

OMEGA proposed sites in Mawrth Vallis

MSL WS2, October 25, 2007

OMEGA proposed sites in Mawrth Vallis

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

and the OMEGA team

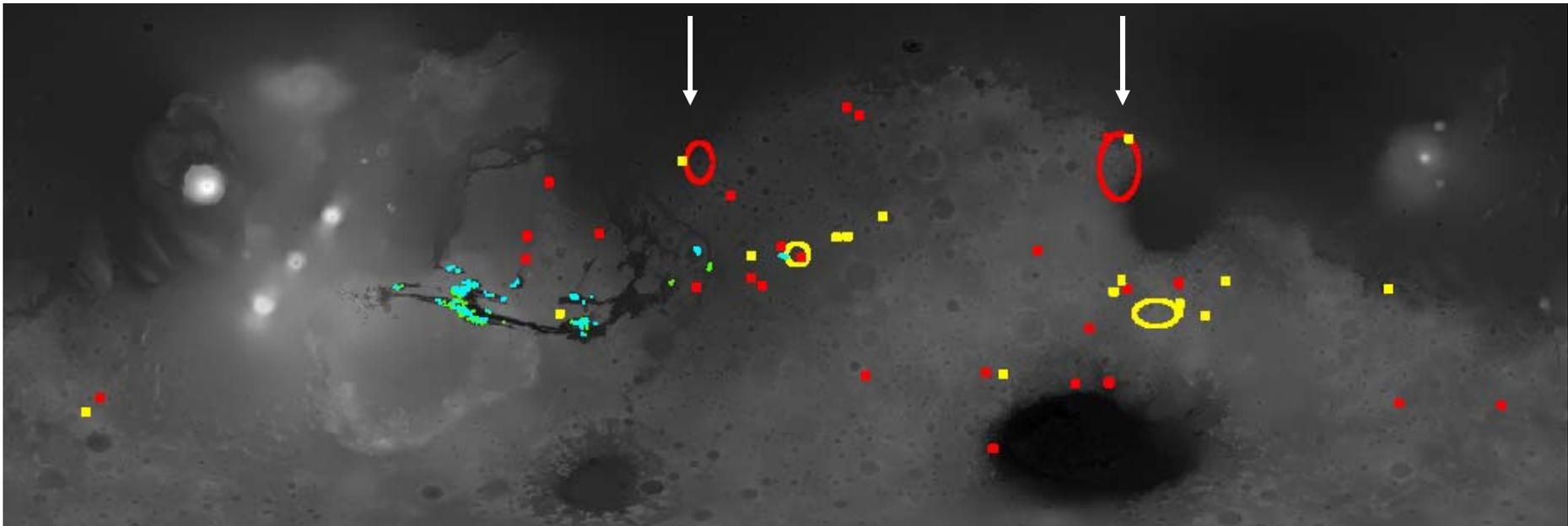
Murchie S., Bishop J., Ehlmann B.L.,

and the CRISM team

OMEGA map of hydrated minerals at Mars

Mawrth Vallis

Nili Fossae



blue : kieserite ($\text{MgSO}_4, \text{H}_2\text{O}$)

