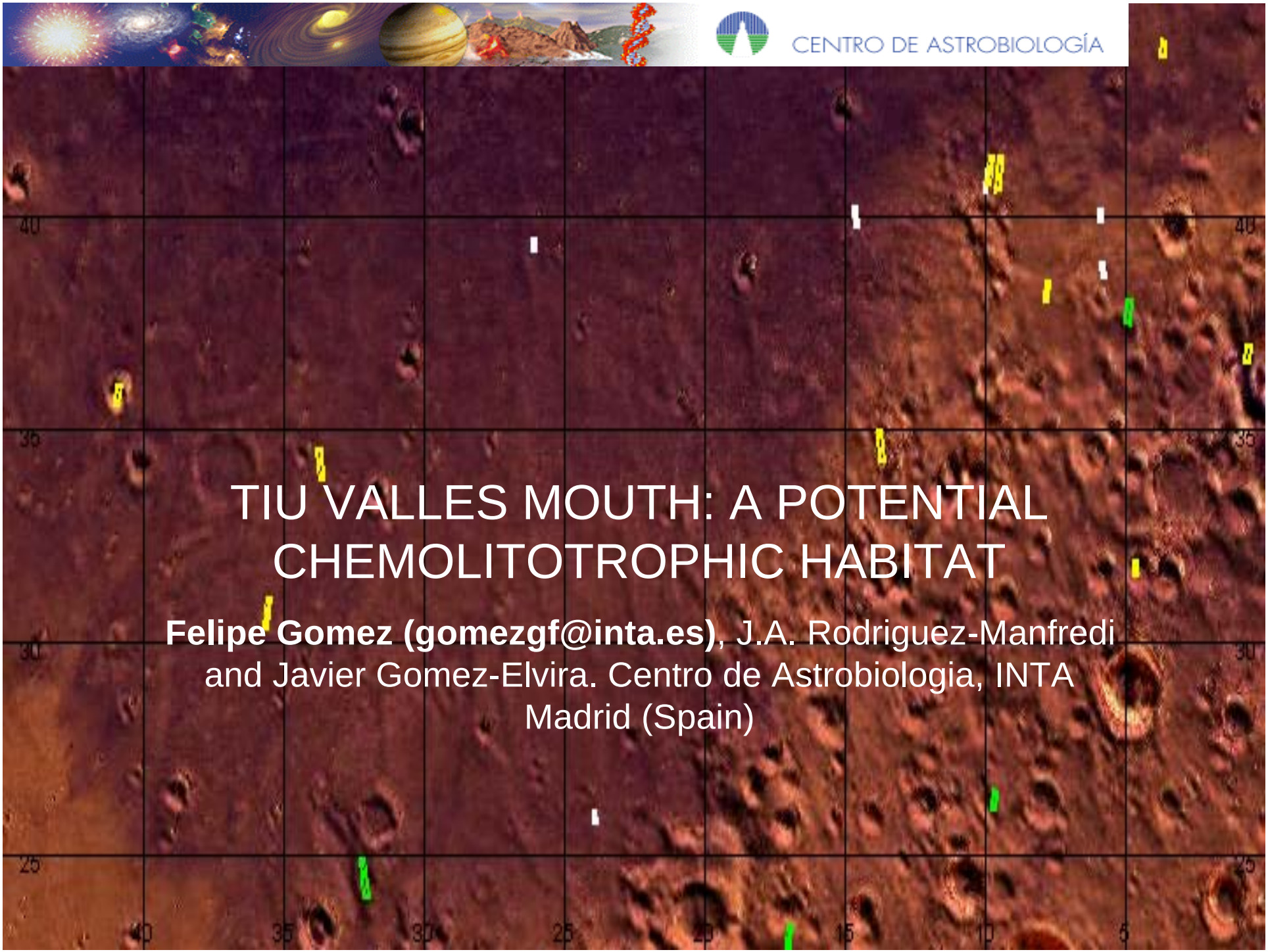
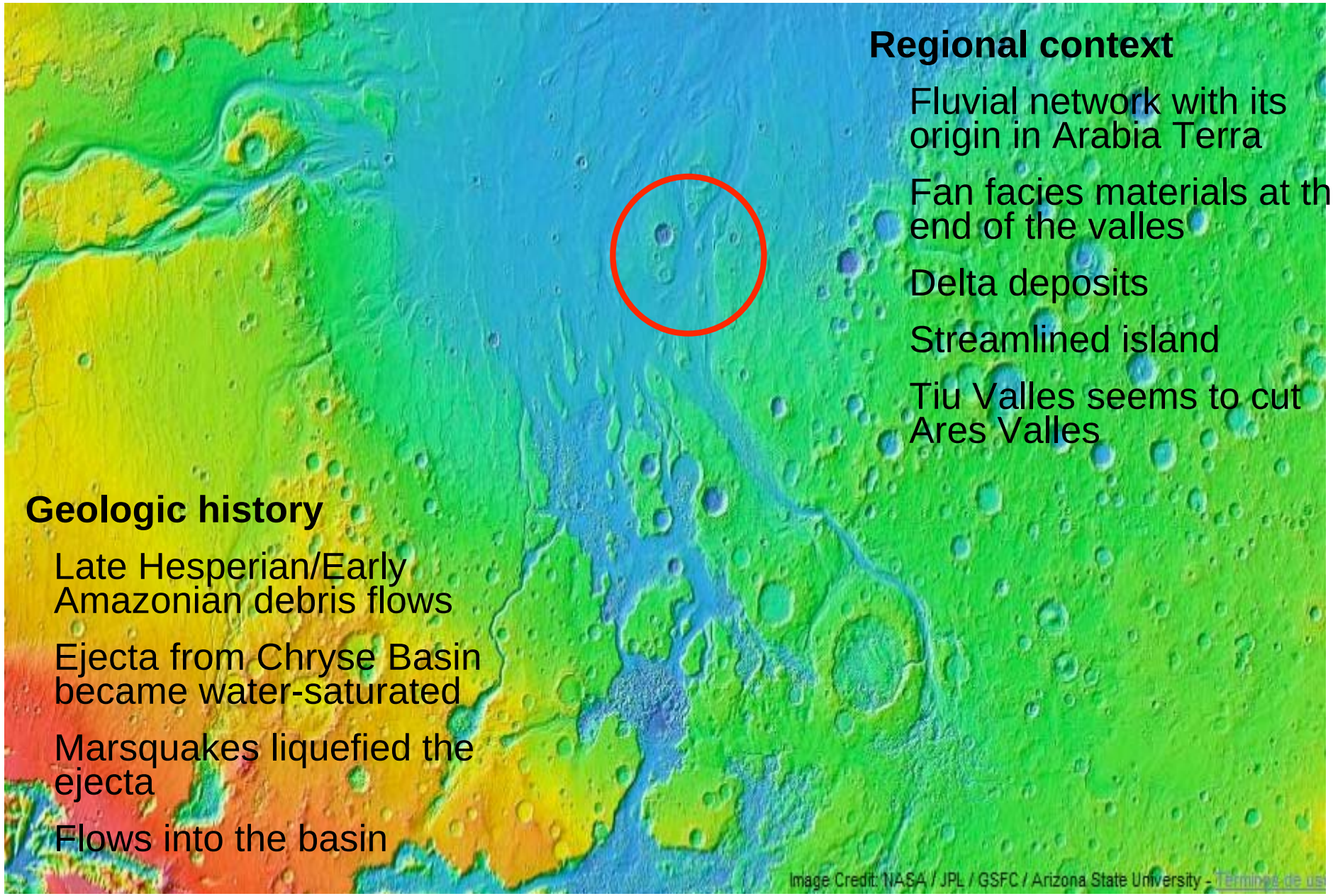


