OMEGA proposed sites in Mawrth Vallis
OMEGA proposed sites in Mawrth Vallis

J-P. Bibring, N. Mangold, D. Loizeau, F. Poulet,

and the OMEGA team

Murchie S., Bishop J., Ehlmann B.L.,

and the CRISM team

MSL WS2, October 25, 2007
Nili Fossae

OMEGA map of hydrated minerals at Mars

Mawrth Vallis  Nili Fossae

blue : kieserite (MgSO$_4$, H$_2$O)
green : polyhydrated sulfates
red : phyllosilicates
yellow : other hydrated minerals
OMEGA map of hydrated minerals at Mars

Nili Fossae

Jack Mustard’s and Nicolas Mangold’s talks
OMEGA map of hydrated minerals at Mars

Mawrth Vallis

this talk
hydration (1.93 µm)

context

25 km Ø
hydration (1.93 µm)

phyllosilicates

○ 25 km Ø

green: Al-OH rich phyllosilicate (2.20 µm)
red: Mg/Fe rich phyllosilicate (2.30 µm)
Mawrth Vallis constitutes the region at the surface of Mars where one finds

1. the higher surface area of phyllosilicates (10’s km)
2. the larger concentration of phyllosilicates (> 40 %)
3. the wider variety of phyllosilicate composition
4. coupled structural and compositional layering at all scales
5. easy access to mafics
The bed and its opening are filled with HCP-rich anhydrous minerals.
Mawrth Vallis constitutes the region at the surface of Mars where one finds

1. the higher surface area of phyllosilicates
2. the larger concentration of phyllosilicates
3. the wider variety of phyllosilicate composition
4. coupled structural and compositional layering at all scales
5. easy access to mafics

There exists a variety of sites to be explored, with similar scientific interest, which offers a large flexibility for safety criteria to be added.

We have identified 3 favored sites, exhibiting the 5 major characteristics quoted, briefly described in the coming slides.
hydration (1.93 µm)

green: Al-OH rich phyllosilicate (2.20 µm)
red: Mg/Fe rich phyllosilicate (2.30 µm)

phylllosilicates
Material of interest fills almost the entire ellipses

Viking context
Mawrth Vallis site 1
hydration (1.93 µm)

HCP

25 km Ø

338.9 E  24.5 N
hydration (1.93 μm)

phylllosilicates

green: Al-OH rich phyllosilicate (2.20 μm)
red: Mg/Fe rich phyllosilicate (2.30 μm)
HRSC color composite

600 m large spots

SPOT 1 (338.80,24.63)
SPOT 2 (338.85,24.40)
SPOT3 (338.875,24.33)
green: Al-OH rich phyllosilicate (2.20 µm)
red: Mg/Fe rich phyllosilicate (2.30 µm)
blue: hydrated minerals (1.93 µm)
A paleosurface with craters covers the south of the site:

Phyllosilicate-rich layers have formed over this surface as shown by the filled craters
cross section of site 1
HRSC DEM
(100 m contours)
slopes <1°
at regional scale
elevation: -3km
MOC scale
Relatively rough
No HIRISE here yet
hydration (1.93 µm)  

phylllosilicates

green: Al-OH rich phyllosilicate (2.20 µm)  
red: Mg/Fe rich phyllosilicate (2.30 µm)
green: Al-OH rich phyllosilicate (2.20 µm)
red: Mg/Fe rich phyllosilicate (2.30 µm)
blue: hydrated minerals (1.93 µm)
HRSC DEM
contours 100 m
slopes: <2°
elevation: - 2.5 km
Mawrth Vallis site 3
hydration (1.93 μm)

HCP
hydration (1.93 µm)  

Phyllosilicates

Green: Al-OH rich phyllosilicate (2.20 µm)  
Red: Mg/Fe rich phyllosilicate (2.30 µm)
green: Al-OH rich phyllosilicate (2.20 µm)
red: Mg/Fe rich phyllosilicate (2.30 µm)
blue; hydrated minerals (1.93 µm)
green: Al-OH rich phyllosilicate (2.20 µm)
red: Mg/Fe rich phyllosilicate (2.30 µm)
elevation: < -2 km
slopes at km scale: <1.5°

Maximum slope 1.5°
Relatively rough at MOC scale

Meter scale roughness

Requires HIRISE
Mawrth Vallis constitutes the region at the surface of Mars where one finds
1. the higher surface area of phyllosilicates
2. the larger concentration of phyllosilicates
3. the wider variety of phyllosilicate composition
4. coupled structural and compositional layering at all scales
Loizeau et al. (2007) Hydration Fe/Mg-clay Al-clay

by courtesy of James Wray

Loizeau et al. (2007)
Hydrated but no diagnostic metal-OH absorptions

2.30 μm
1.91 μm
2.20 μm
1.91 μm
1.4 μm
1.91 μm
2.20 μm
1.91 μm
1.4 μm

CRISM Ratio Spectra

Strongest Al-OH

Strongest Fe/Mg-OH

“Typical” metal-OH

Hydrated but no diagnostic metal-OH absorptions
Key

BD1900 = Hydrated
BD2200 = Al-rich phyllos
BD2300 = Fe/Mg-rich phyllos

CRISM FRT_3BFB on HiRISE PSP_2140_2025
Key

BD1900 = Hydrated
BD2200 = Al-rich phyllos
BD2300 = Fe/Mg-rich phyllos
Mawrth Vallis constitutes the region at the surface of Mars where one finds

1. the higher surface area of phyllosilicates
2. the larger concentration of phyllosilicates
3. the wider variety of phyllosilicate composition
4. coupled structural and compositional layering at all scales
5. easy access to mafics

There exists a variety of sites to be explored, with almost equal scientific interest, which offers a large flexibility for safety criteria to be added.

We have identified 3 favored sites, exhibiting the 5 major characteristics.
**OMEGA proposed sites in Mawrth Vallis**

Mawrth Vallis constitutes the region at the surface of Mars where one finds

1. the higher surface area of phyllosilicates
2. the larger concentration of phyllosilicates
3. the wider variety of phyllosilicate composition
4. coupled structural and compositional layering at all scales
5. easy access to mafics

There exists a variety of sites to be explored, with almost equal scientific interest, which offers a large flexibility for safety criteria to be added.

We have identified 3 favored sites, exhibiting the 5 major characteristics.

We are ready to cooperate with the Project in an in-depth study, combining OMEGA data with other data sets (HRSC, CRISM and HIRISE, TES and THEMIS primarily) to optimize the site selection and increase the overall mission robustness at system and science level.
Summary

1. Ideal sites to sample phyllosilicates of potential astrobiological relevance

2. Largest variety of composition, from Mg/Fe smectites → Al-rich ones

3. Diagnostic coupling of compositional / structural layering down fine-scale

4. Access to both LCP-rich and HCP-rich materials

5. Elevation, slopes and thermal inertia (200-400 SI) favorable

6. Analyses doable right upon landing (no go to sites)

Go Phyllosian: Go Mawrth