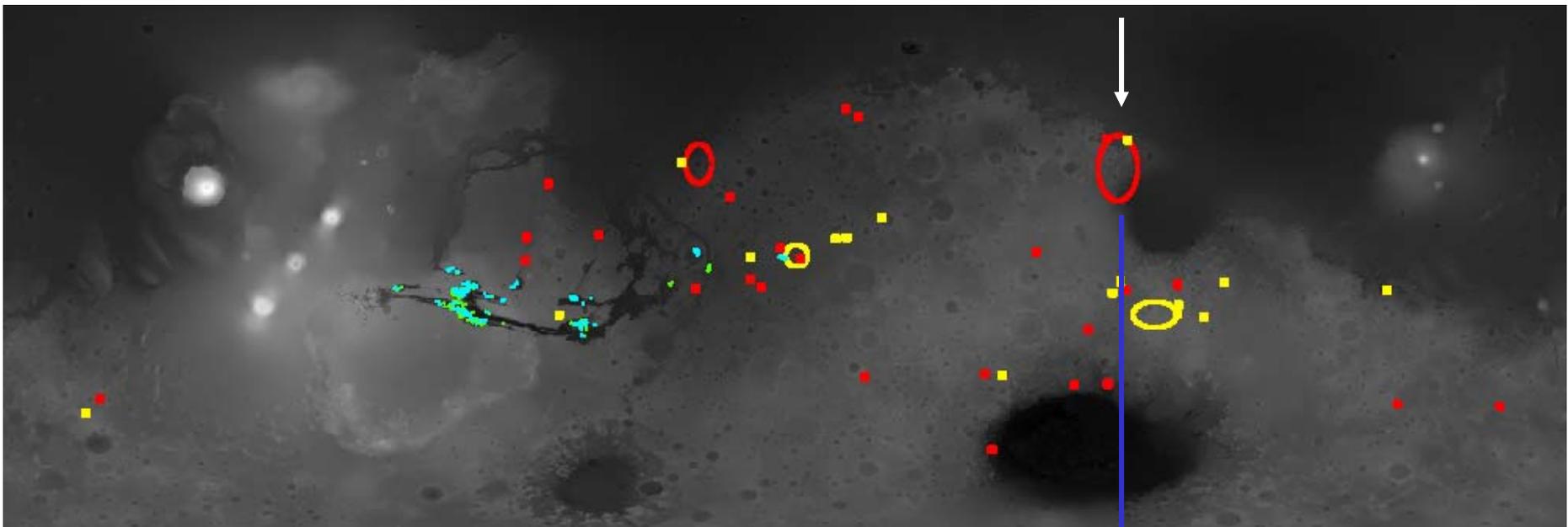
green : polyhydrated sulfates

red : phyllosilicates

yellow : other hydrated minerals

OMEGA map of hydrated minerals at Mars

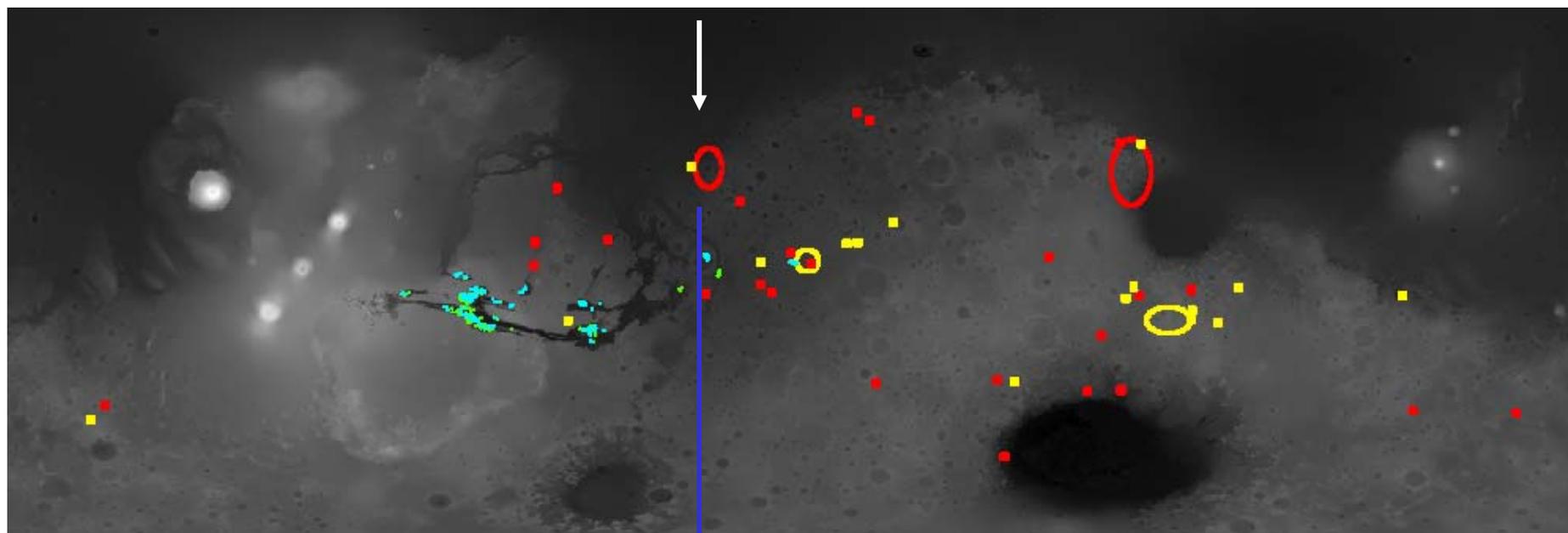
Nili Fossae



Jack Mustard's and Nicolas Mangold's talks

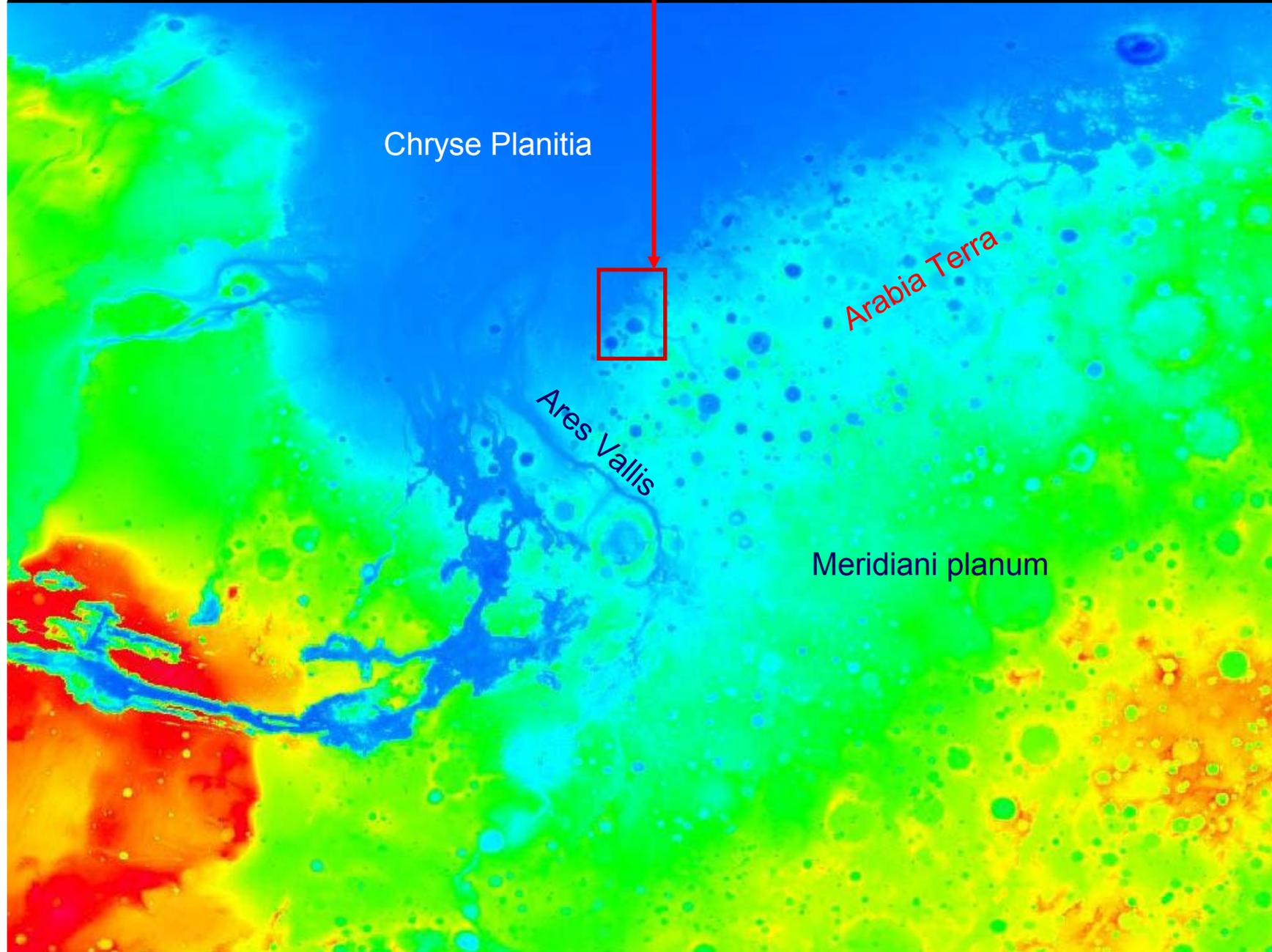
OMEGA map of hydrated minerals at Mars

Mawrth Vallis

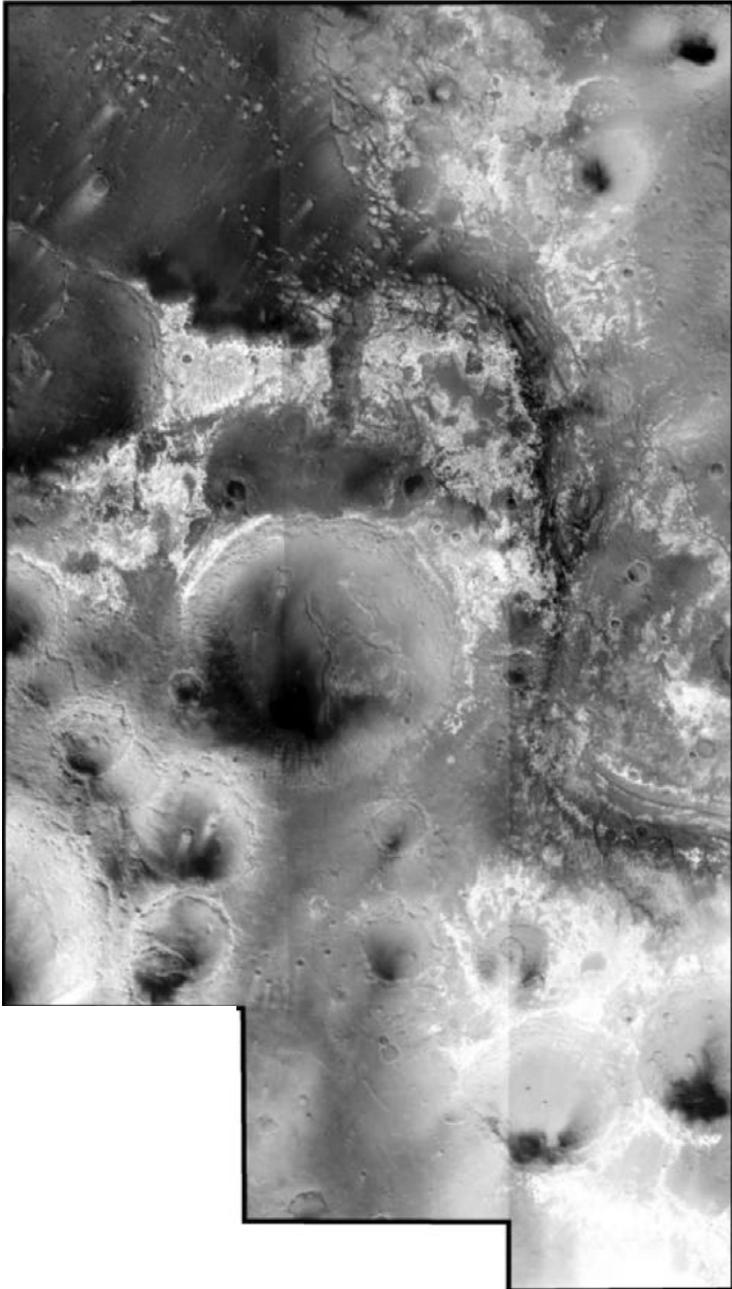


this talk

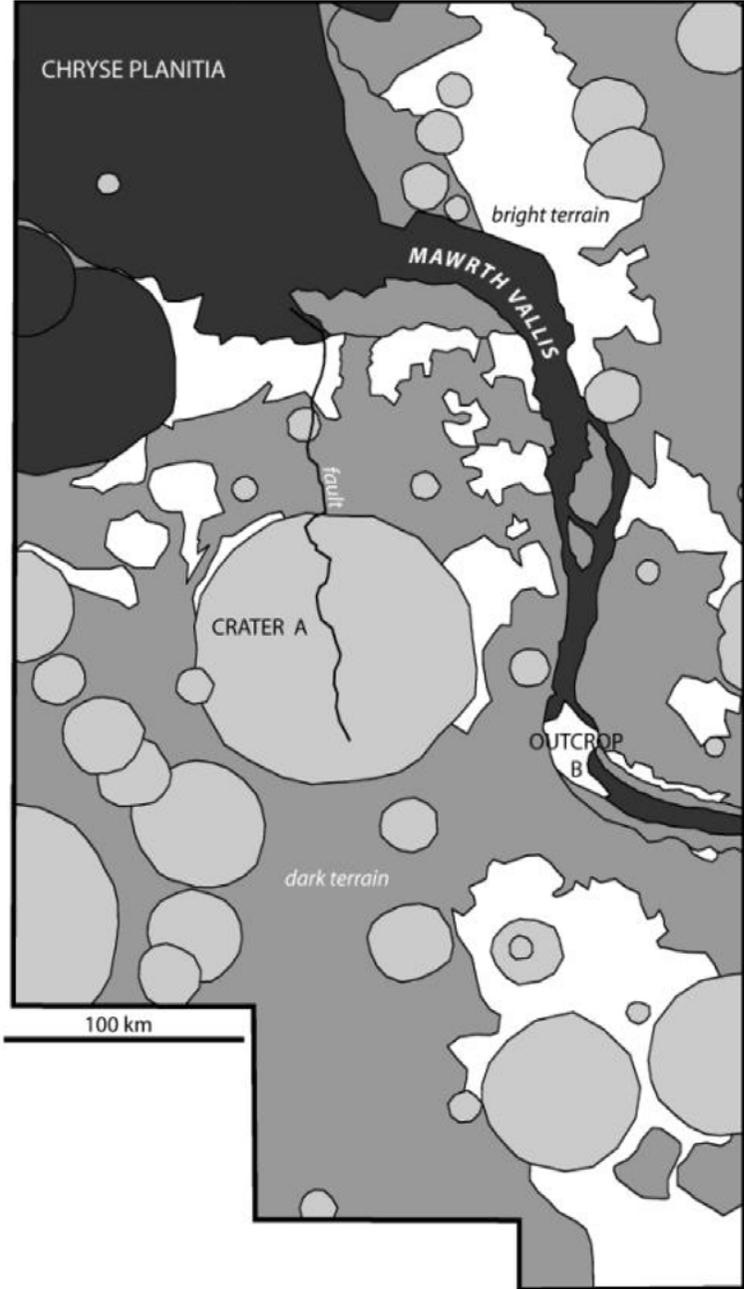
Mawrth Vallis



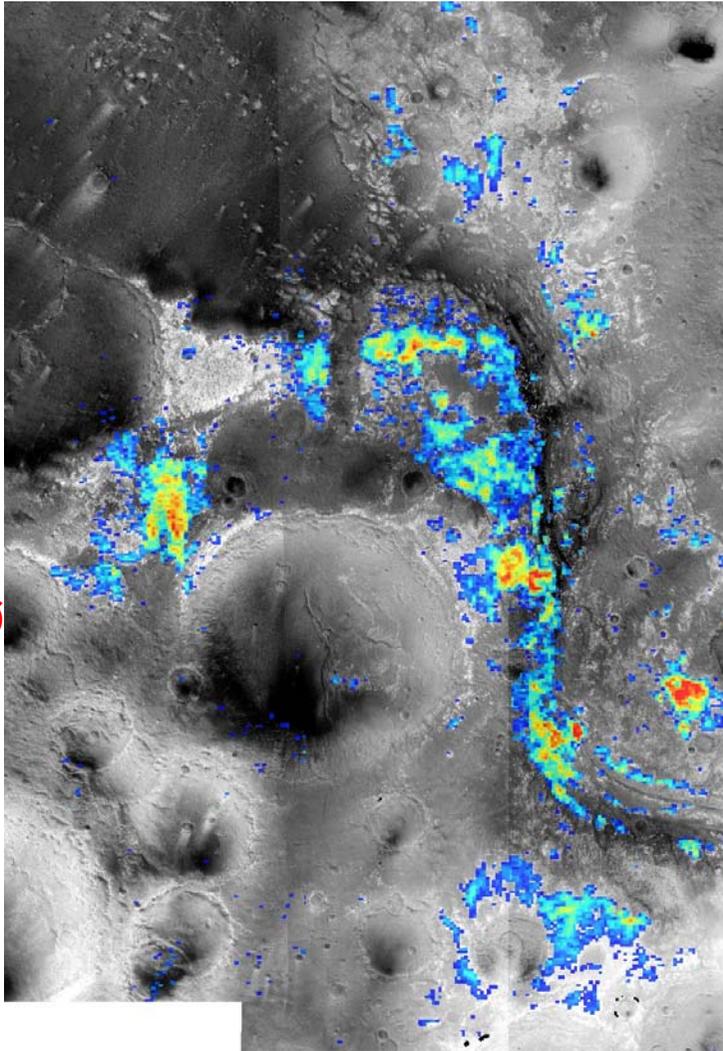
HRSC mosaic



context

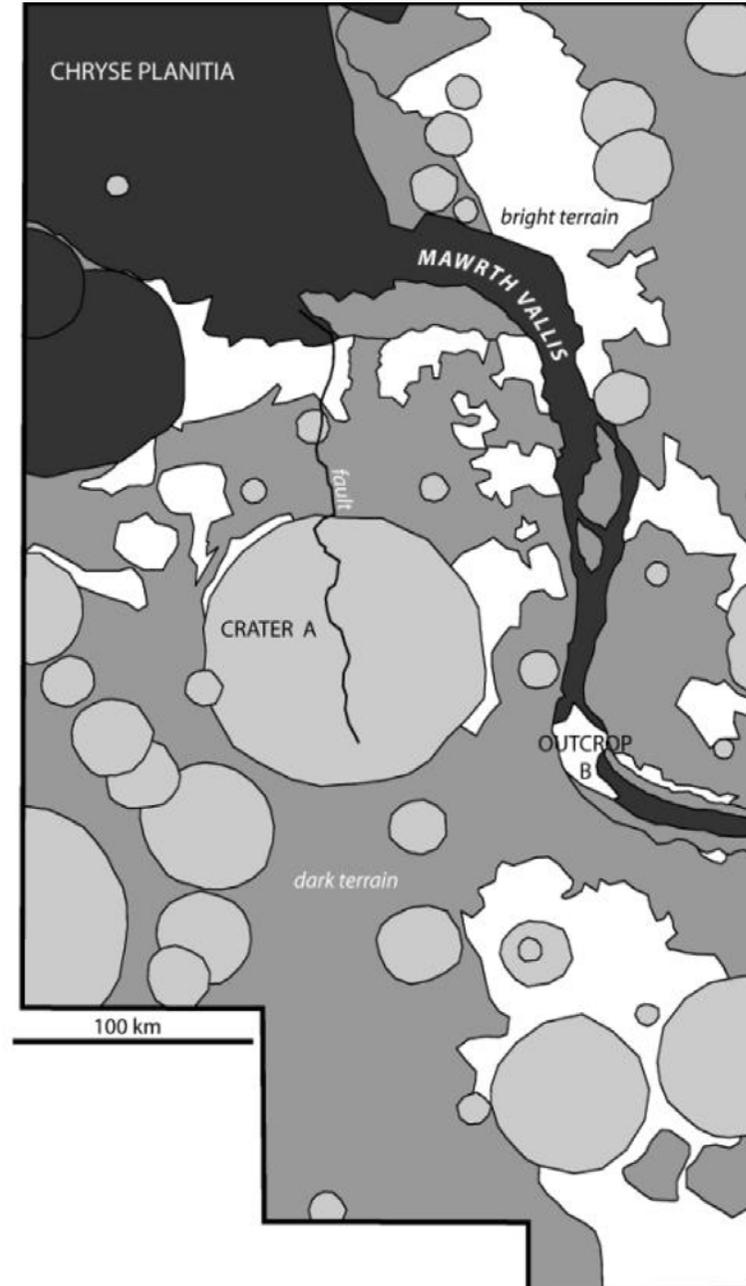


hydration (1.93 μm)

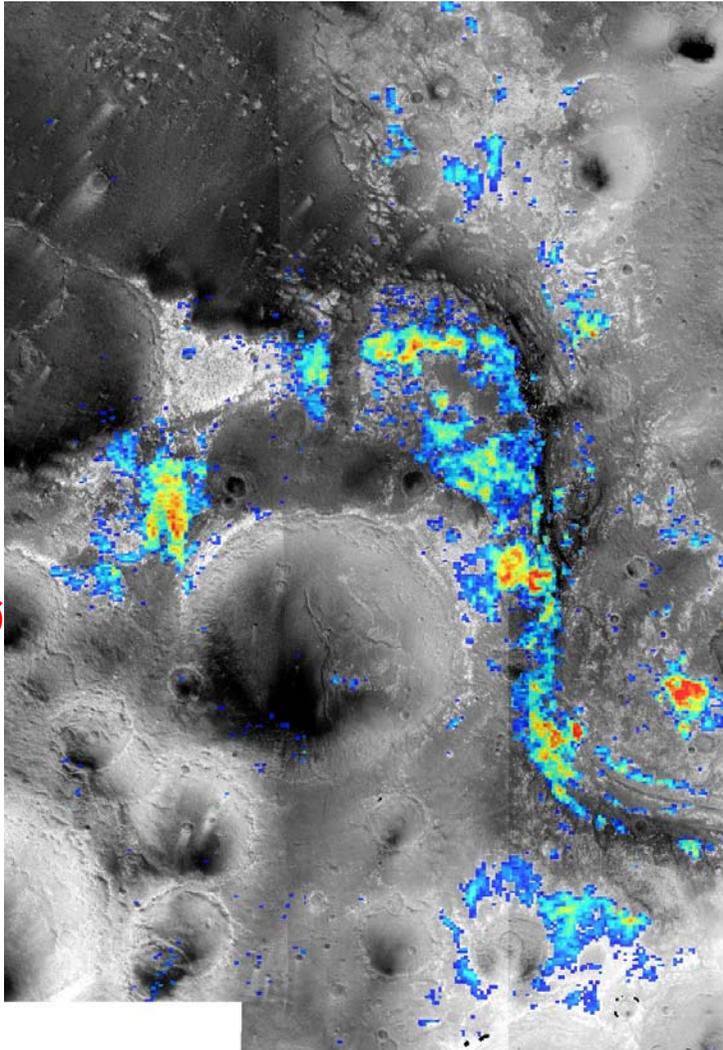


○
25 km \emptyset

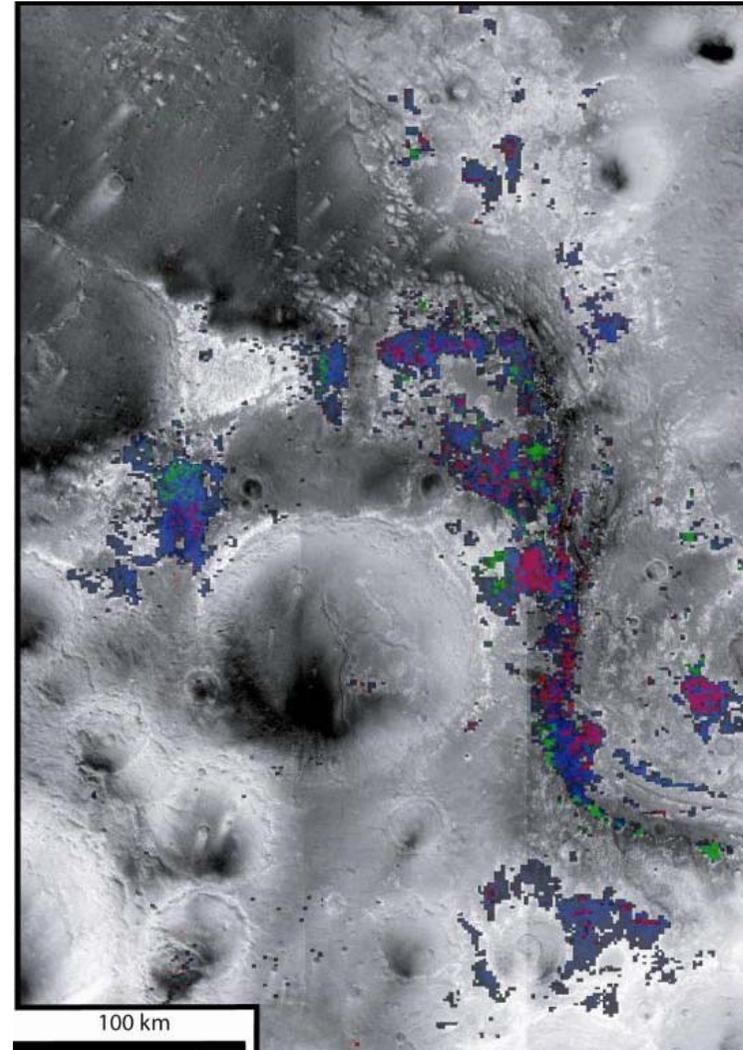
context



hydration (1.93 μm)



phyllosilicates



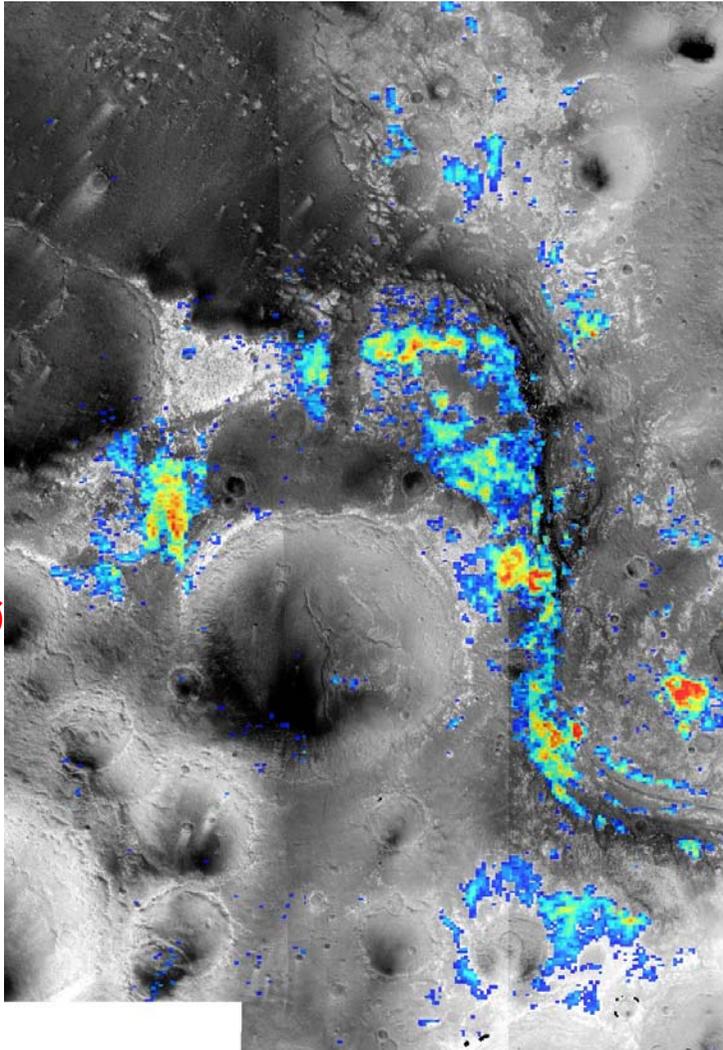
green: Al-OH rich phyllosilicate (2.20 μm)
red: Mg/Fe rich phyllosilicate (2.30 μm)

OMEGA proposed sites in Mawrth Vallis

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

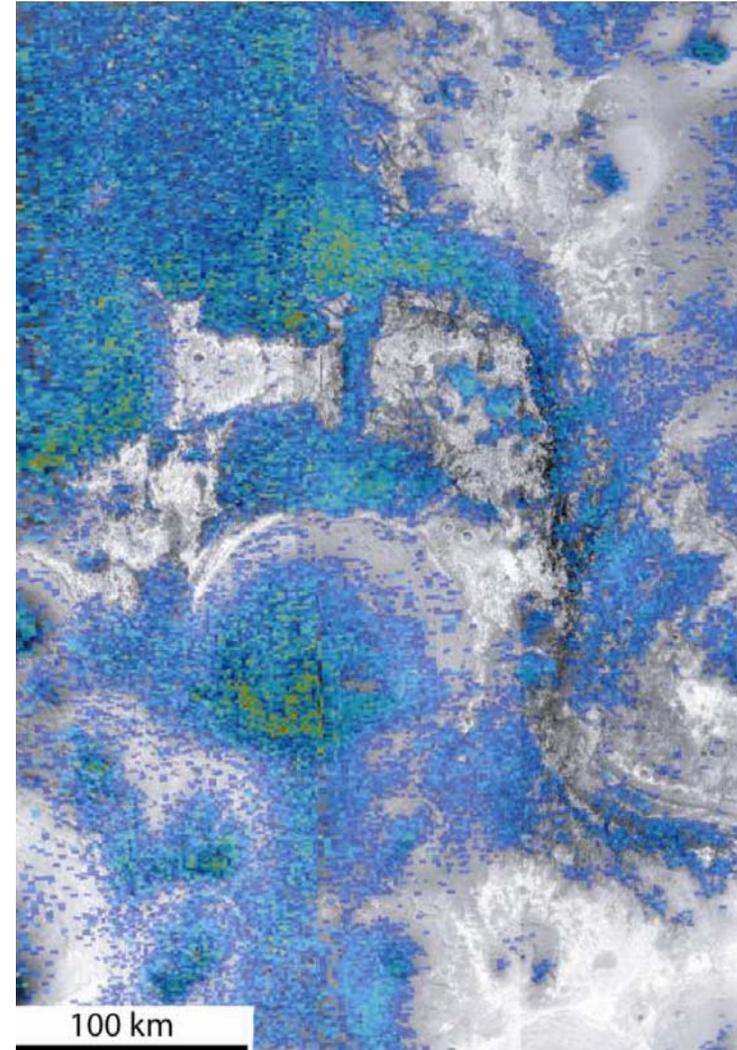
1. the higher surface area of phyllosilicates (10's km)
2. the larger concentration of phyllosilicates (> 40 %)
3. the wider variety of phyllosilicate composition
4. coupled structural and compositional layering at all scales
5. easy access to mafics

hydration (1.93 μm)