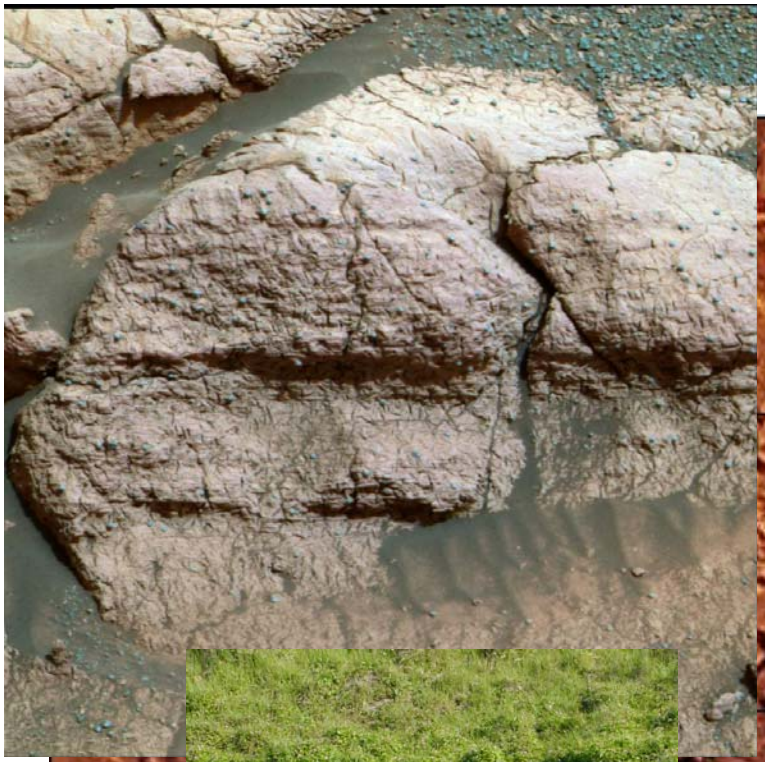
CENTRO DE ASTROBIOLOGÍA

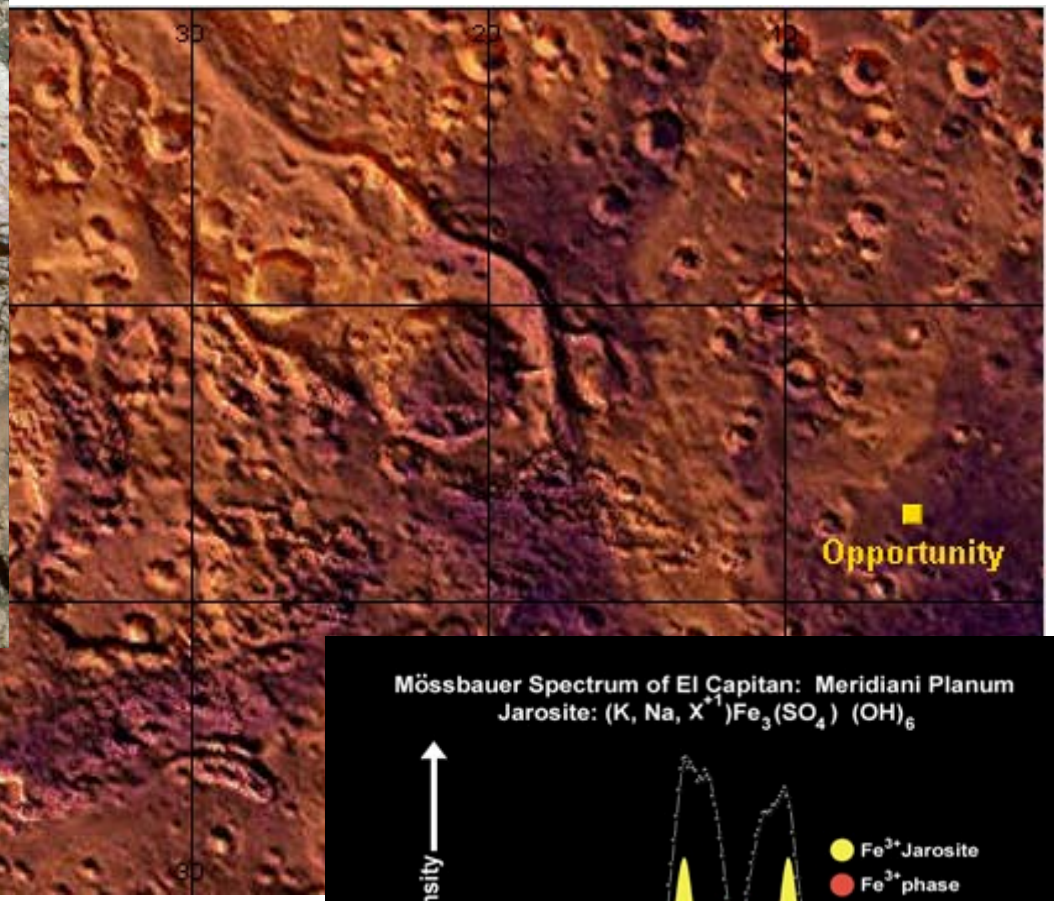
TIU VALLES MOUTH: A POTENTIAL CHEMOLITOTROPHIC HABITAT

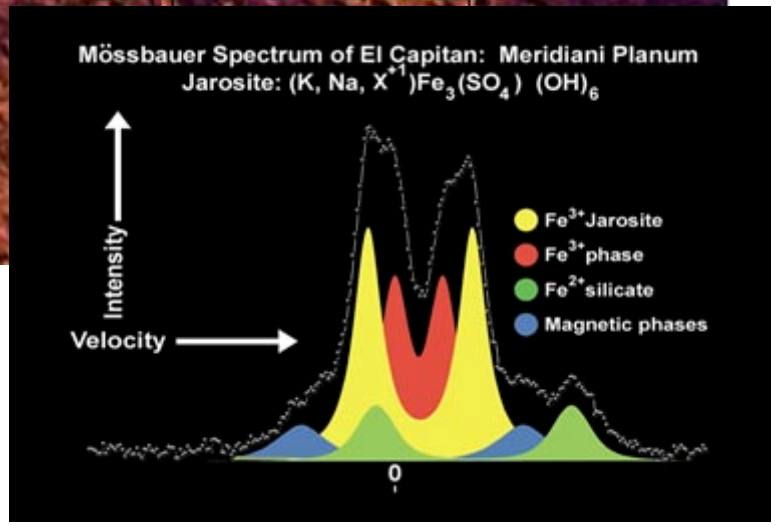
Felipe Gomez (gomezgf@inta.es), J.A. Rodriguez-Manfredi and Javier Gomez-Elvira. Centro de Astrobiologia, INTA Madrid (Spain)


