TIU VALLES MOUTH: A POTENTIAL CHEMOLITOTROPHIC HABITAT

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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
Mineralogical context

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
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.
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, T\(^a\), 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/m² K s¹/²
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
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
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