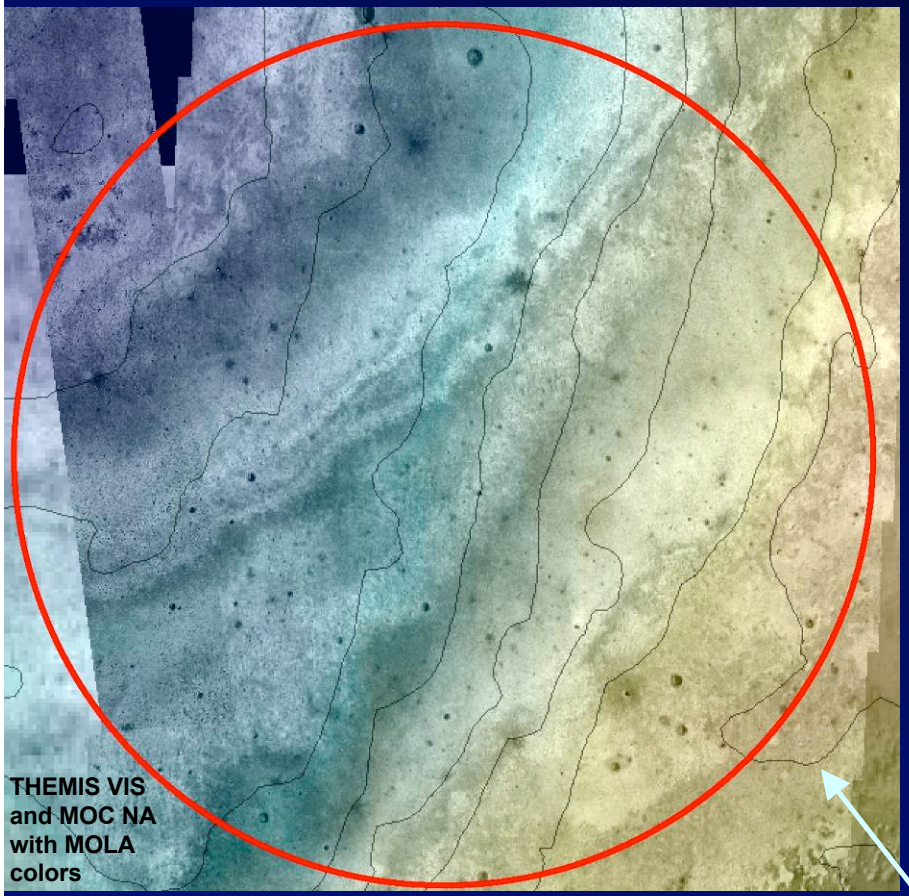
Ellipse is within a >200-km-long exposure of layered sulfate-rich bedrocks.



THEMIS Day IR mosaic credit: ASU


hematite
30 m contours
THEMIS VIS and MOC NA
with MOLA colors
(dips are exaggerated)
nnw
sse

Ellipse Characteristics



Center: 0.0° N, 3.7°E

Elevation: -1.30 km (1σ = 64 m)