25 km \varnothing

HCP



The bed and its opening are filled with **HCP-rich** anhydrous minerals

OMEGA proposed sites in Mawrth Vallis

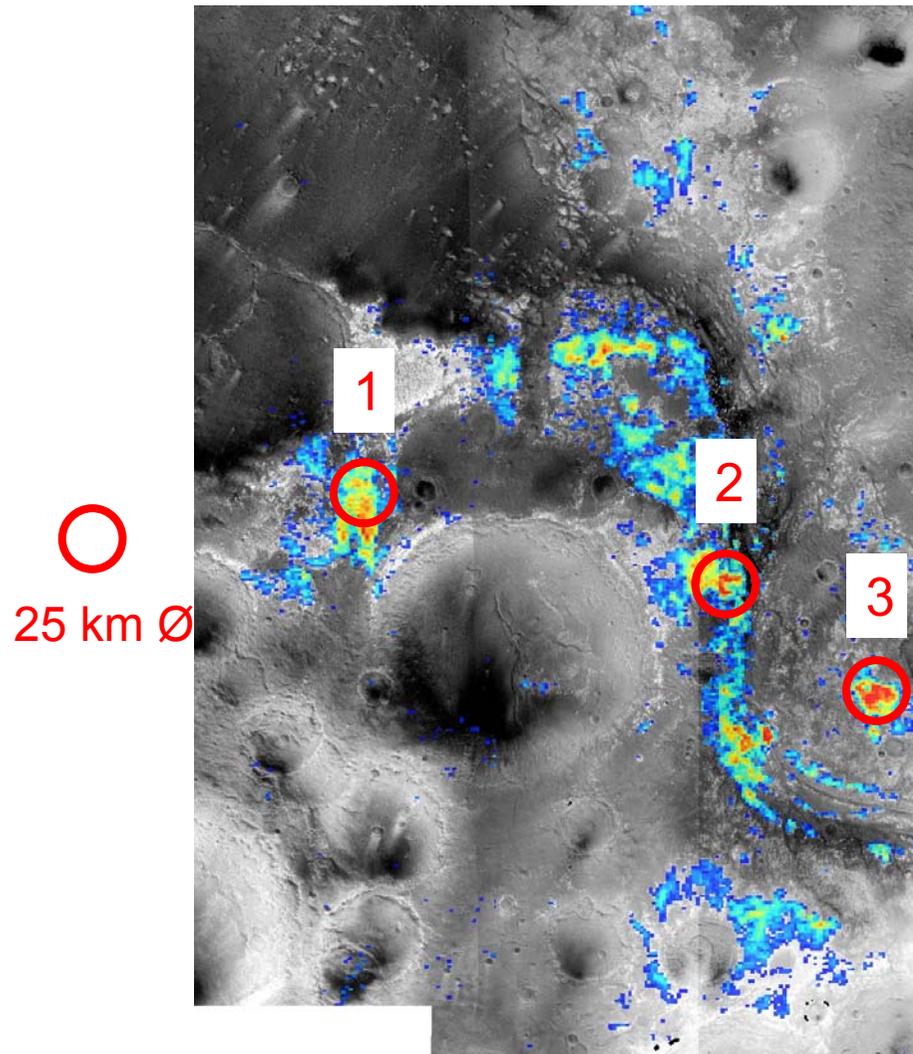
Mawrth Vallis constitutes the region at the surface of Mars where one finds

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

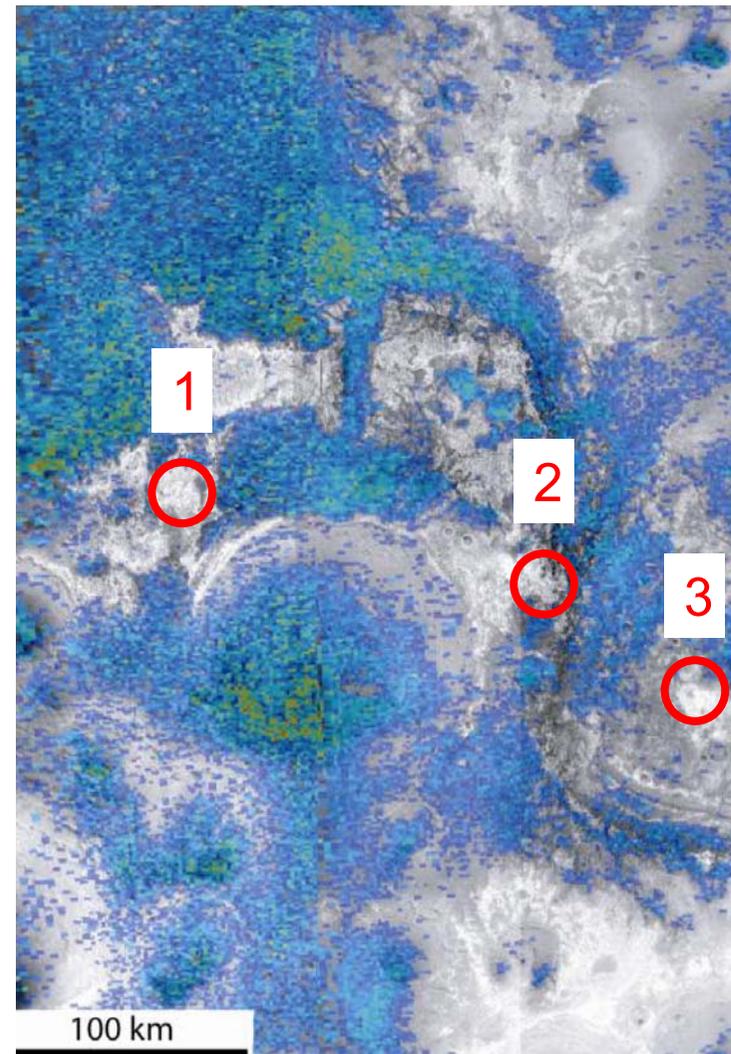
There exists a variety of sites to be explored, with similar scientific interest, which offers a large flexibility for safety criteria to be added.

We have identified 3 favored sites, exhibiting the 5 major characteristics quoted, briefly described in the coming slides.

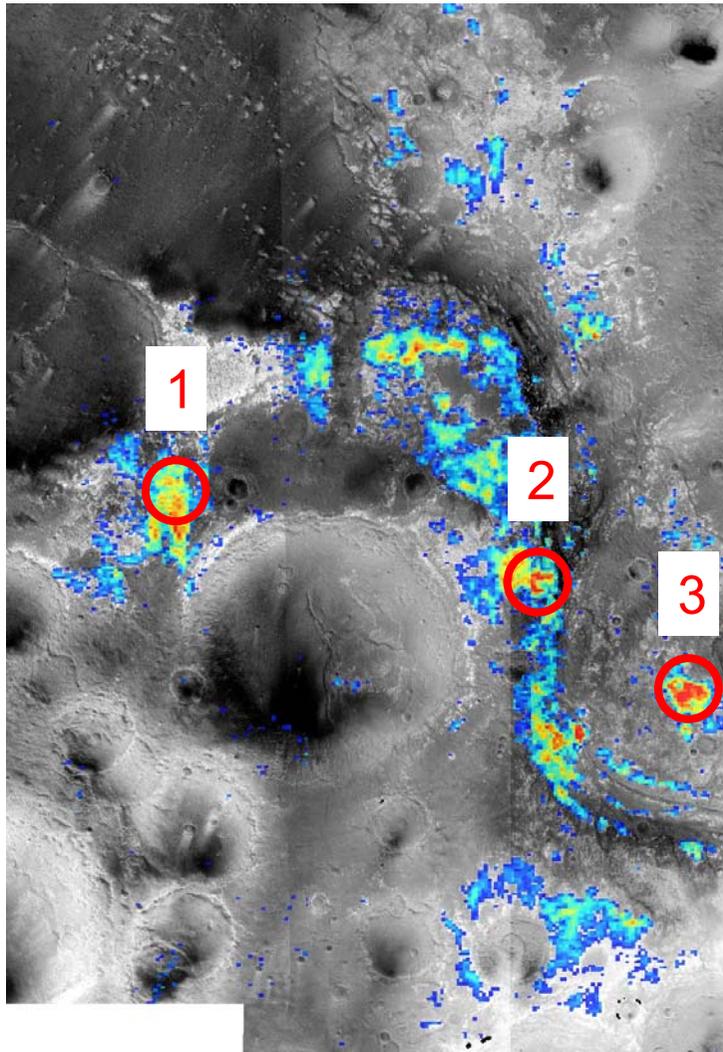
hydration (1.93 μm)



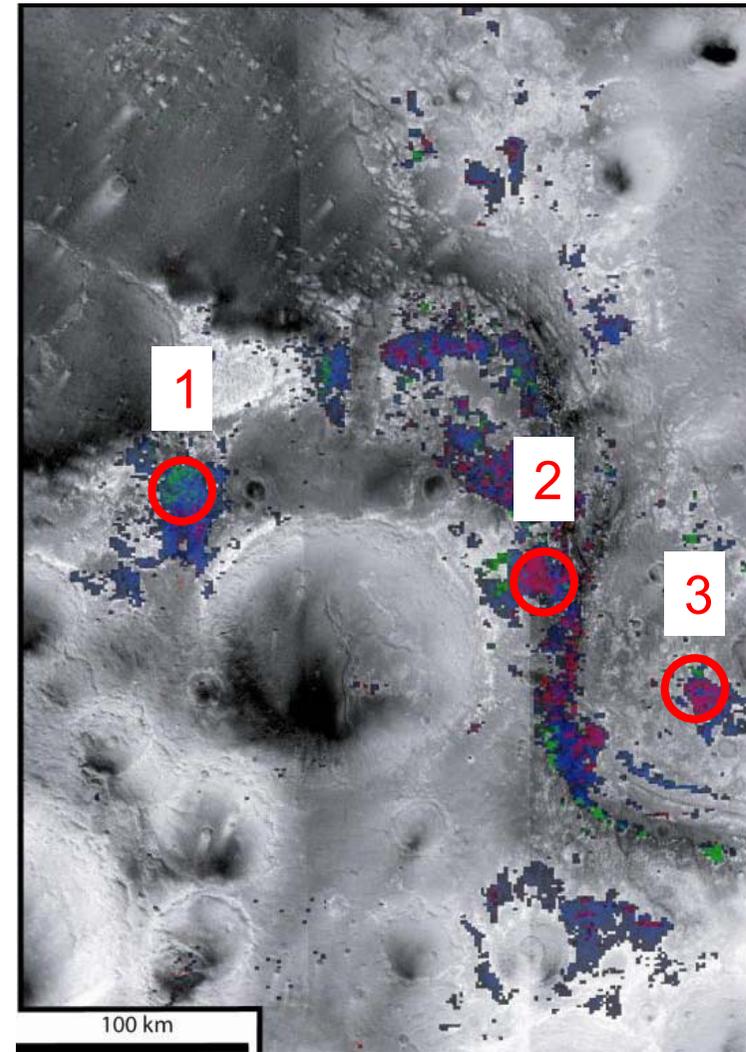
HCP



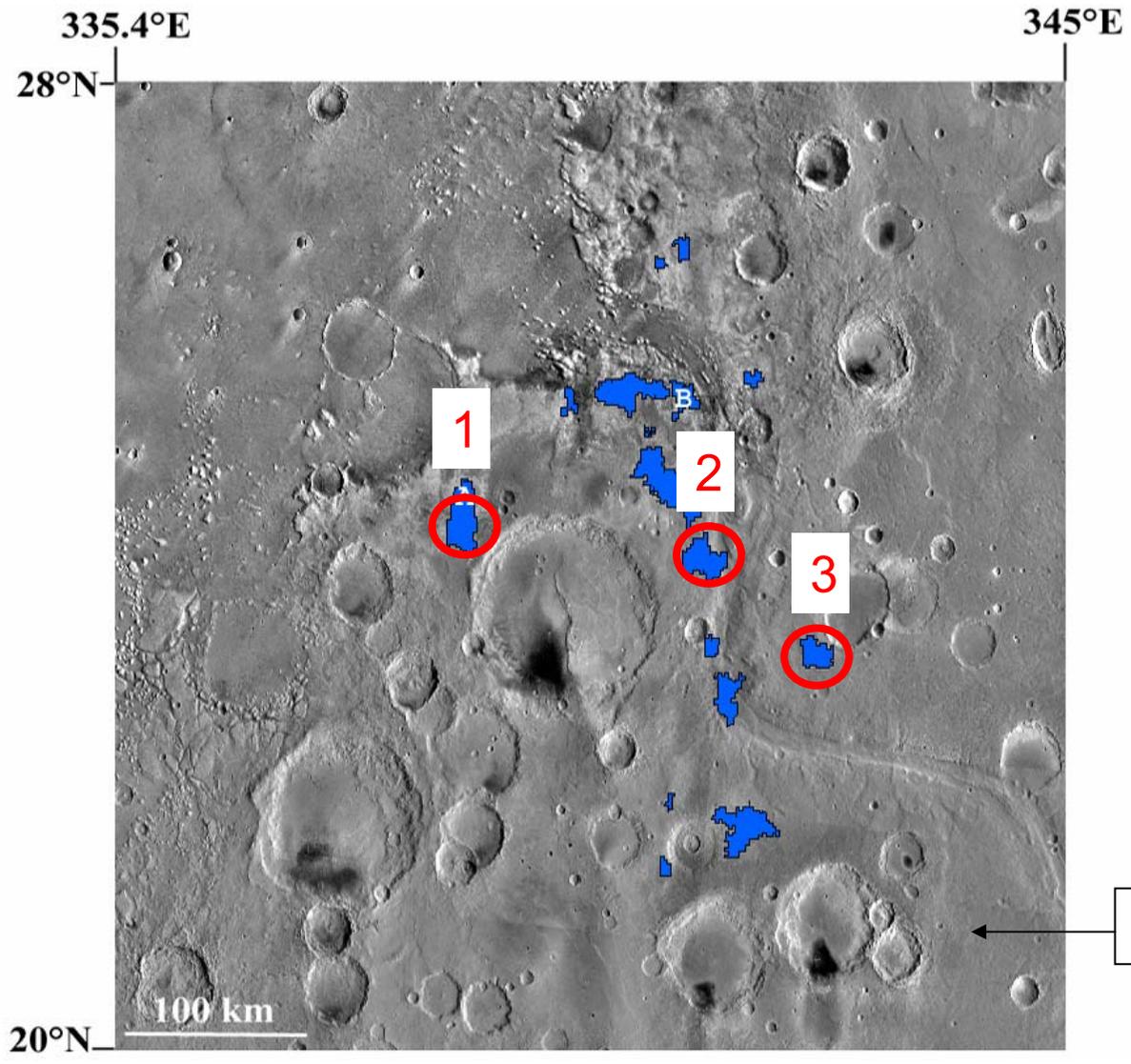
hydration (1.93 μm)