Regional context
Fluvial network with its origin in Arabia Terra
Fan facies materials at the end of the valles
Delta deposits
Streamlined island
Tiu Valles seems to cut Ares Valles
Geologic history
Late Hesperian/Early Amazonian debris flows
Ejecta from Chryse Basin became water-saturated
Marsquakes liquefied the ejecta
Flows into the basin
Image Credit: NASA / JPL / GSFC / Arizona State University

Mineralogical context

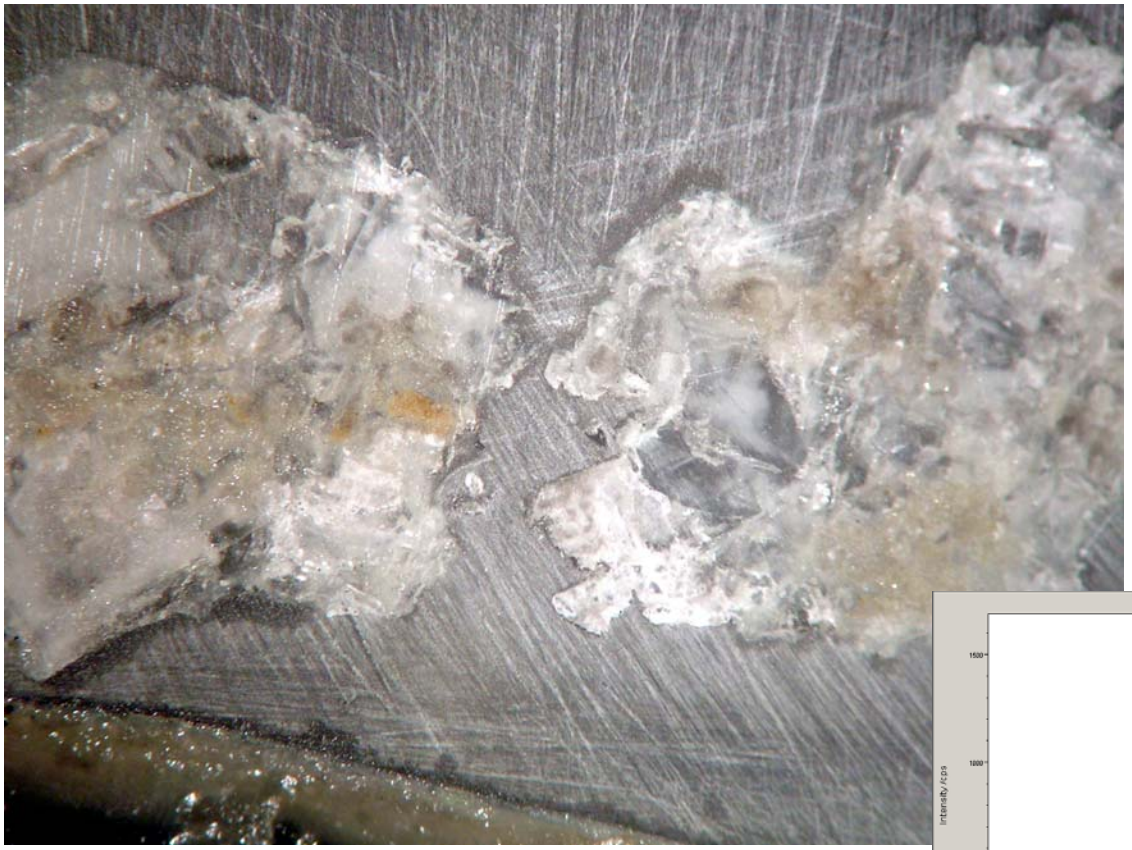


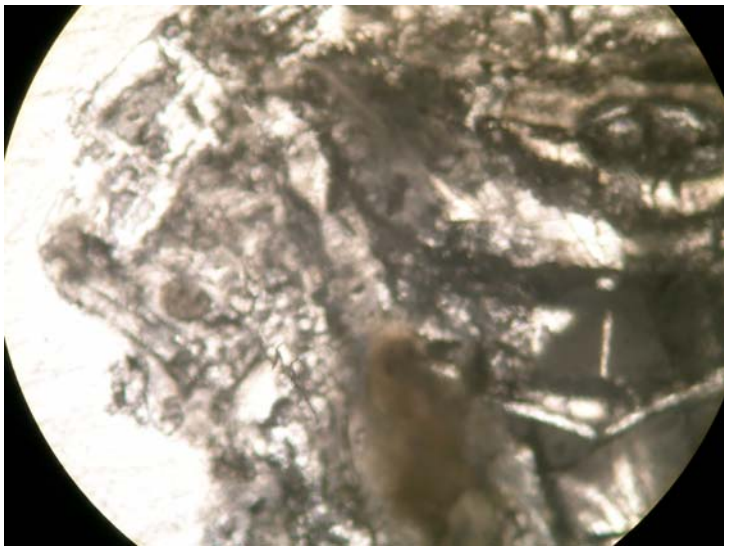


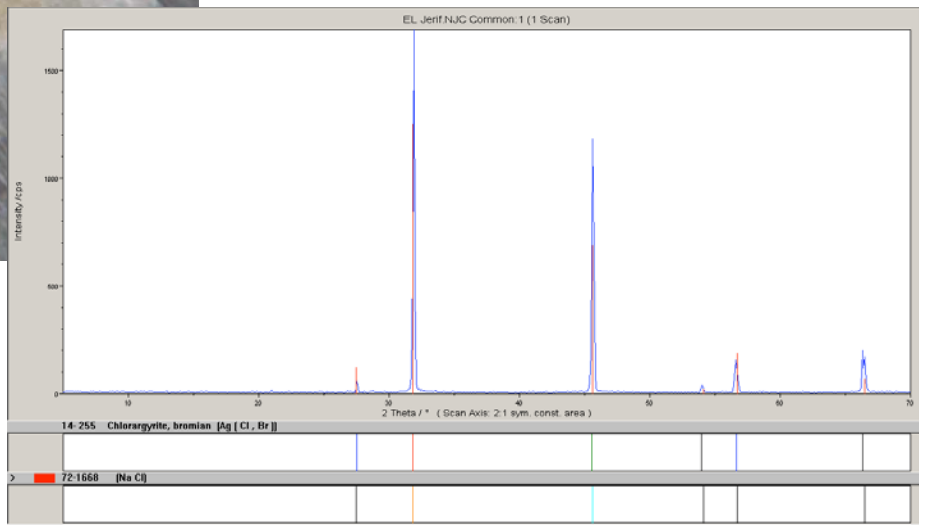


Klingelhoefer, G. et al., *Science*, v. **306** (2004)