Max Slopes: 5 km=0.9°; 2 km=1.7°;
MOLA shot-to-shot average of ~1°

IRTM Rock Abundance: ~7%

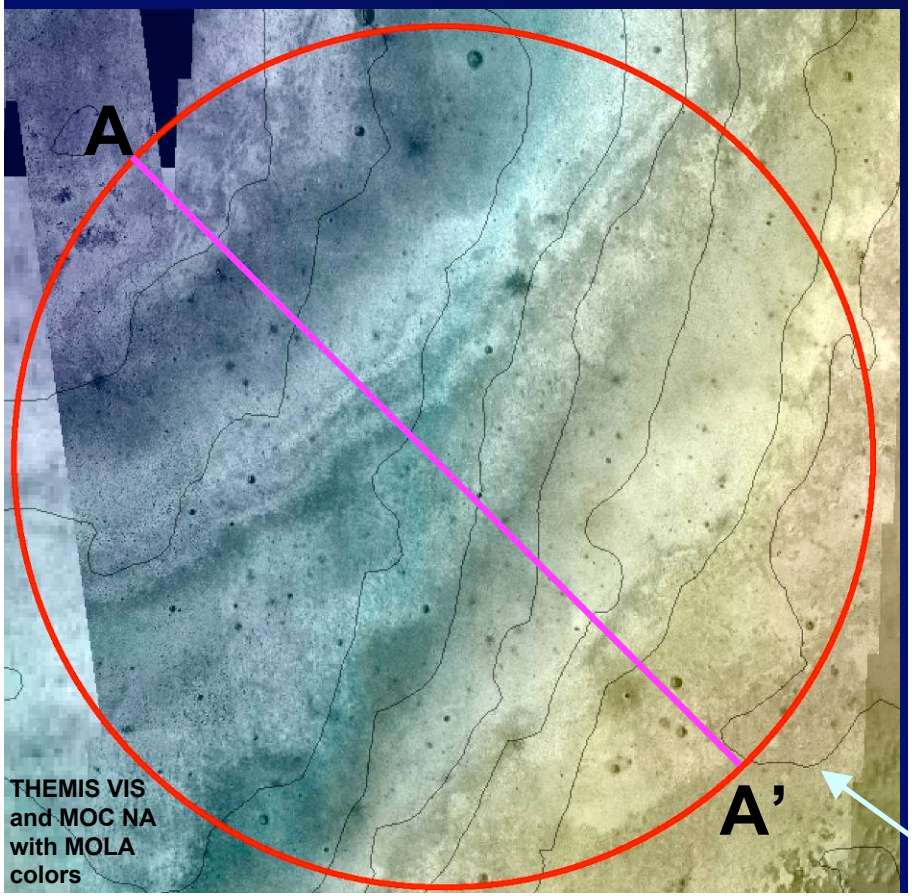
Thermal Inertia: 350-550 J m^{-2} K^{-1} $s^{-1/2}$

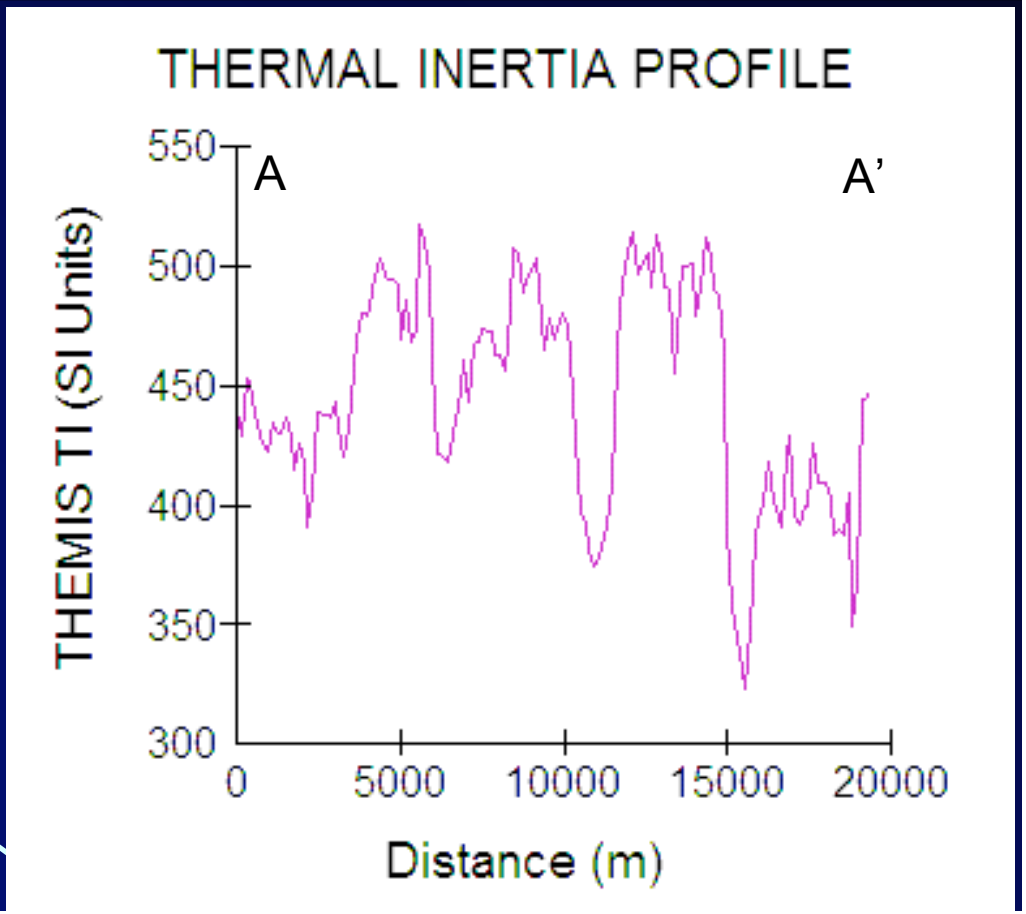
Albedo: 0.19-0.21

Dust Index: Steve Ruff says it's great.