phyllosilicates



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



Material of interest fills almost the entire ellipses

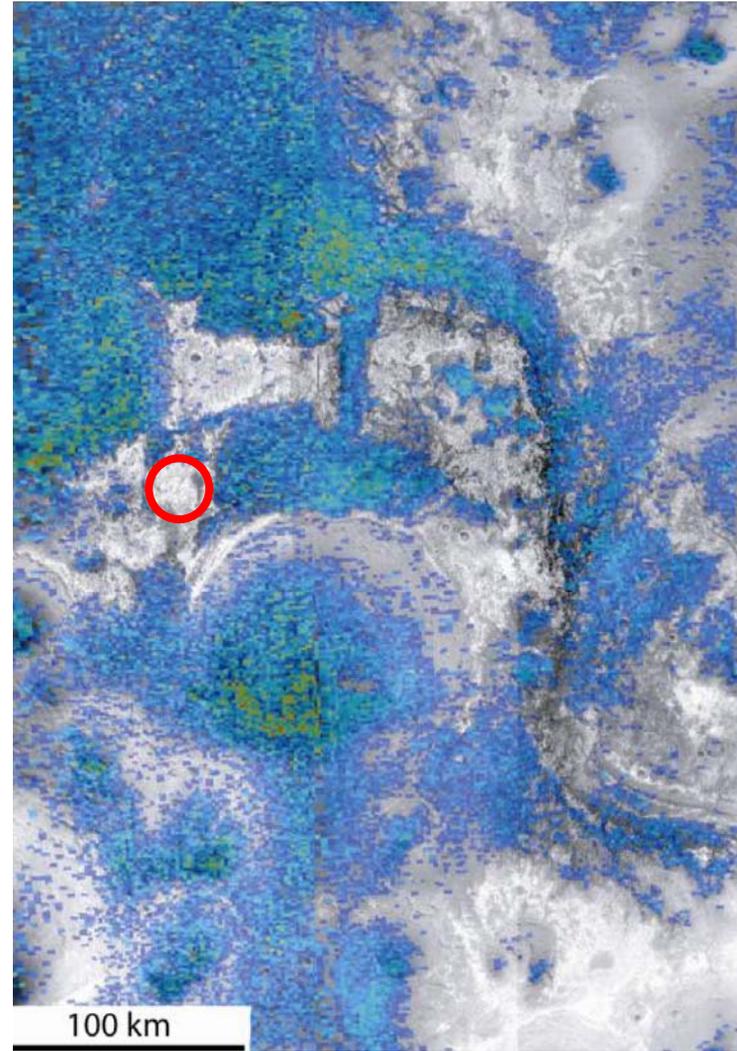
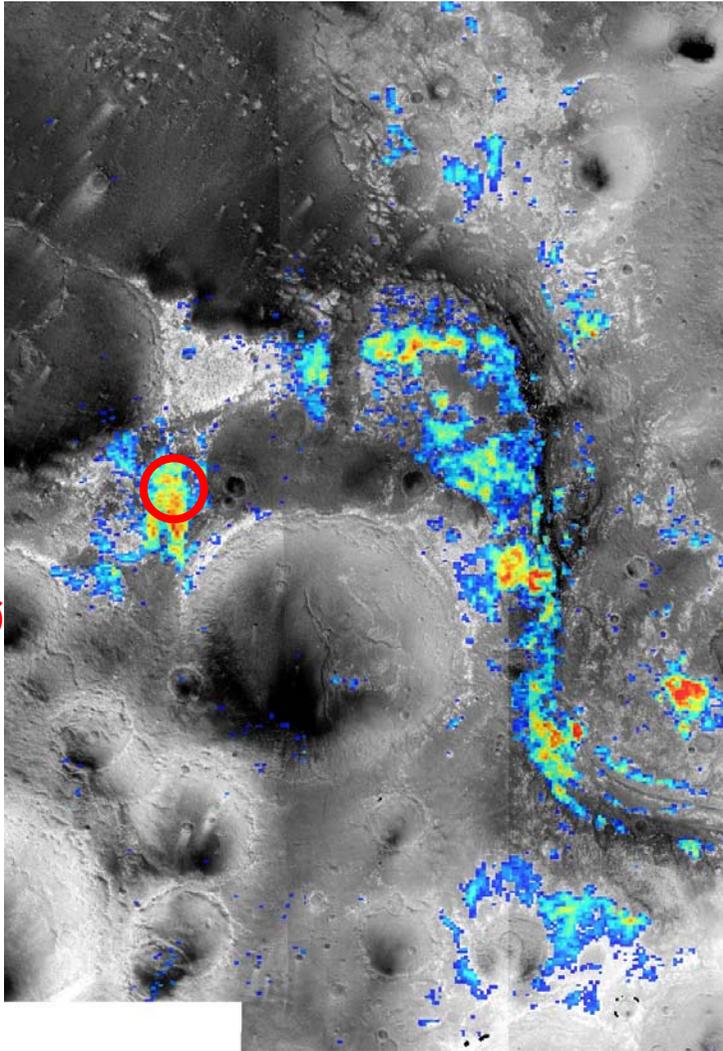
Viking context

Mawrth Vallis site 1

hydration (1.93 μm)

HCP

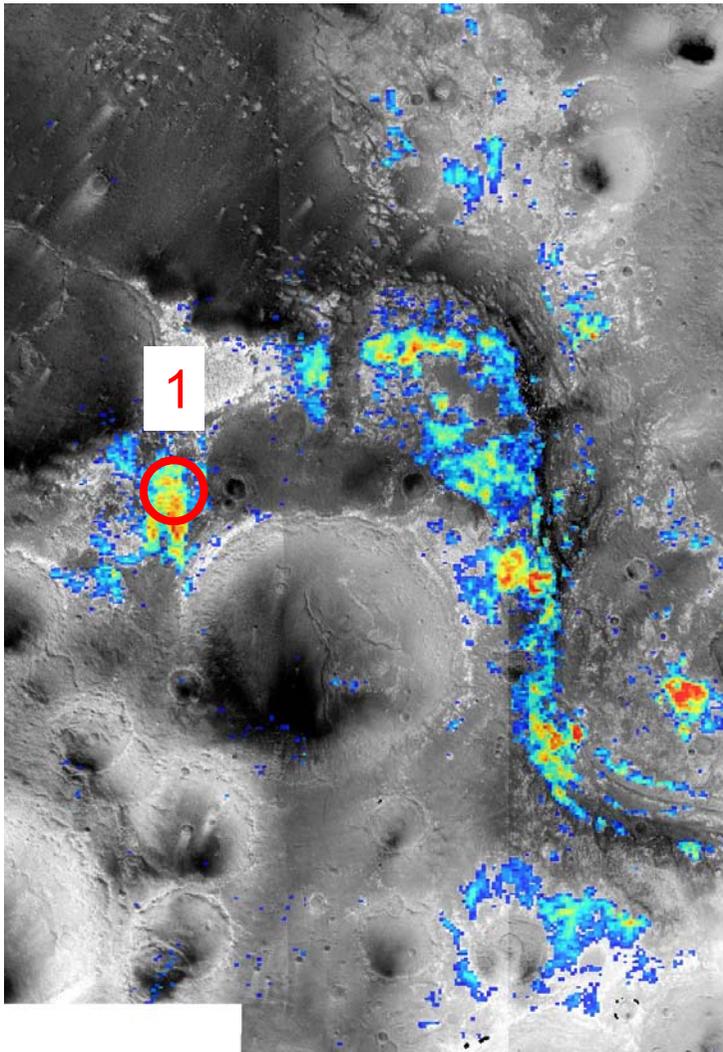
25 km \varnothing



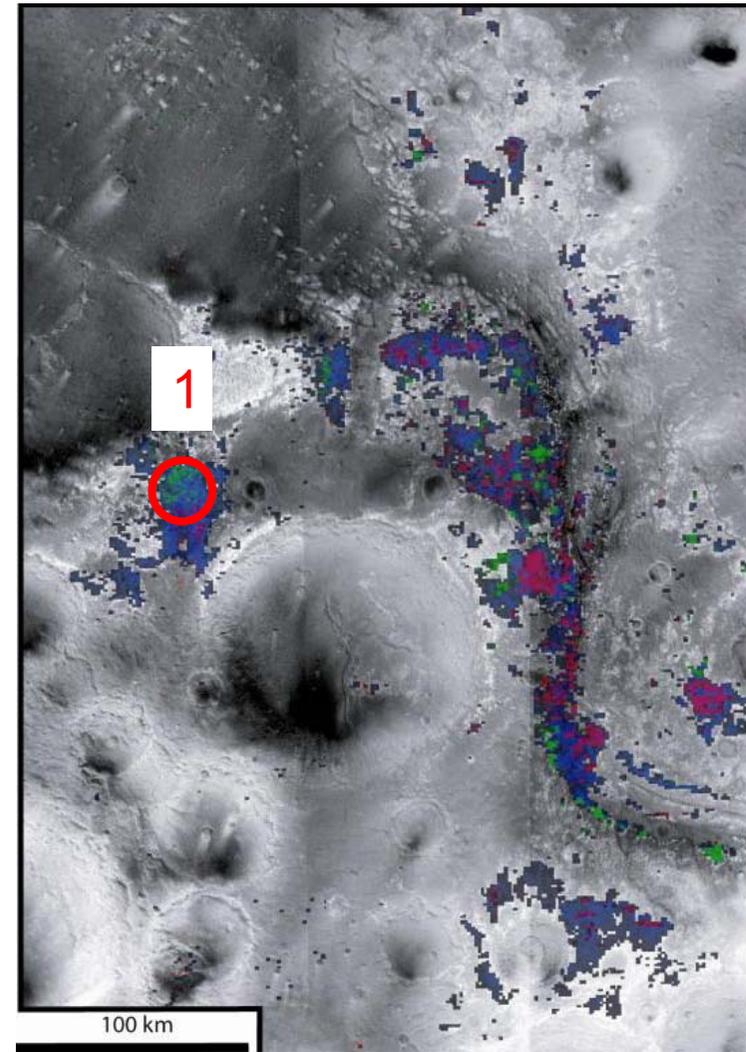
338.9 E

24.5 N

hydration (1.93 μm)



phyllosilicates



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

HRSC color composite

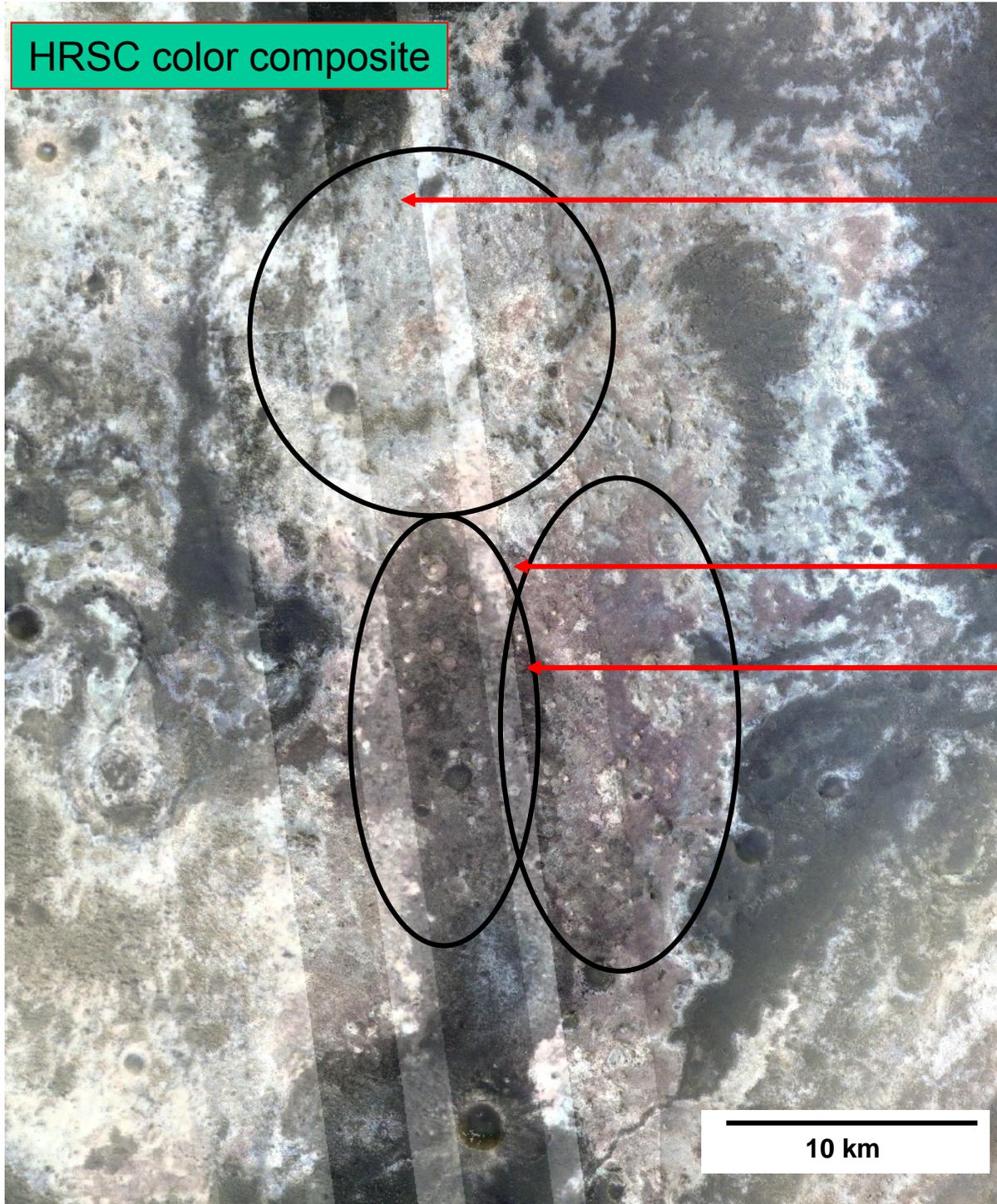
600 m large spots

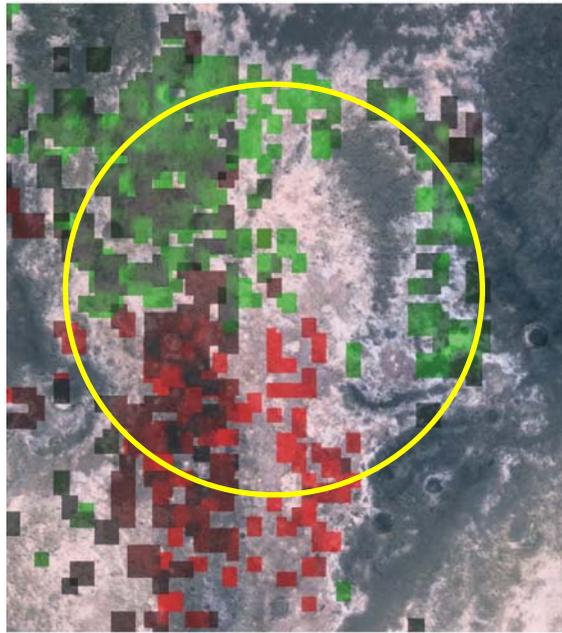
SPOT 1 (338.80,24.63)

SPOT 2 (338.85,24.40)

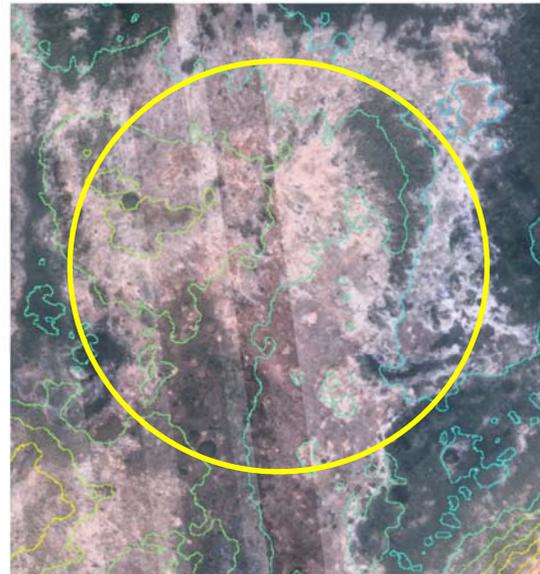
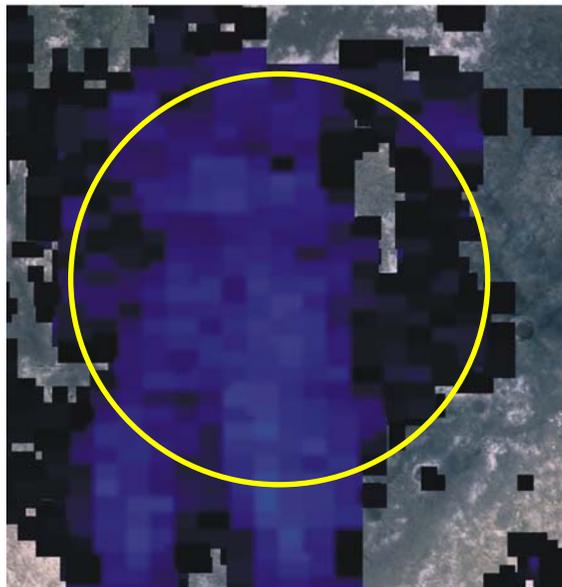
SPOT3 (338.875,24.33)