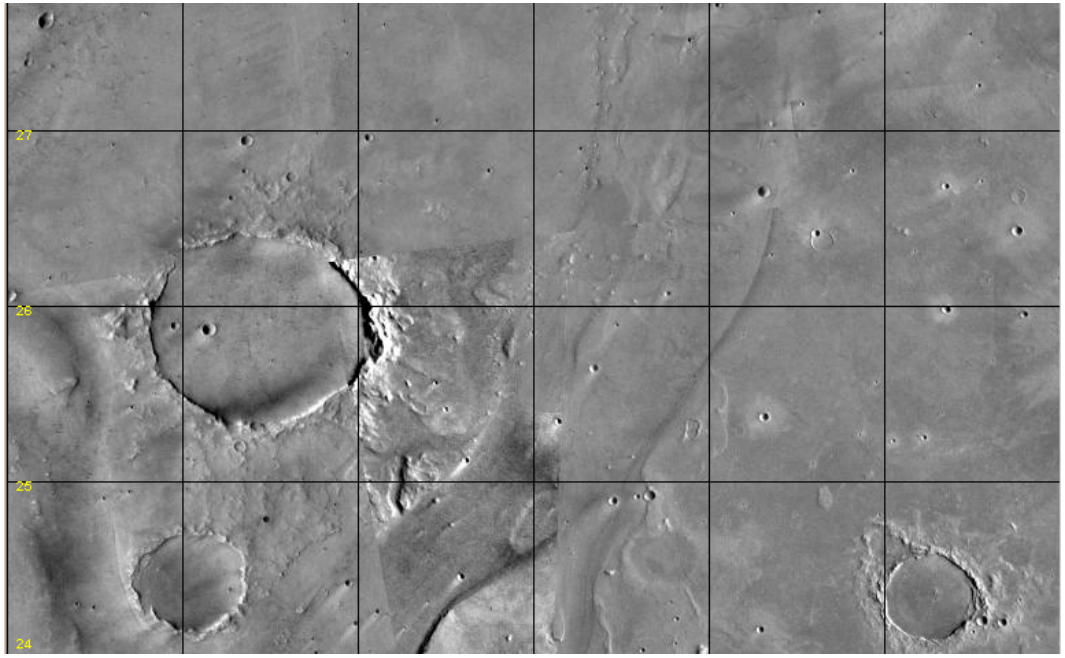
Organics inside salts







Mineralogical similarities: in this chemolithotrophic iron driven ecosystem, these minerals under anoxic conditions are the bioproducts and/or metabolites for habitability