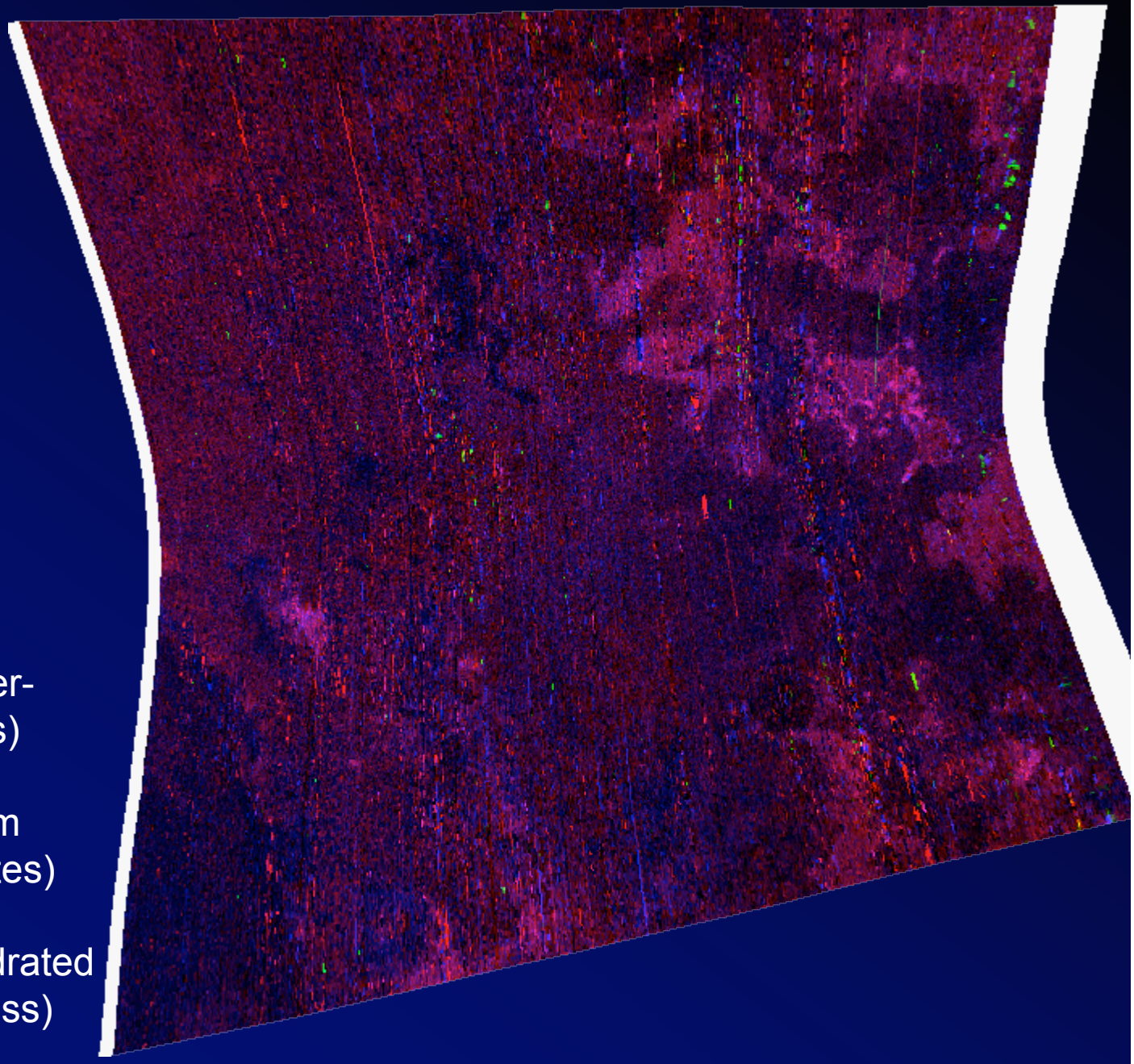
Winds: Atm Council says a-okay!

The diverse layers suggest a changing depositional environment and/or varying degrees of aqueous alteration.