10 km





HRSC
color



100 m
contours
HRSC
DEM

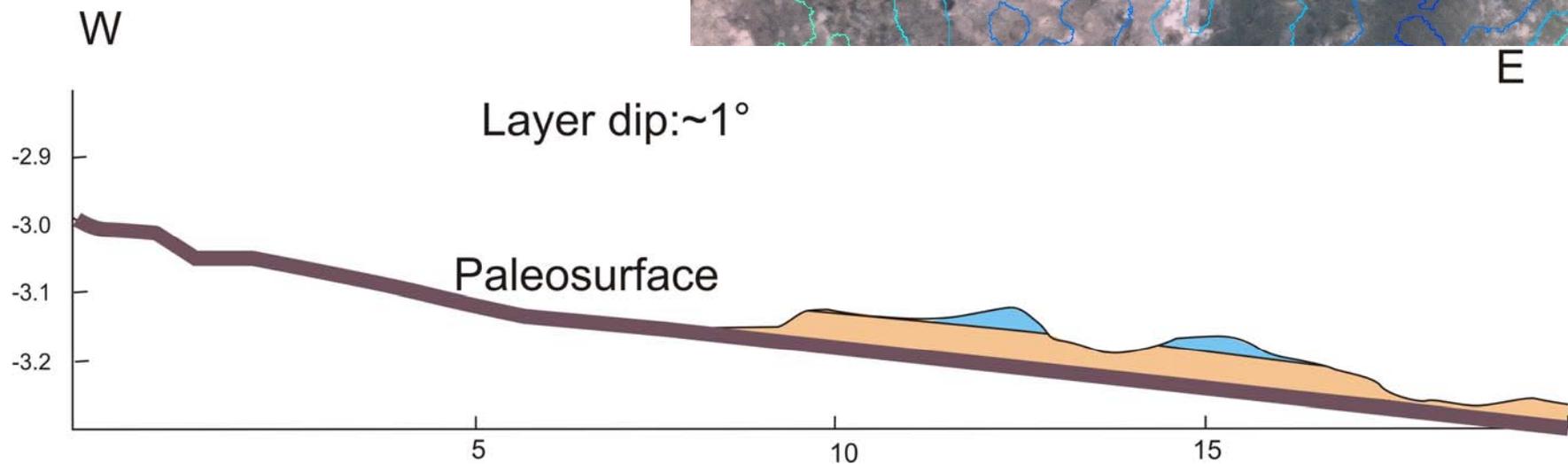
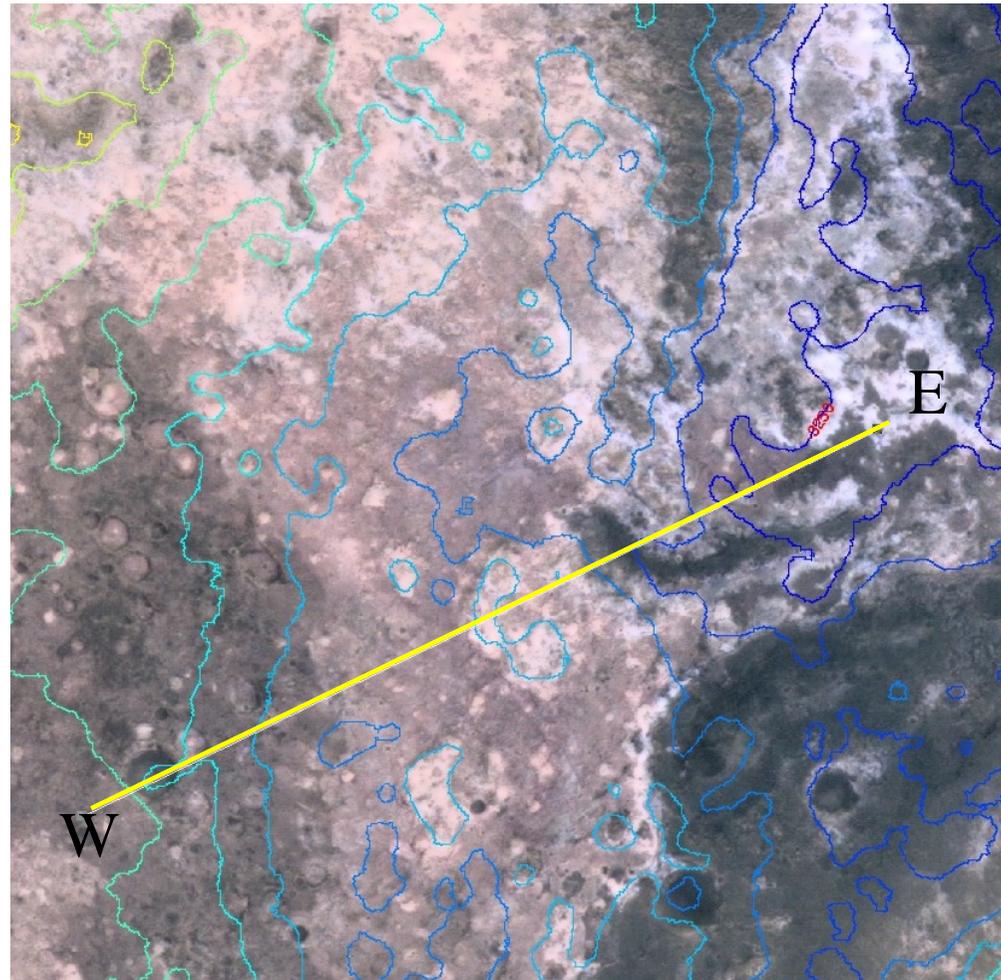
green: Al-OH rich phyllosilicate (2.20 μm)
red: Mg/Fe rich phyllosilicate (2.30 μm)
blue; hydrated minerals (1.93 μm)

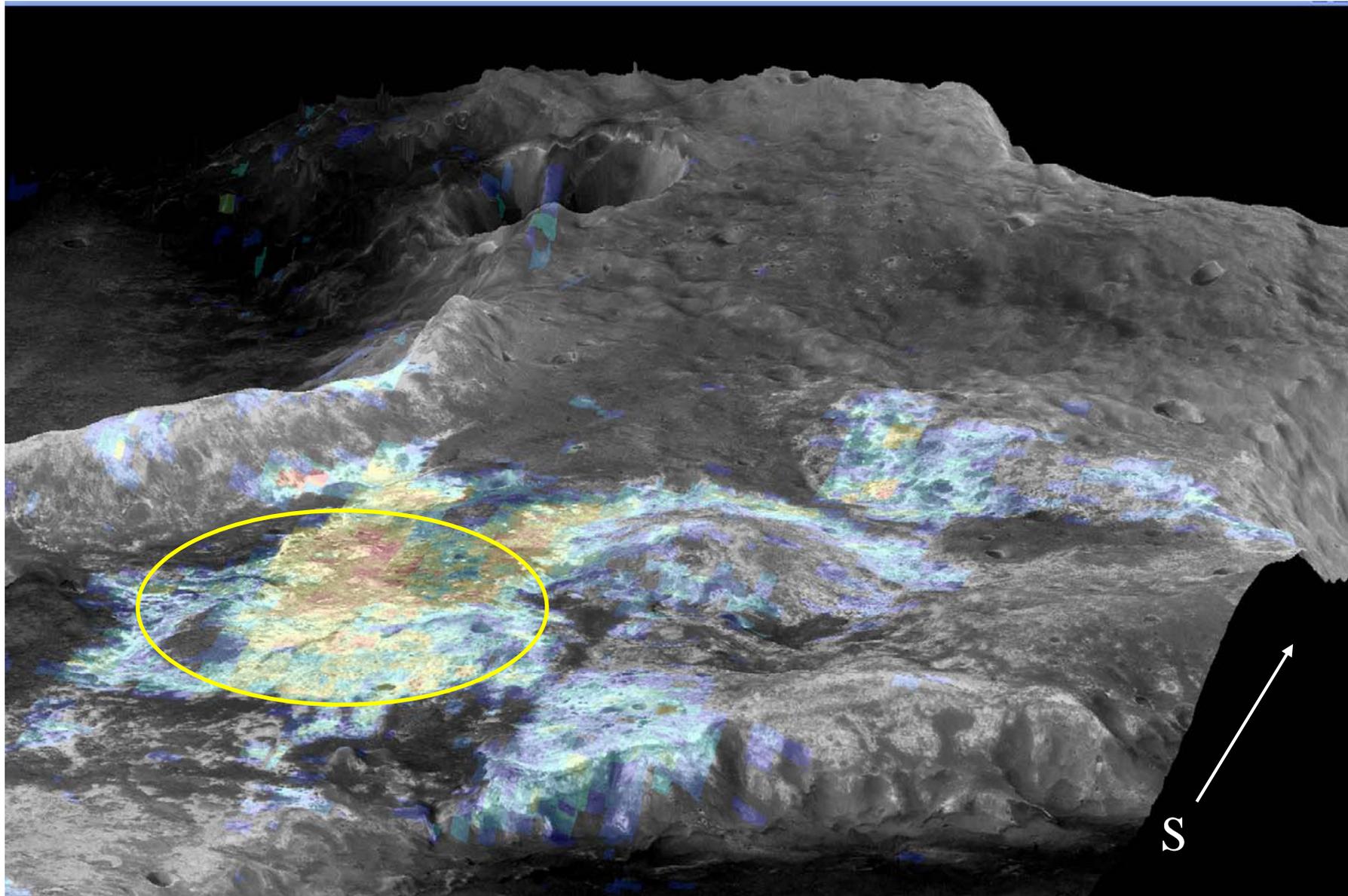
A paleosurface with craters covers the south of the site:

Phyllosilicate-rich layers have formed over this surface as shown by the filled craters



cross section of site 1

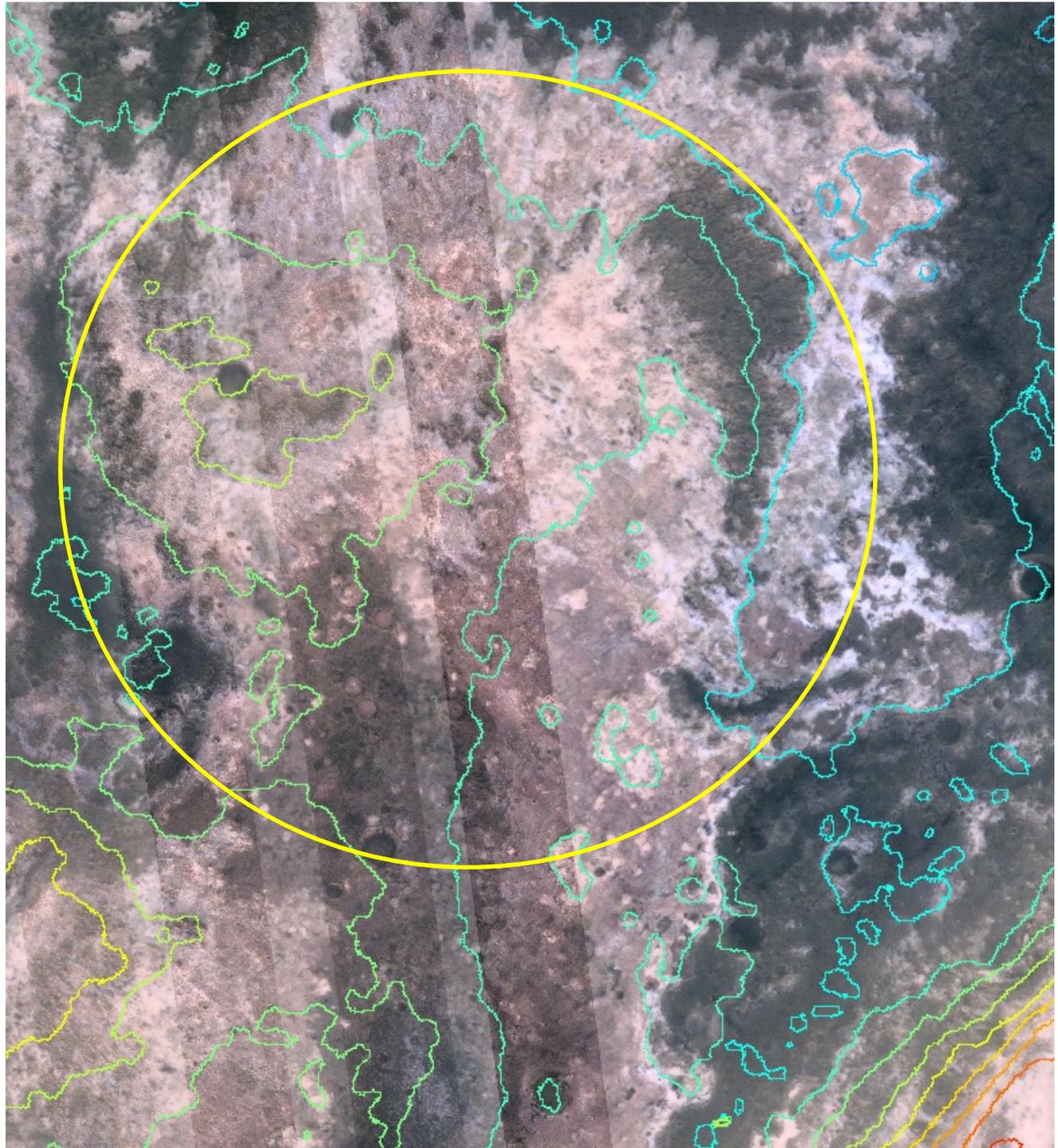




HRSC DEM
(100 m contours)