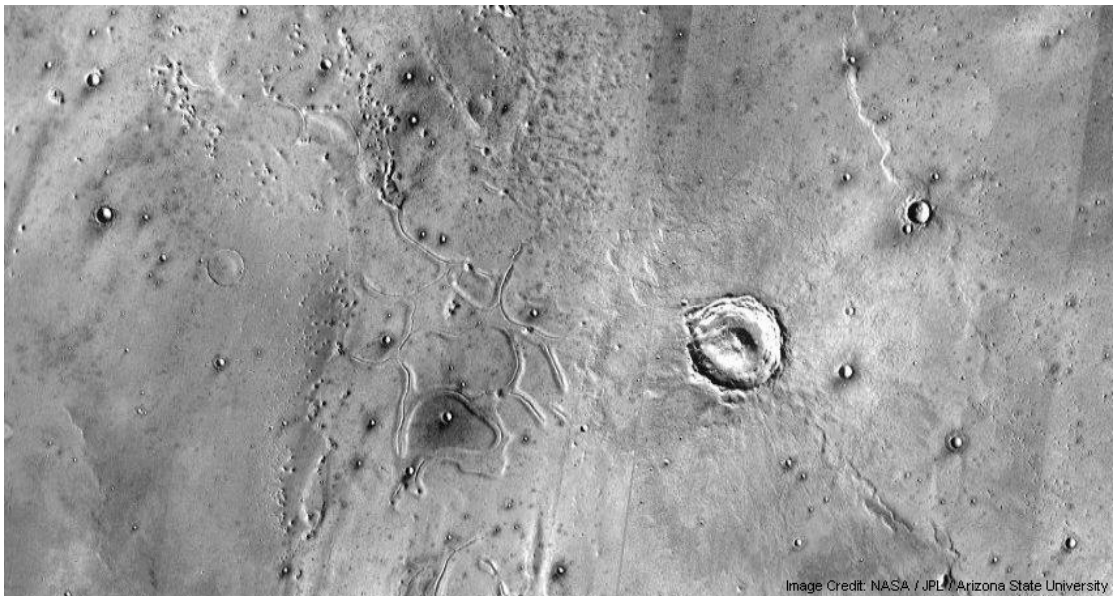


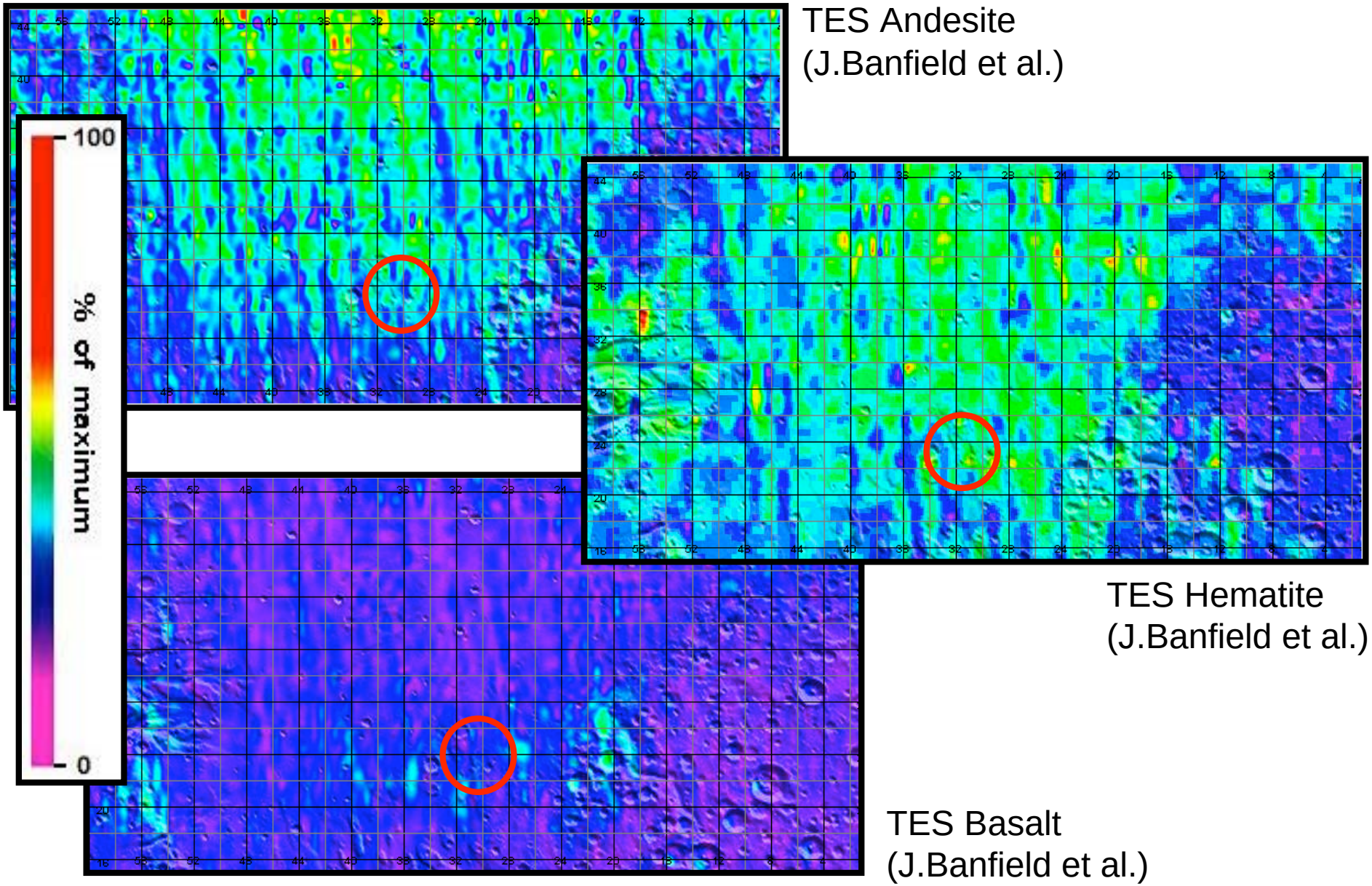
Sequence of fluvial processes

Sedimentary deposits

Depositional like structures

Long-term water



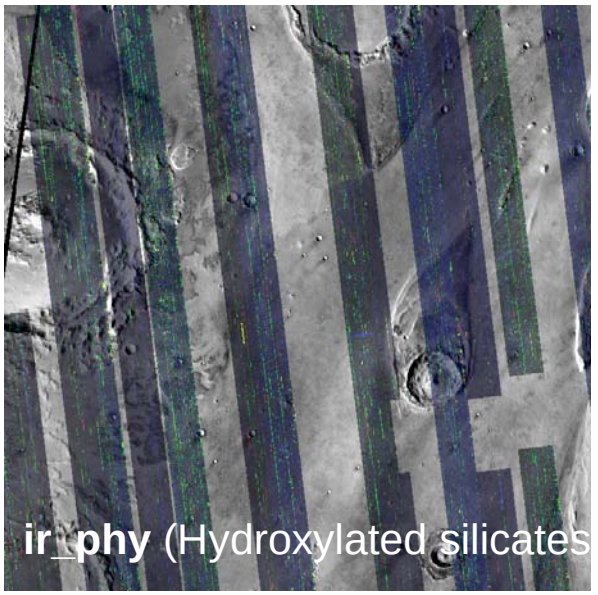


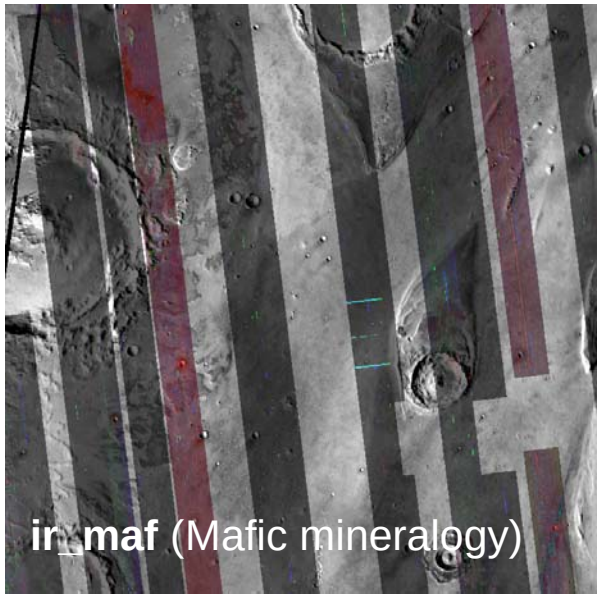
TES Andesite
(J.Banfield et al.)

TES Hematite
(J.Banfield et al.)

TES Basalt
(J.Banfield et al.)

CRISM data at several spectral bands with surface composition: low percentage presence of olivine and pyroxene (ir_maf) but with a very interesting presence of altered materials in the form of water bounds minerals like aluminum phyllosilicates or hydrated silica (ir_phy), and of very interest, the high presence of minerals or glasses with bound or dissolved molecular water and sulfates (ir_hyd) which represent altered materials and water





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Why Tiu Valles?

Preservation of biosignatures

Habitability

mineralogical similarities with chemolithotrophic environments

could be Tiu Valles the subsurface materials of Terra Meridiani? Subsurface protected environments

Surface radiation vs. Iron dust radiation protection

past water presence

Mineralogical characterization and comparison

with MER Opportunity landing place (Early Mars evolution?)