Local CRISM data show abundant bound water, sulfates, and possible clay minerals



ir_hyd
Bound water
red = SINDEX (water-containing minerals)

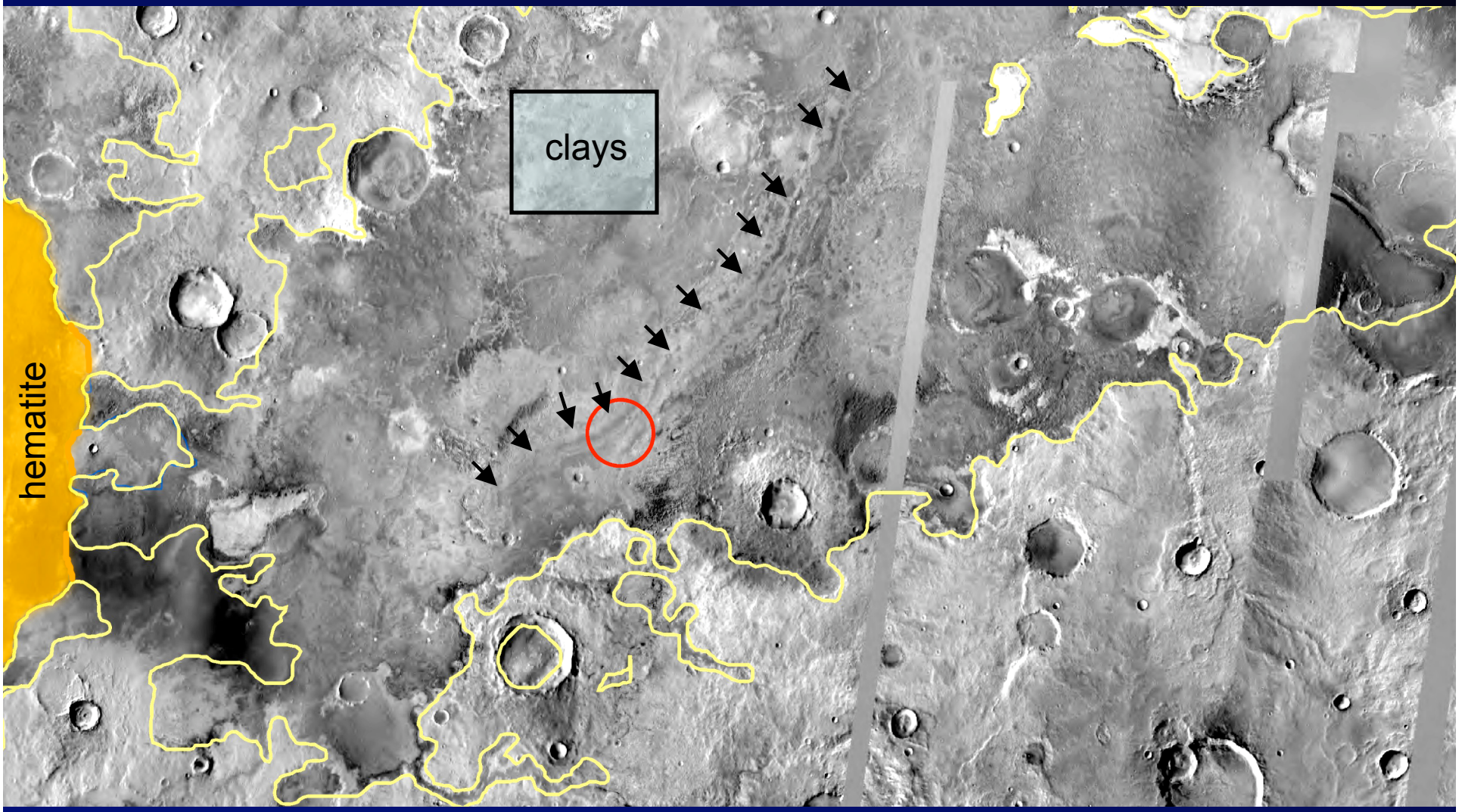
green = BD2100 nm (monohydrated sulfates)

blue = BD1900nm. (hydrated sulfates, clays, or glass)