slopes $< 1^\circ$
at regional scale

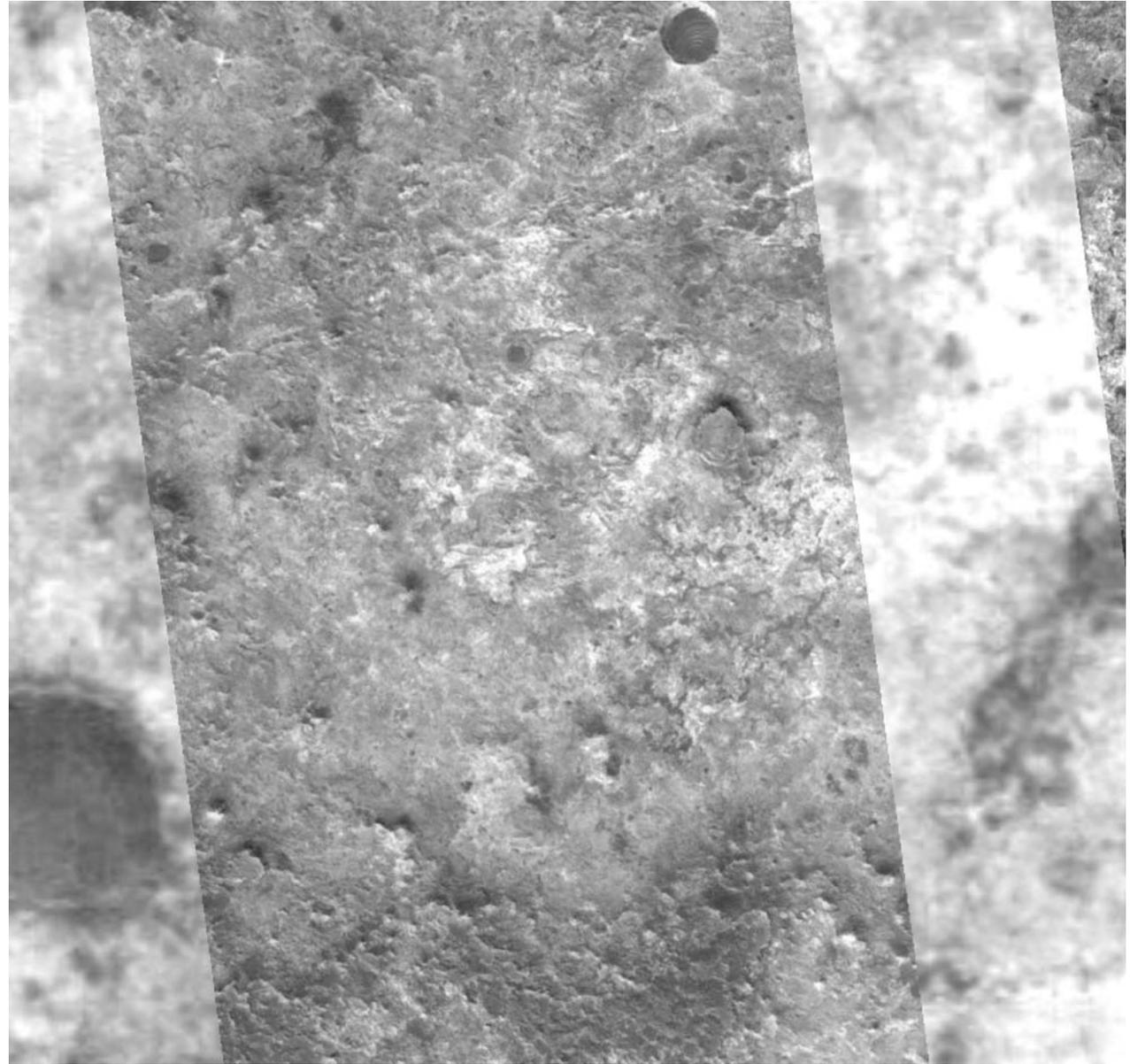
elevation: - 3km



MOC scale

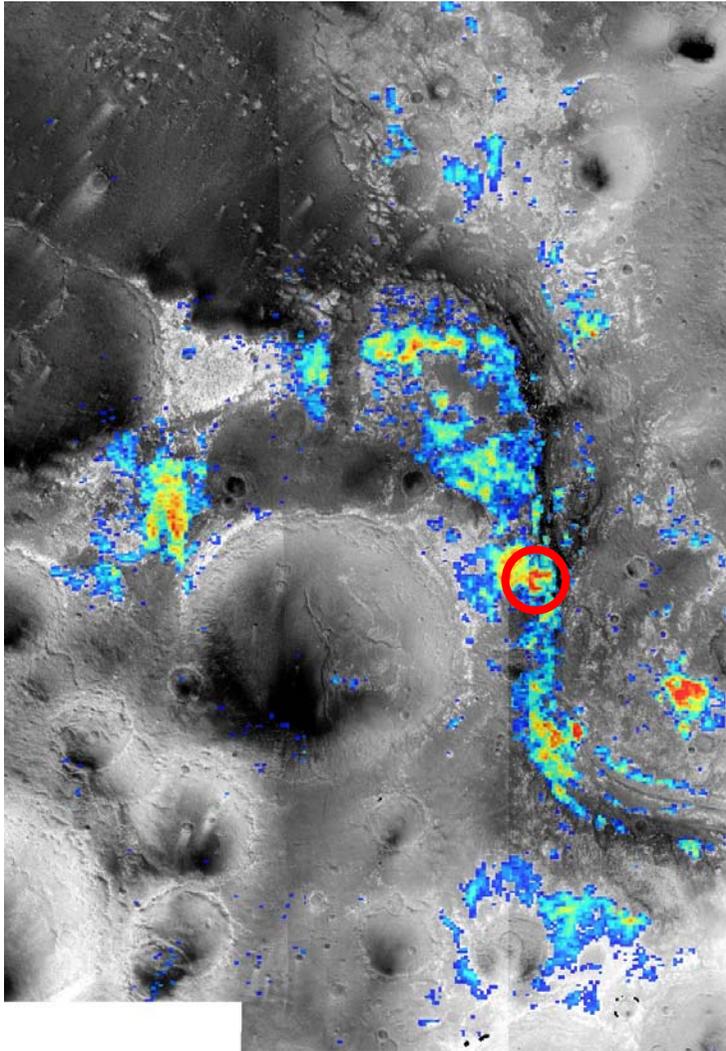
Relatively rough

No HIRISE here yet

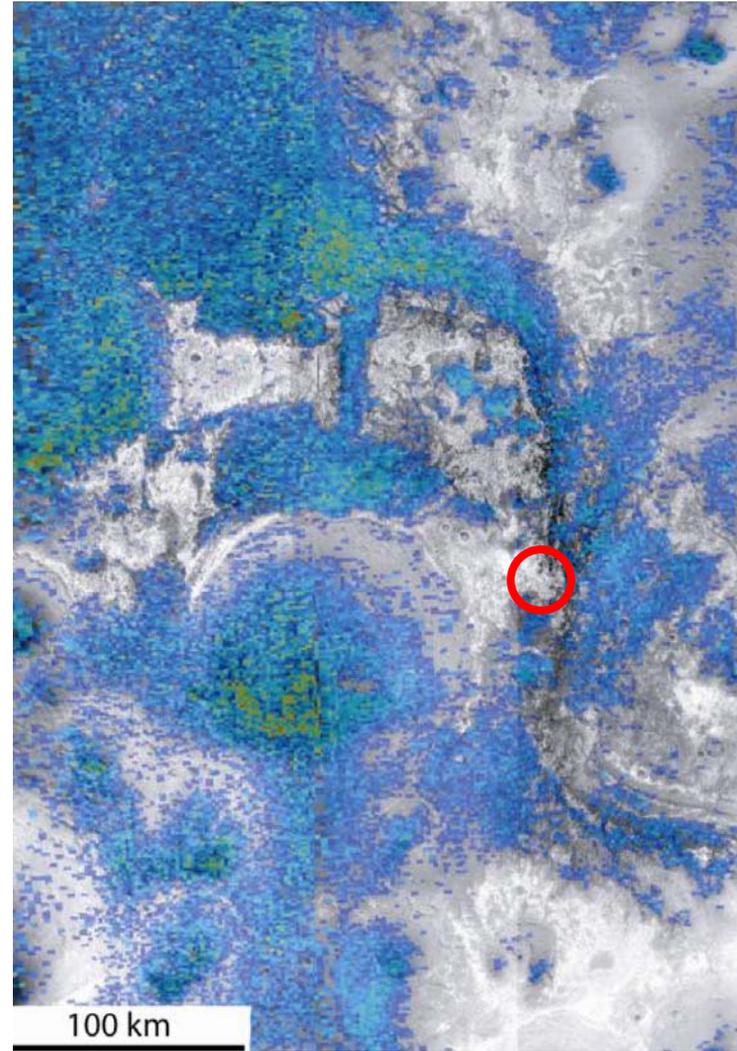


Mawrth Vallis site 2

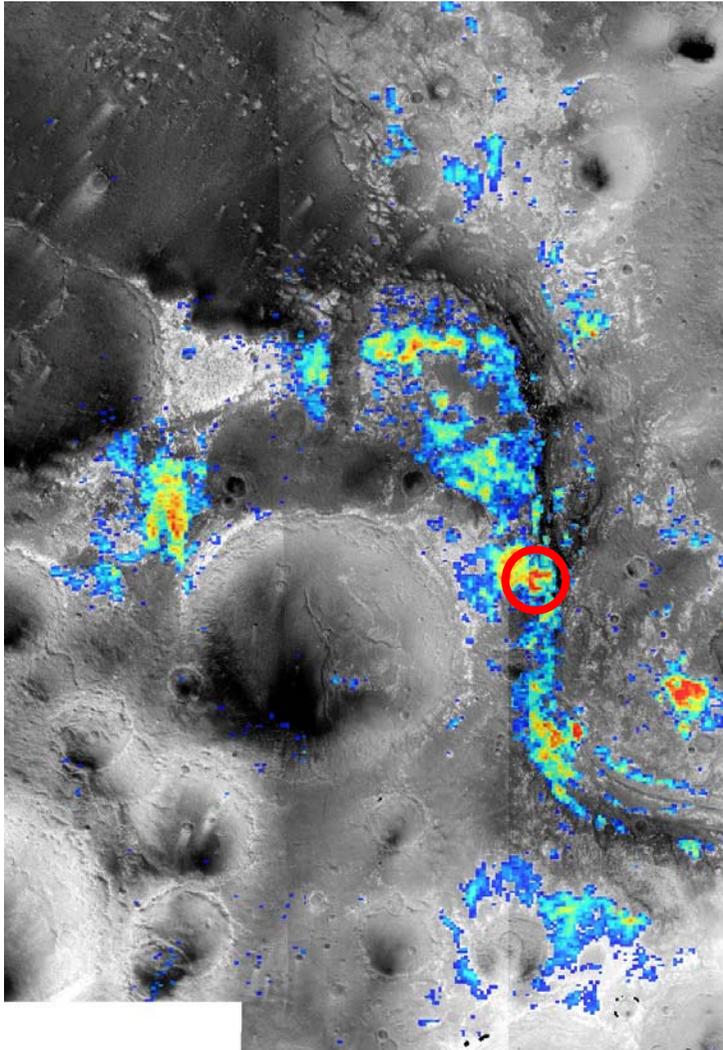
hydration (1.93 μm)



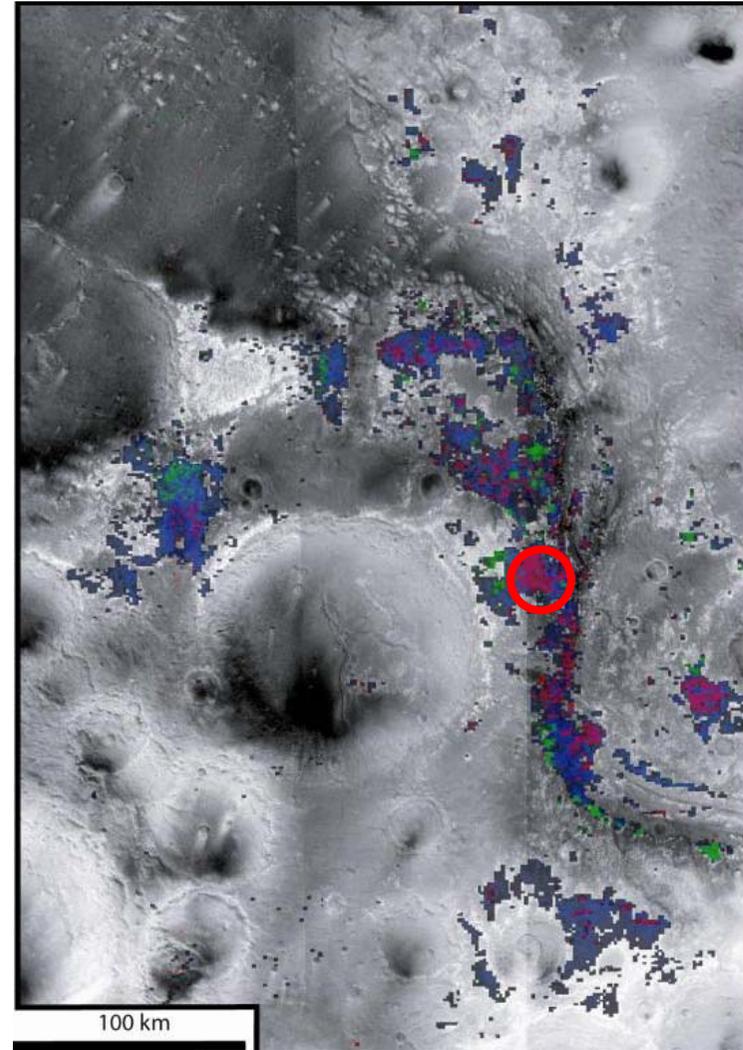
HCP



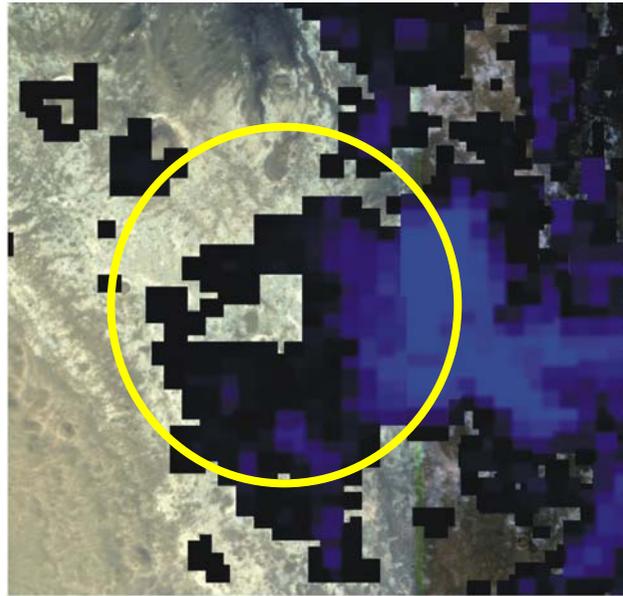
hydration (1.93 μm)



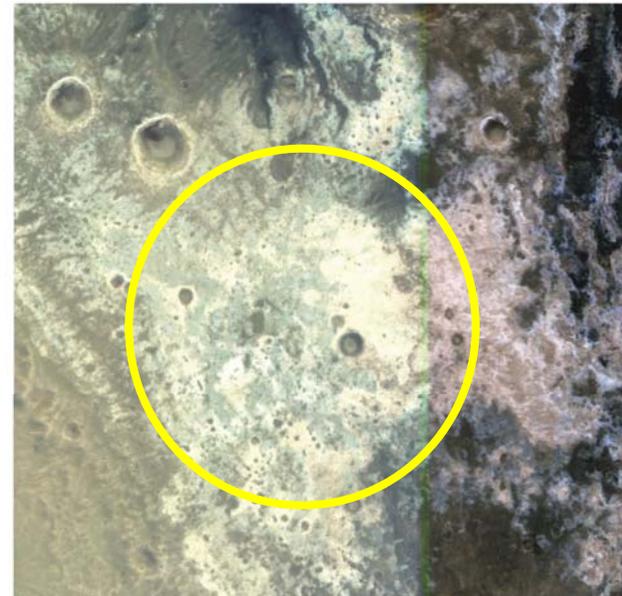
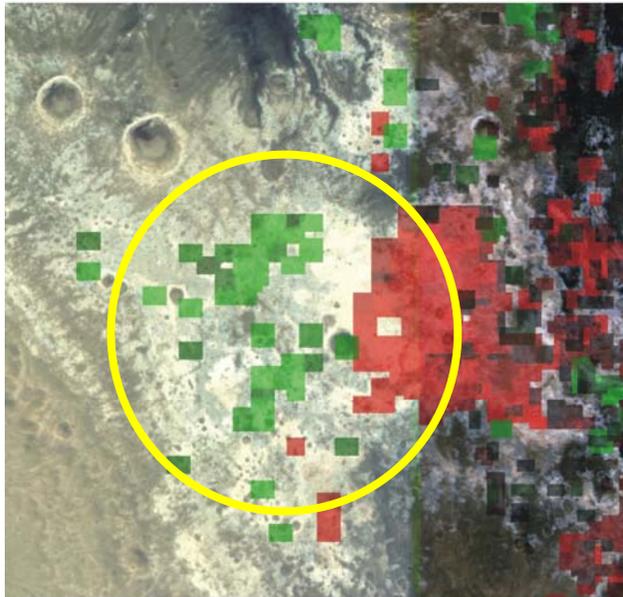
phyllosilicates