MSL objectives

Determine whether life ever arose on Mars

Biological potential

Past habitability: water and mineralogical evolution, Life building blocks

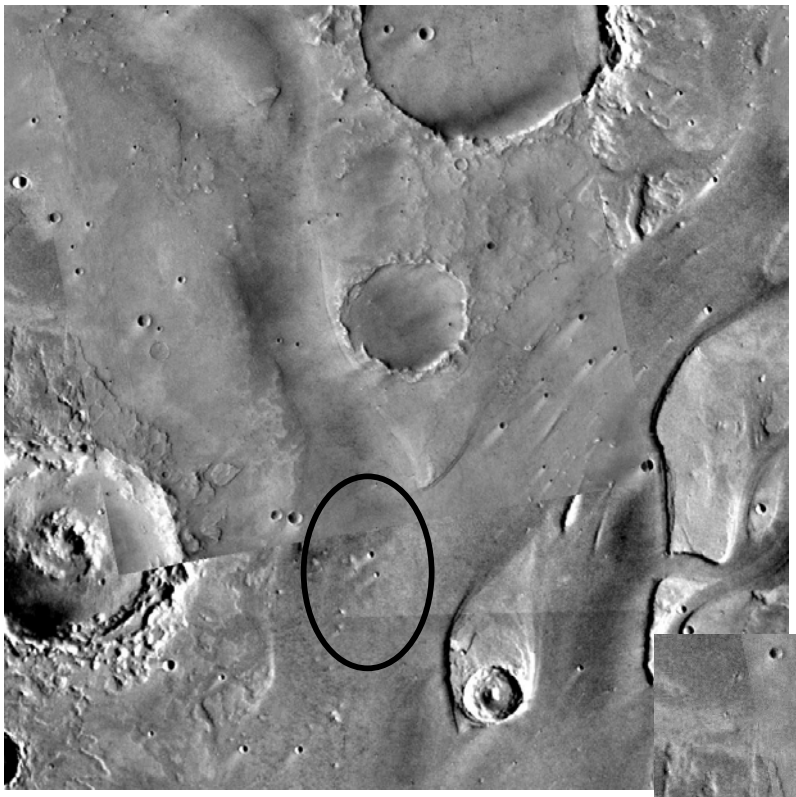
Characterize the climate of Mars

Humidity, Tª, P, UV, winds

Characterize the geology of Mars

Geology and geochemistry: Organics?

Prepare for human exploration



Landing ellipse centered at 22.9N 32.25 W

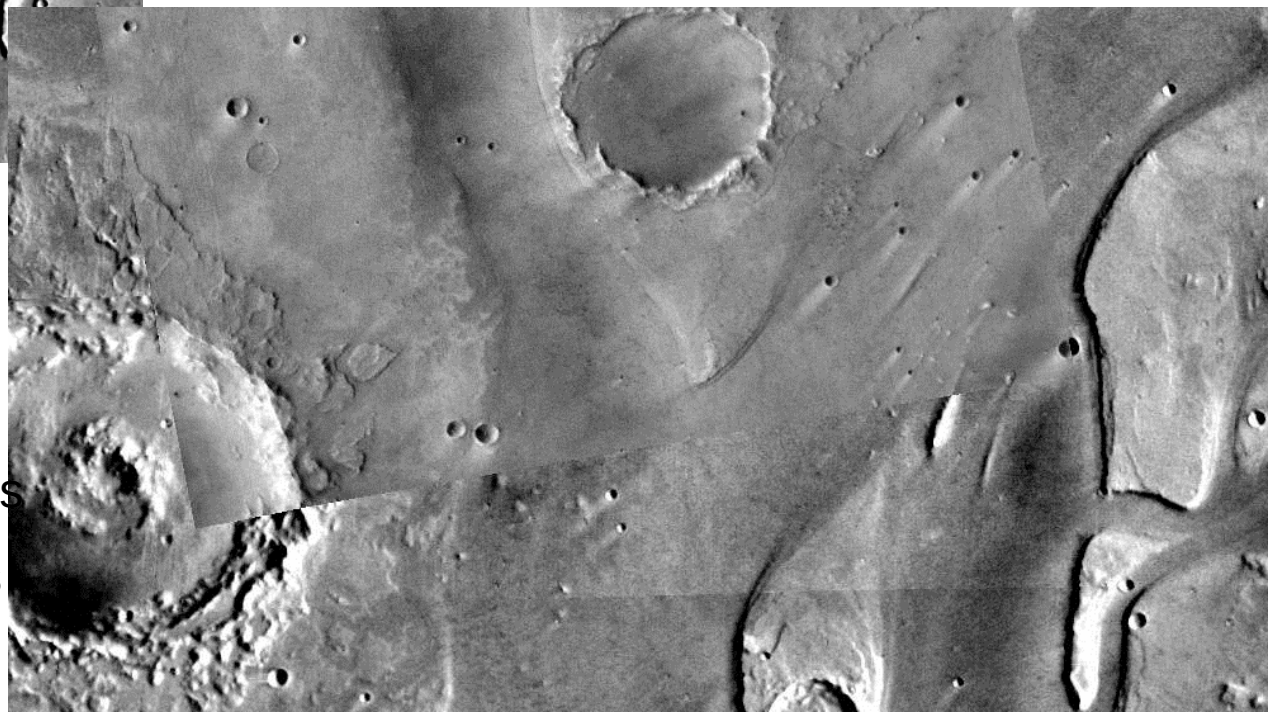
MOLA elevation: -3.8 Km

Averaged Thermal inertia: ~400 J/m^2 K s$^{1/2}$

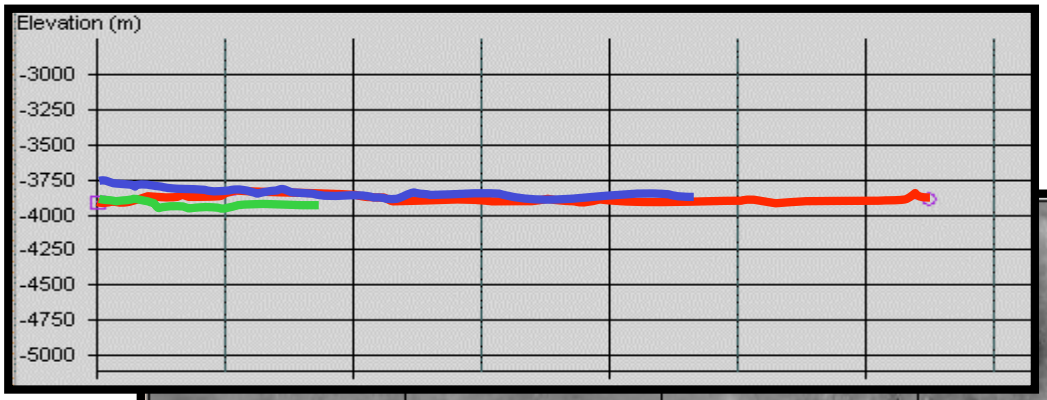
Expected temp at noon on landing season: 225 K