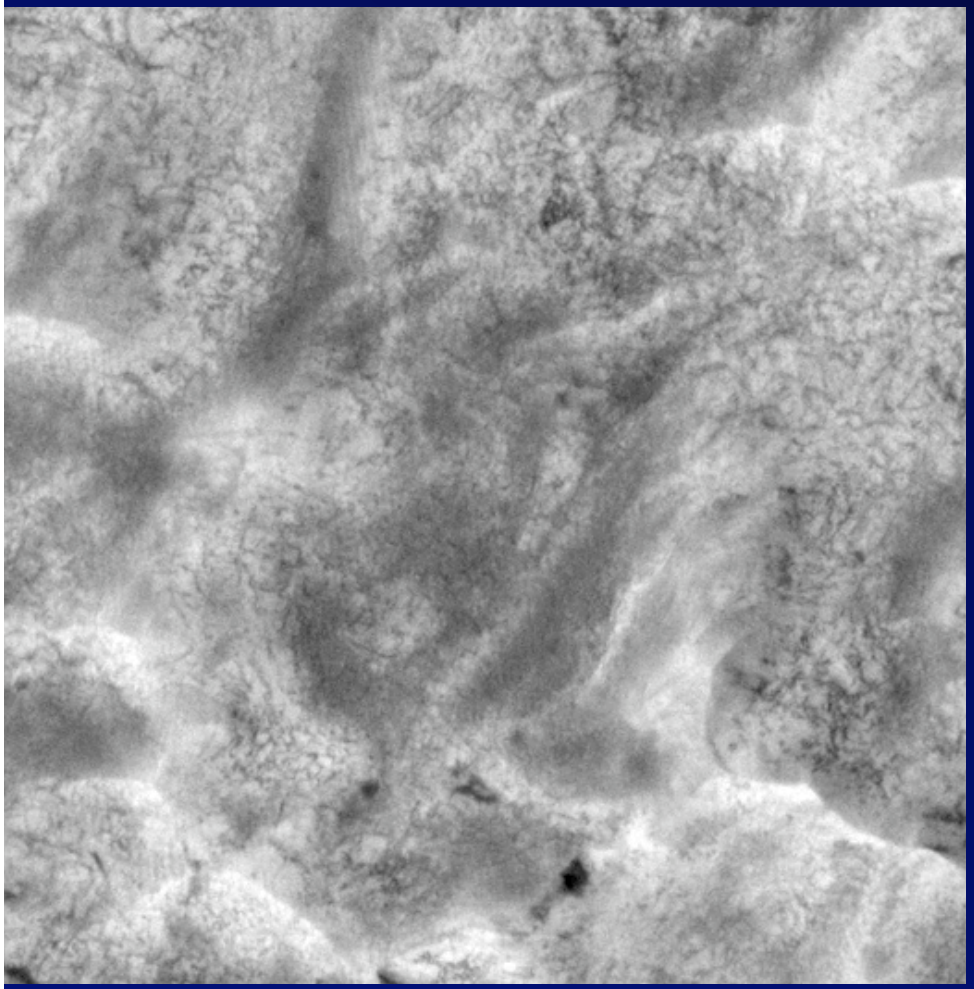
What about phyllosilicates?