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

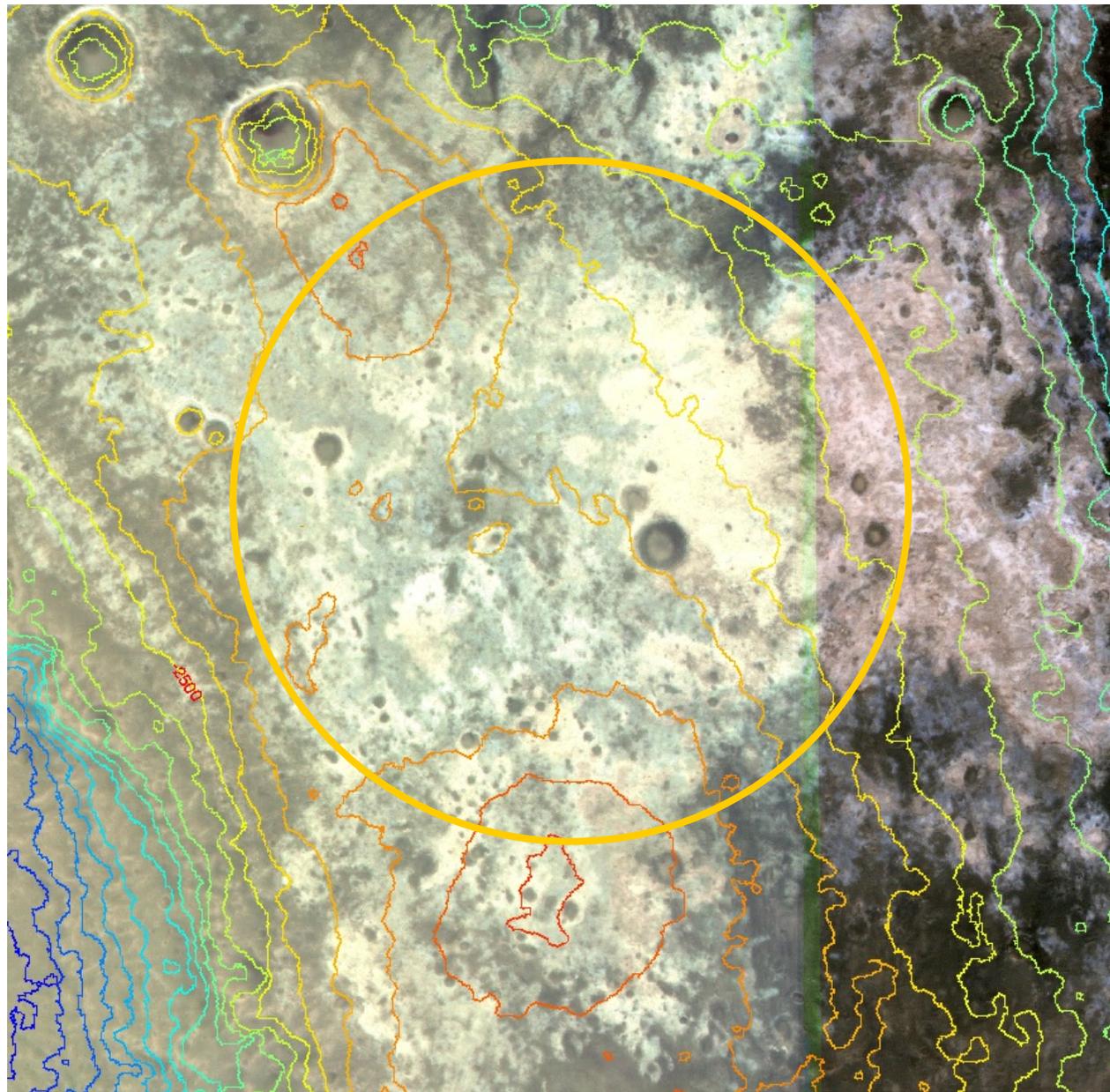


HRSC
color

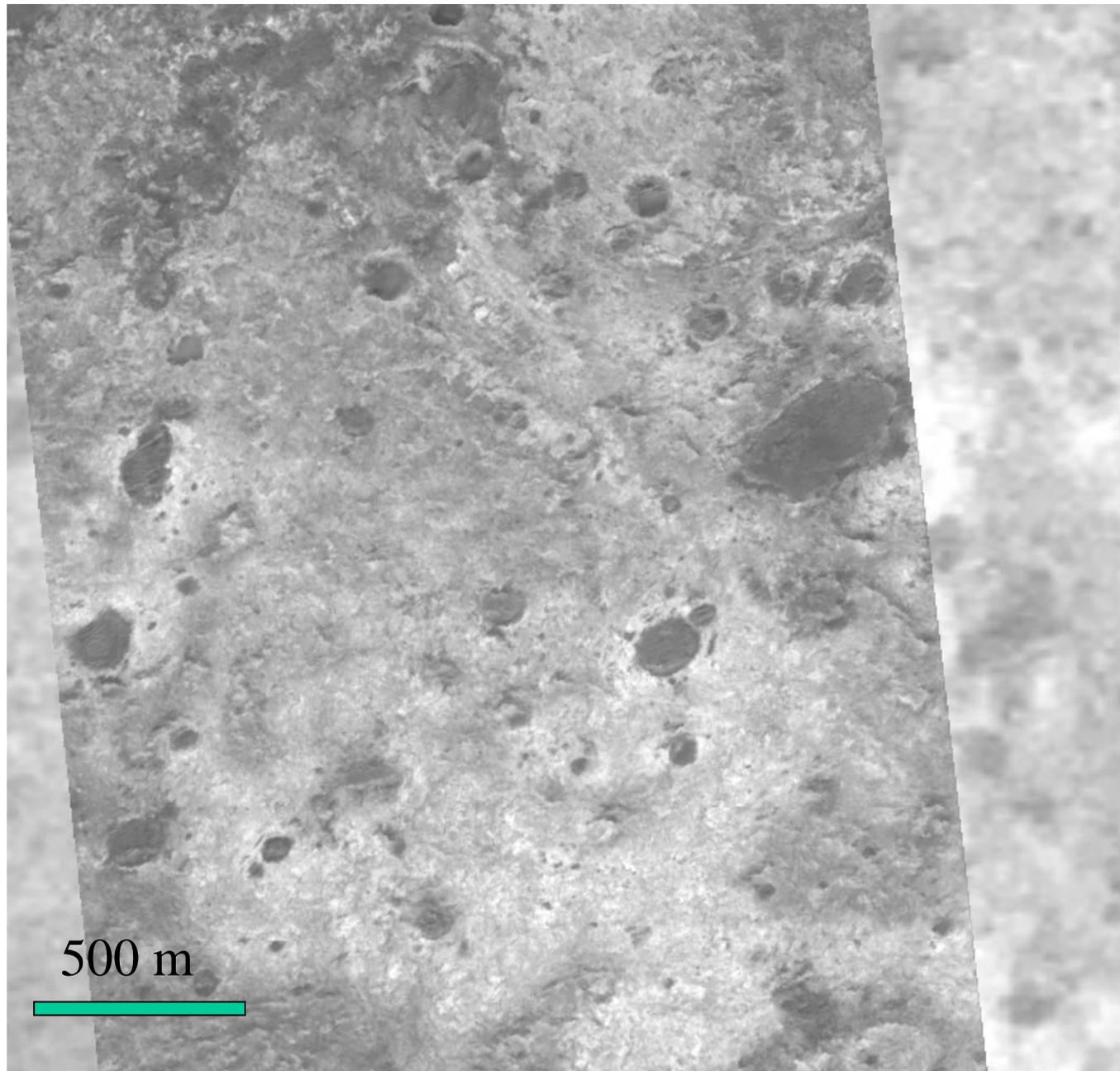


green: Al-OH rich phyllosilicate (2.20 μm)
red: Mg/Fe rich phyllosilicate (2.30 μm)
blue; hydrated minerals (1.93 μm)

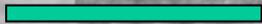
HRSC DEM
contours 100 m
slopes: $<2^\circ$
elevation: - 2.5 km



MOC scale

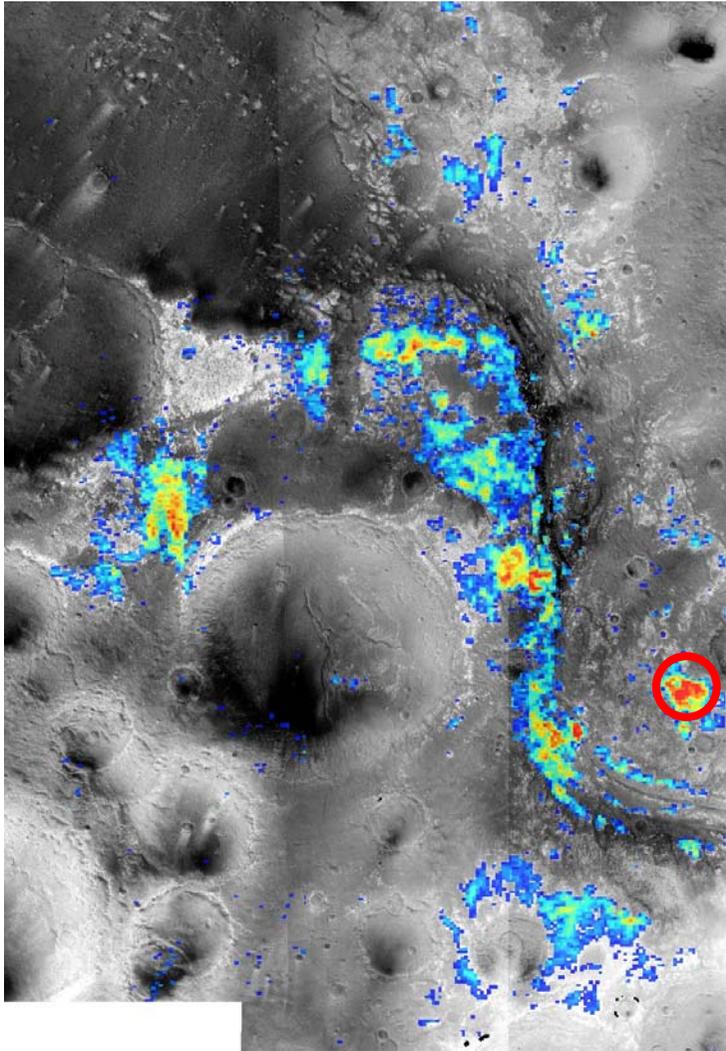


500 m

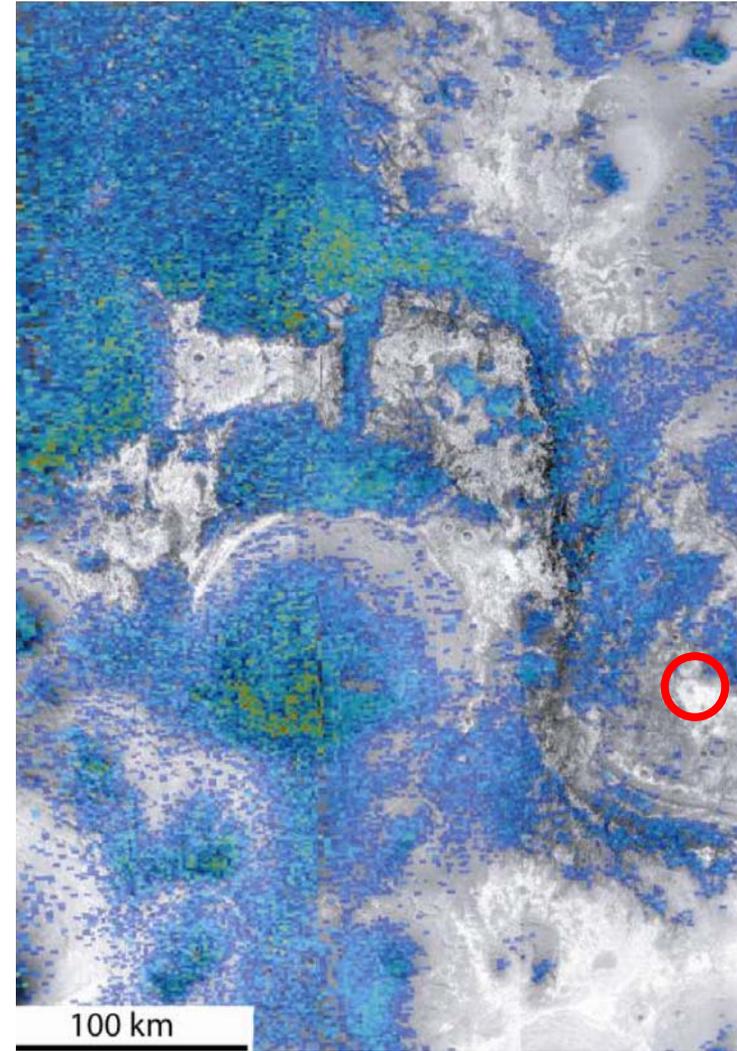


Mawrth Vallis site 3

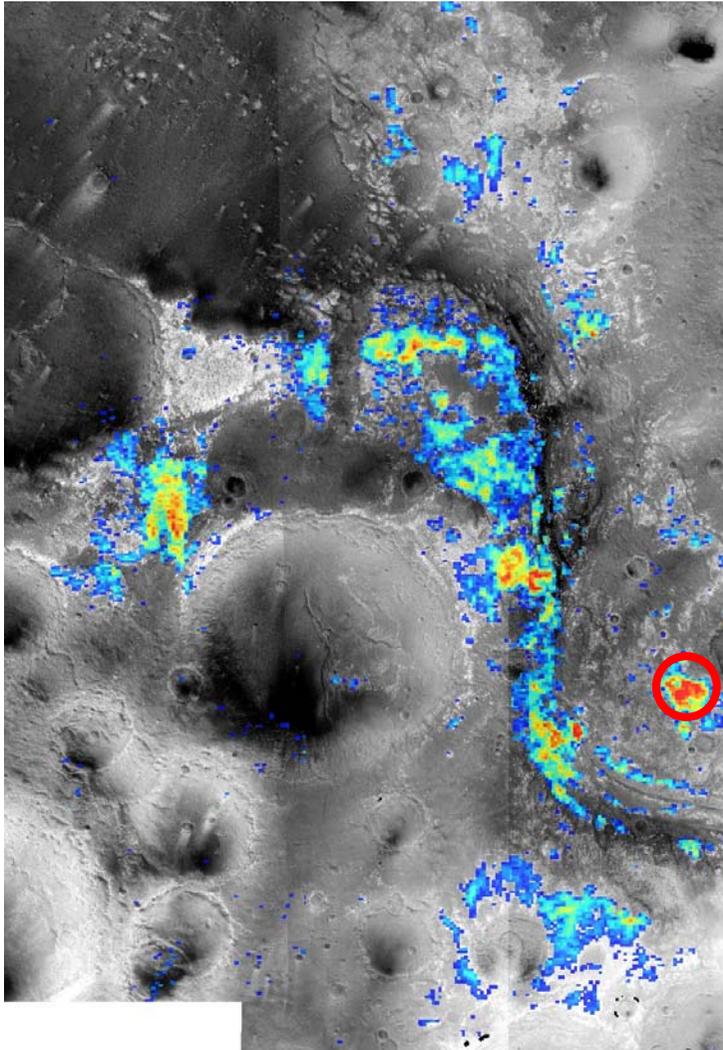
hydration (1.93 μm)



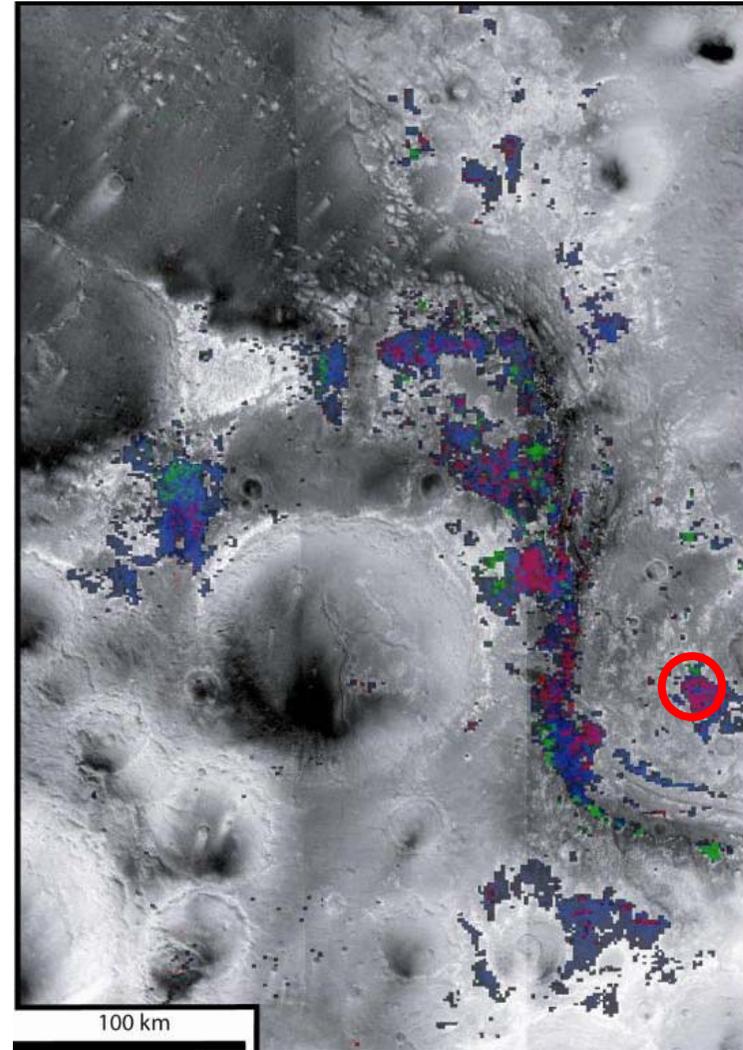
HCP



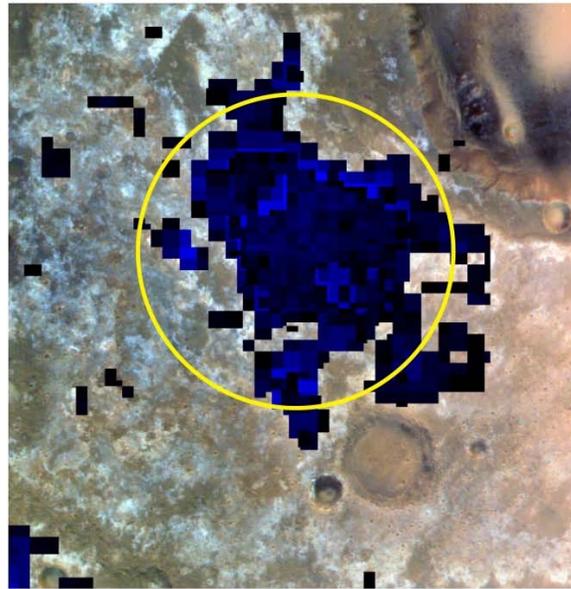
hydration (1.93 μm)



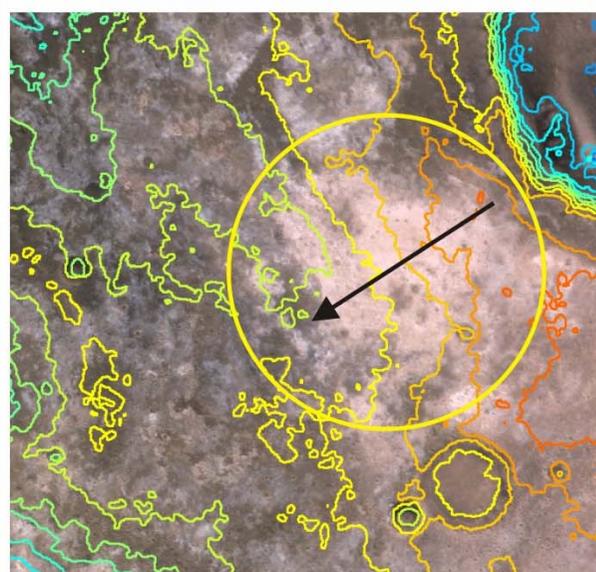
phyllosilicates



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



HRSC
color



100 m
contours
HRSC
DEM

Maximum slope 1.5°

green: Al-OH rich phyllosilicate (2.20 μm)
red: Mg/Fe rich phyllosilicate (2.30 μm)
blue; hydrated minerals (1.93 μm)