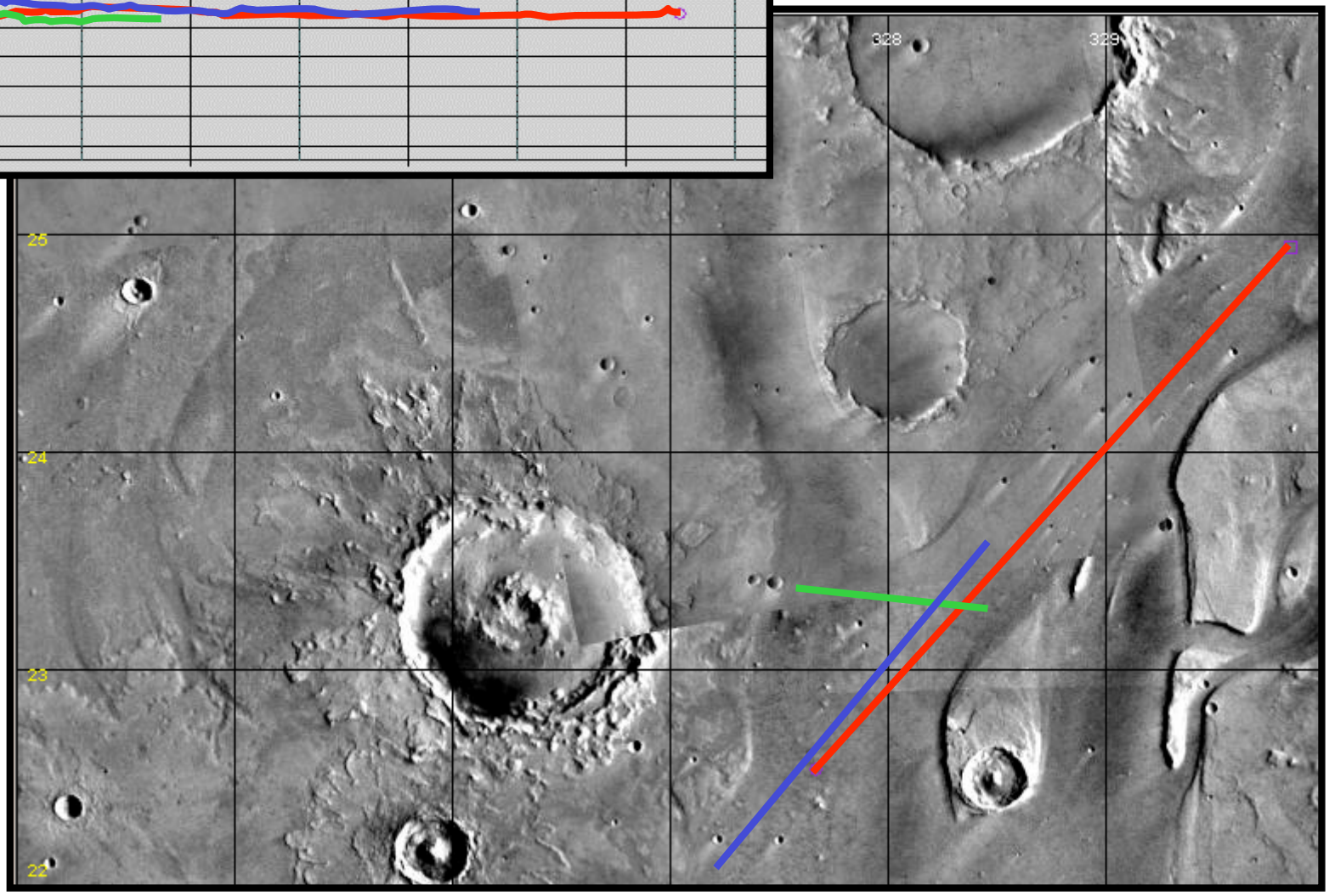
Averaged winds:

- Northward @ 7 Km: ~7 m/s
- Eastward @ 7 Km: ~2 m/s
- Northward @ 18 Km: ~4 m/s
- Eastward @ 18 Km: ~4 m/s