It can’t be considered a good landing site without phyllosilicates…

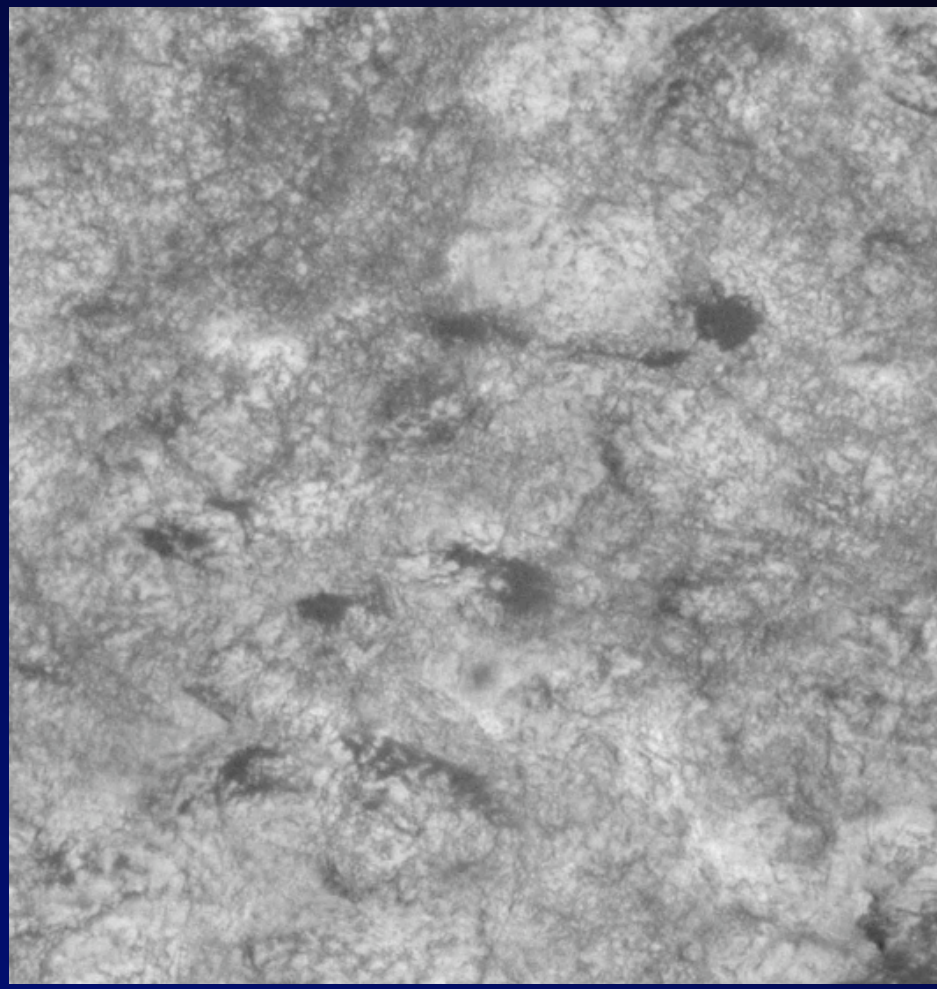
Phyllosilicates are seen 80 km north by OMEGA (Poulet, Bibring, etc) in the same stratigraphic section



1. The limited CRISM coverage shows hints of phyllosilicates.
2. Morphological evidence is strong.



phyllosilicate-bearing bedrock 80 km north



landing ellipse

(HiRISE full res)

Wait a sec, sulfates are good for biology too

- Early terrestrial biology relied solely upon chemical energy from disequilibria.
- Oxidation of reduced forms of sulfur are among the most advantageous reactions from an energy standpoint.
  - This is why briny lakes can be very biologically productive.
  - Sulfur metabolizers have been implicated in the origin of life on Earth.
- Sulfates can preserve organics and biosignatures.

Advantages of East Meridiani

Great Science In a Safe Haven!

- Only safe haven site of the original candidates.
- Immediate science return.
  - ANYWHERE you land in the ellipse, you will find water-altered bedrock under the rover.
- Rock and dust free.

Equatorial Site

- Ellipse center latitude = 0.0 degrees
- Low elevation (-1.3 km)

- Increased # samples analyzed
- Reduced thermal cycling
- Year-round science ops

Ability to place site in broader geological context

- Largest, continuous stratigraphic section under consideration for MSL.
  - At least 800 m thick in places and stretching over 3 × 10^5 km^2
- Opportunity sampled an upper stratum…this site lies at the heart of the stratigraphic section >600 km away.
  - Chance to tie together observations from two landers!
- Mapping relations with surrounding materials constrain age to Late Noachian/Early Hesperian.

A habitable environment

- Sulfate-bearing bedrock and hydrated minerals *over entire ellipse*.
  - Sulfur (and iron) oxidizers have been implicated in the origin of life on Earth.
- Clays nearby, and likely in landing ellipse.
- Thick and widespread stratigraphic sequence requires water for a long time.

Preservation of biosignatures, precursors, and/or organic carbon

- Sulfates often preserve these things on Earth.
  - Saline lakes are loaded with microbes.
  - Organic matter often trapped in crystals.
- Clays are likely in the ellipse and are great environments for preservation.
- Thick deposits with diverse stratigraphy are highly desirable.
  - Ability to place in the broader context is also key.
- One of the only places on Mars with (putative) phyllosilicates and sulfates.
- Recently exposed bedrock (fresh outcrop) is paramount and this is the case at East Meridiani.

Ability to assess biological potential with MSL payload

- MSL is well-designed to study sulfur and iron chemistry/mineralogy.
  - These are constraints on the potential emergence of life on Mars.
- Cameras provide grain analysis and local context for placement in the regional setting.
- A diverse stratigraphy is locally available.

East Meridiani

- Safe haven, great local science, excellent astrobiological potential, and ability to relate to the Big Picture of Mars.