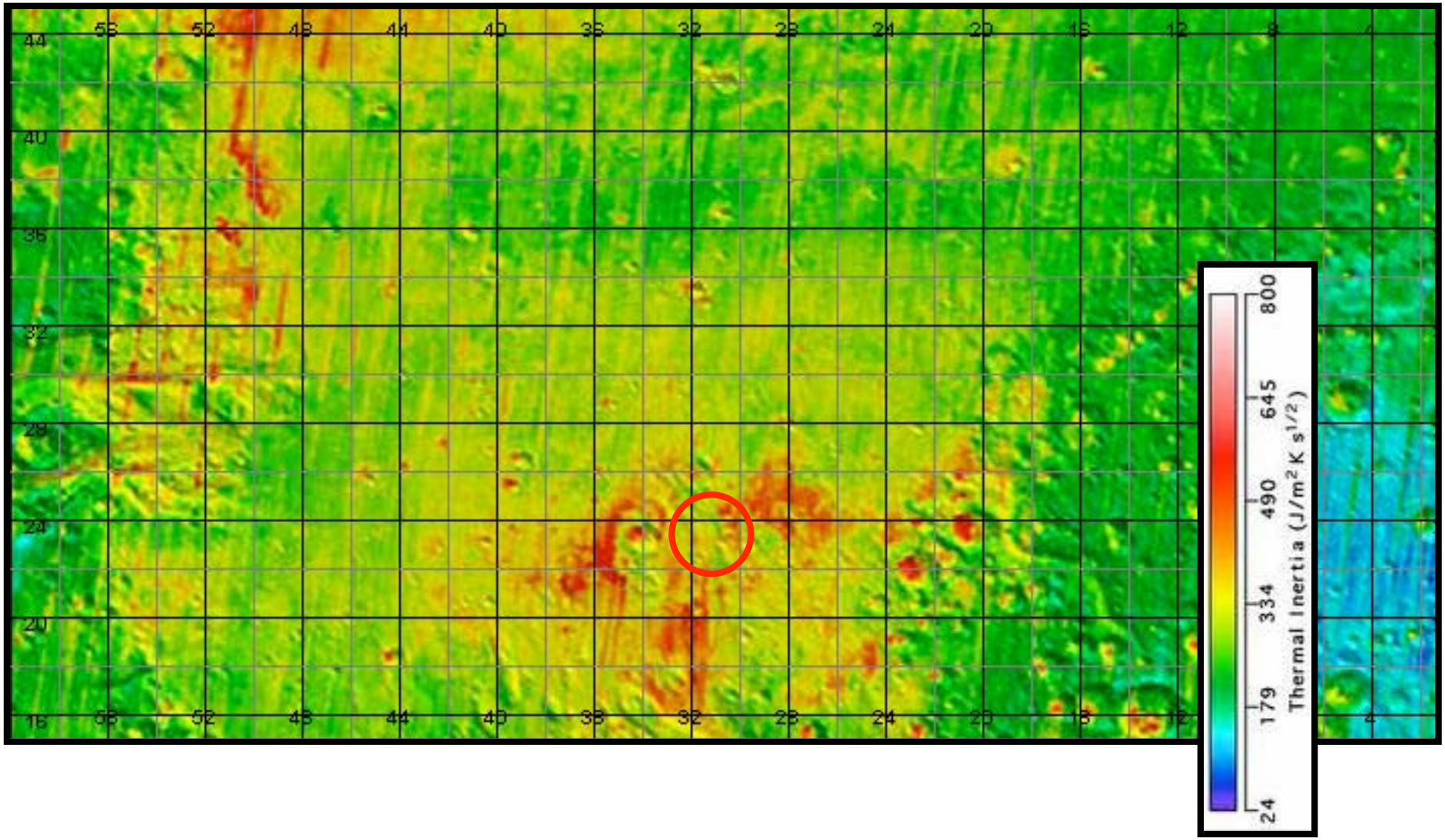


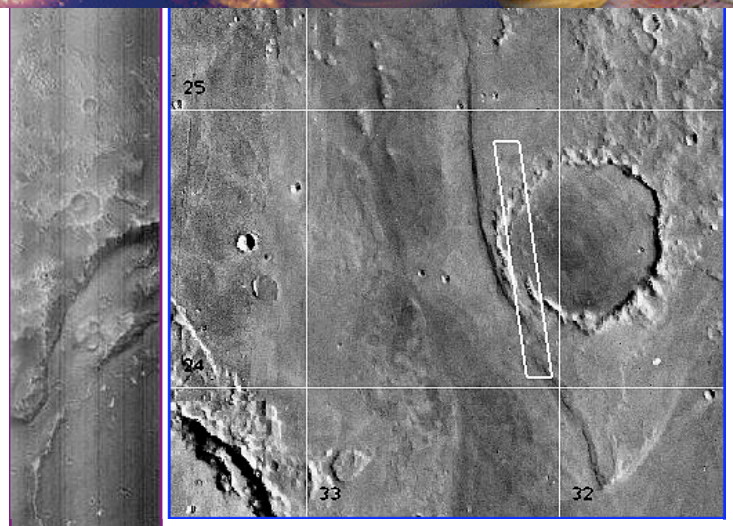
Elevation profiles from MOLA

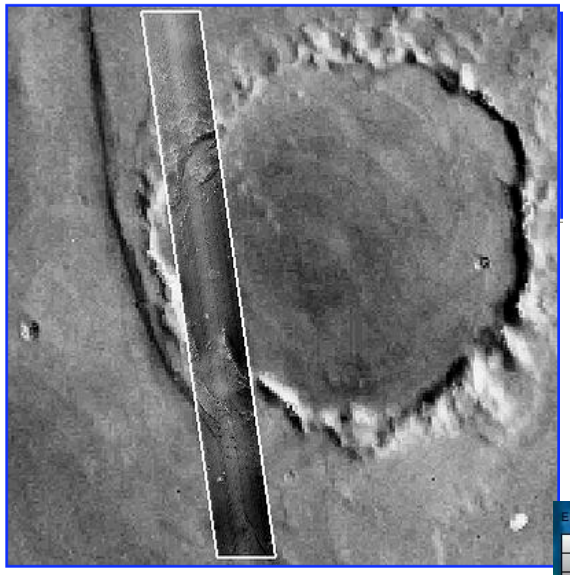




Thermal inertia from TES

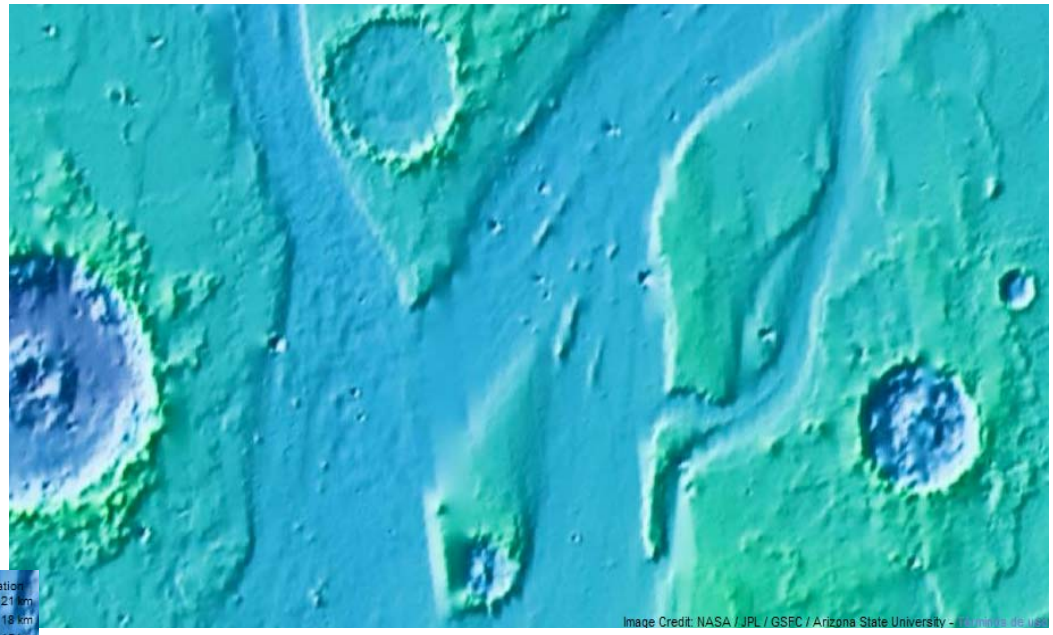






MOC **SPO249401**
Latitude: 24.62°

Longitude: 32.45° W
Resolution: 5.29 m



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MSL payload and habitability study on Tiu Valles

Is there water on the subsurface?

DAN

Water signatures on rocks and surface soil?

MastCam

Is the presence of iron minerals ubiquitous on this area?

CheMin

Sediments origin? Nature of the deposits-textural information

MastCam, ChemCam, CheMin

Are organics present?

SAM

Are environmental conditions suitable for habitability?

REMS

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Tiu Valles from the MSL objectives point of view

Biological objectives:

- Determine the nature and inventory of organic carbon compounds
- Inventory the chemical building blocks of life (carbon, hydrogen, nitrogen, oxygen, phosphorous and sulfur)
- Identify features that may represent the effects of biological processes

Geological and geochemical objectives:

- Investigate the chemical, isotopic, and mineralogical composition of the Martian surface and near-surface geological materials
- Interpret the processes that have formed and modified rocks and soils

Planetary process objectives:

- Assess long-timescale (i.e., 4-billion-year) atmospheric evolution processes
- Determine present state, distribution and cycling of water and carbon dioxide

Surface radiation objective:

- Characterize the broad spectrum of surface radiation, including galactic cosmic radiation, solar proton events and secondary neutrons