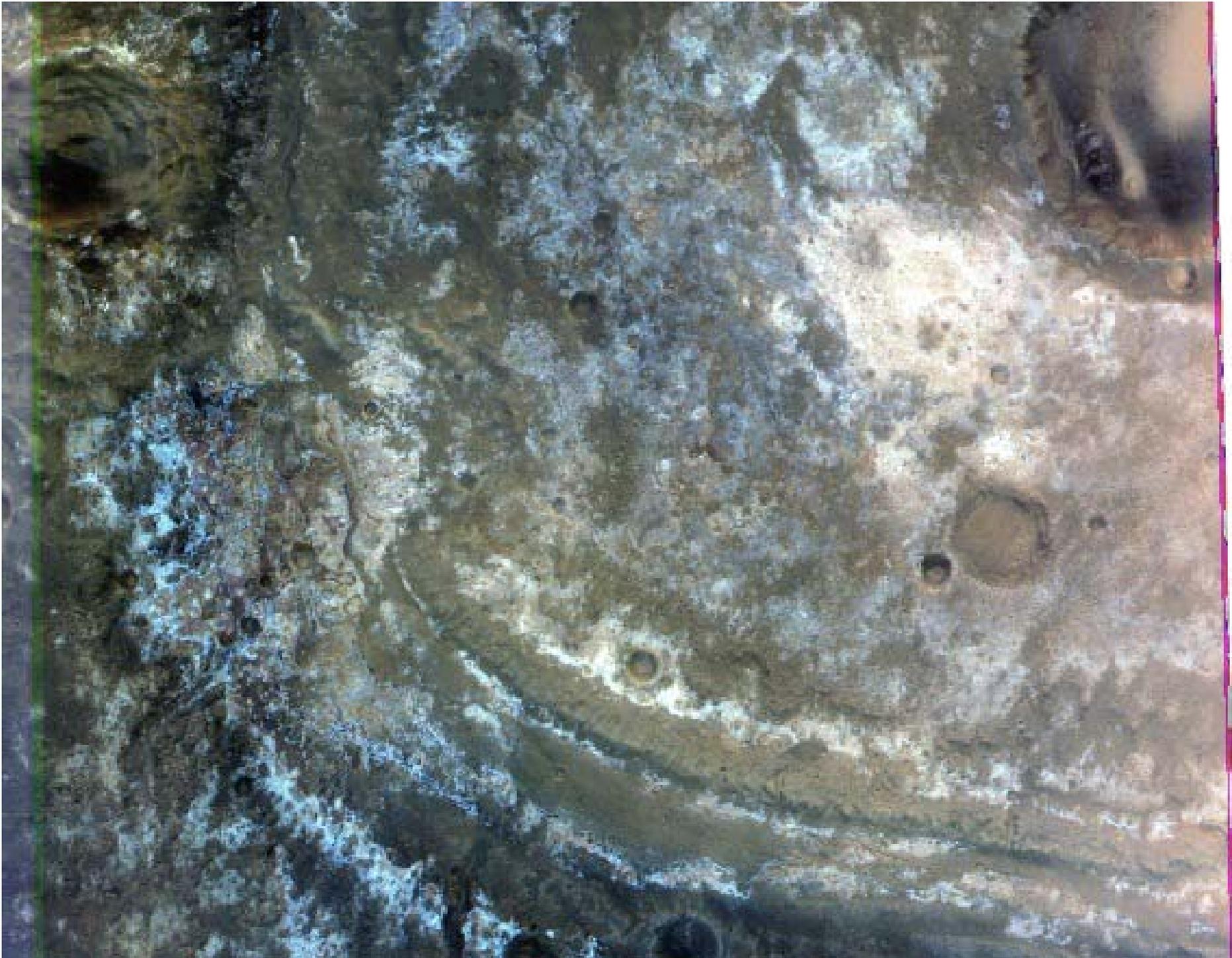
HRSC color composite

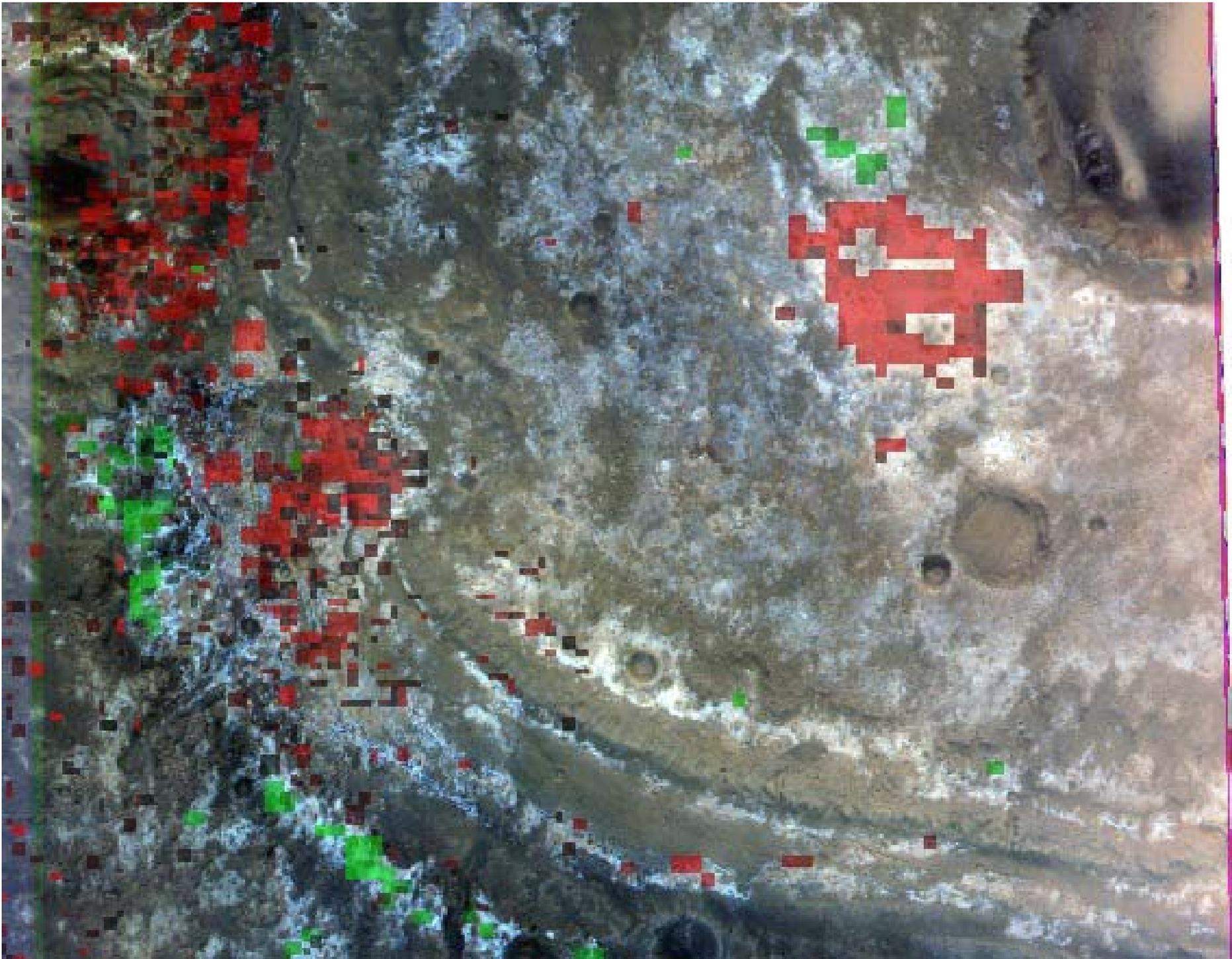


green: Al-OH rich phyllosilicate (2.20 μm)
red: Mg/Fe rich phyllosilicate (2.30 μm)

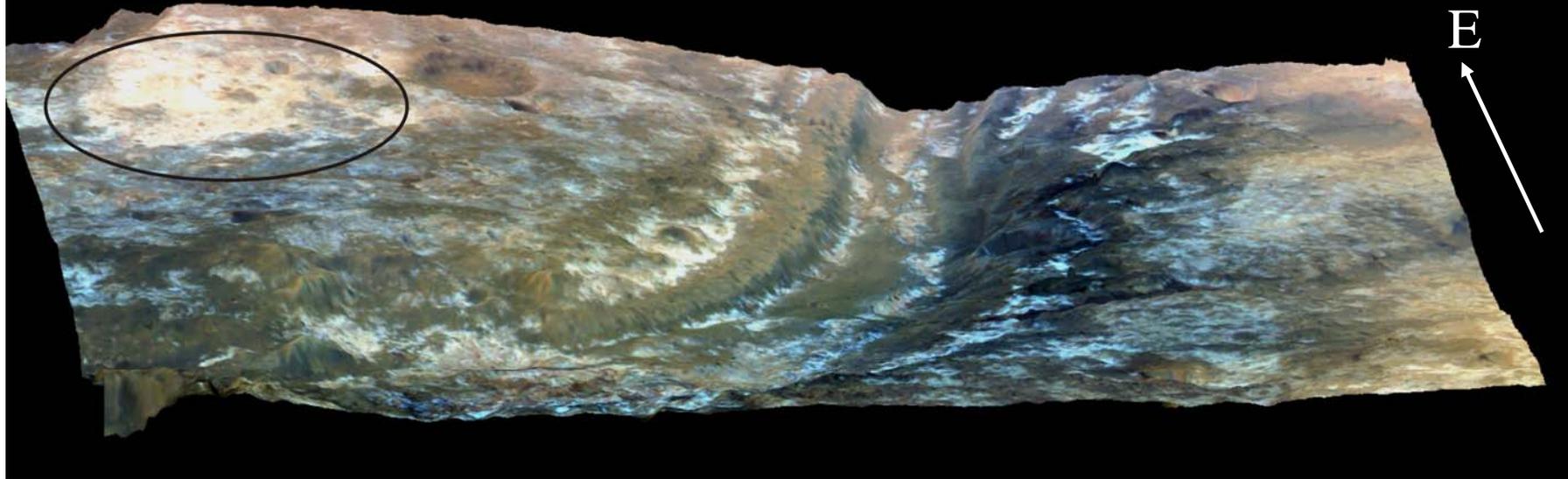








Landing Site 3

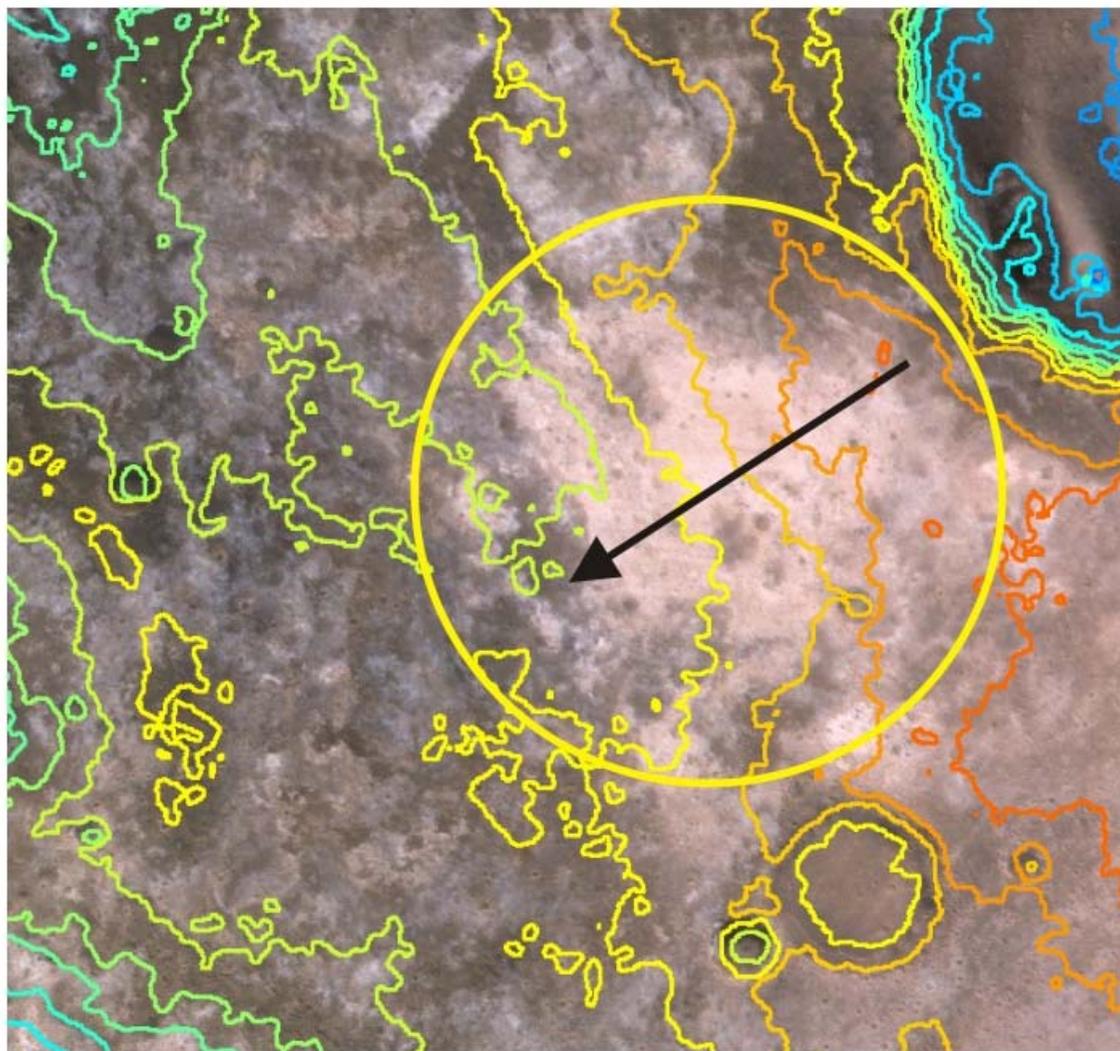


E

N

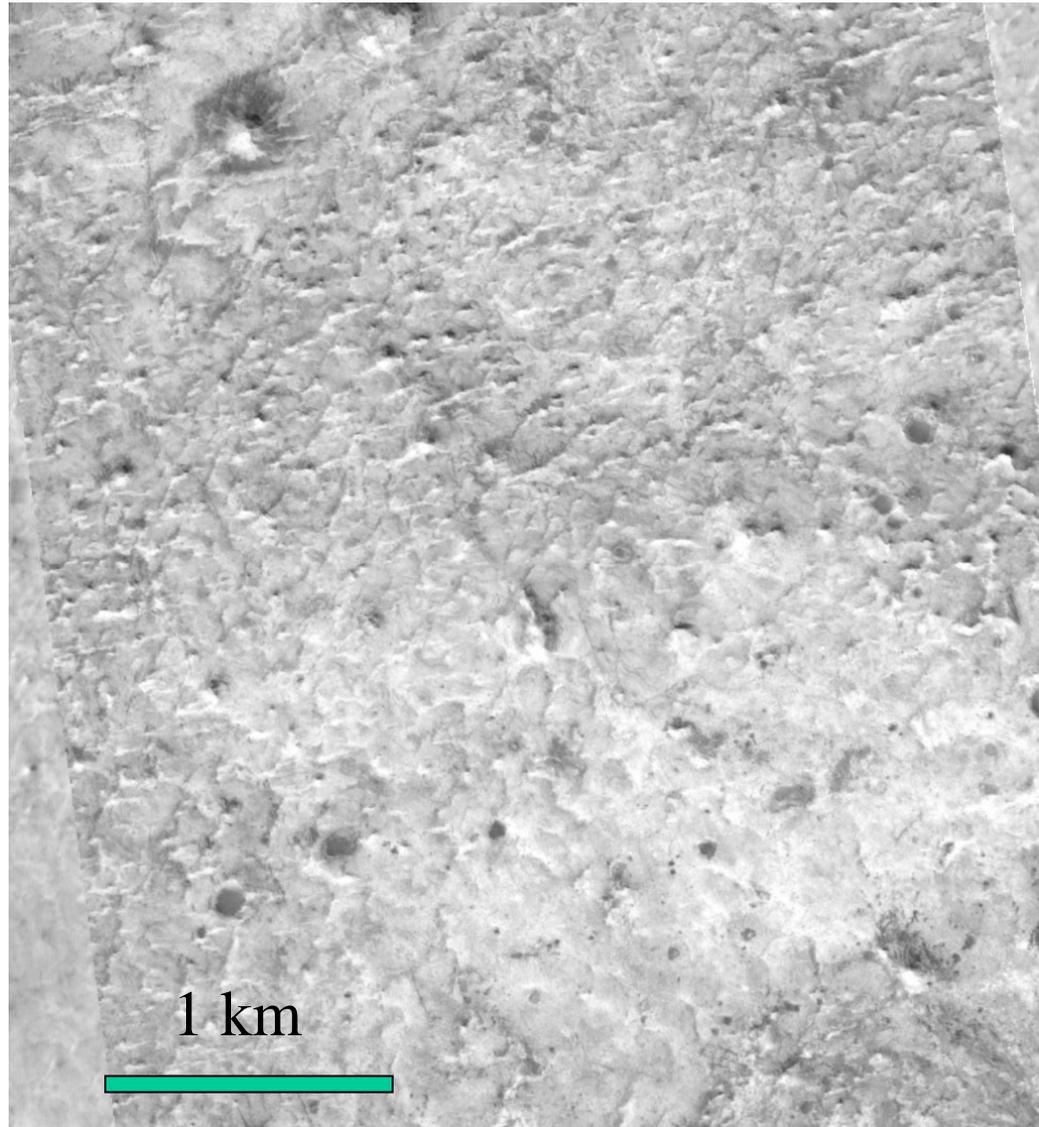
S

elevation: < -2 km
slopes at km scale: $< 1.5^\circ$



Maximum slope 1.5°

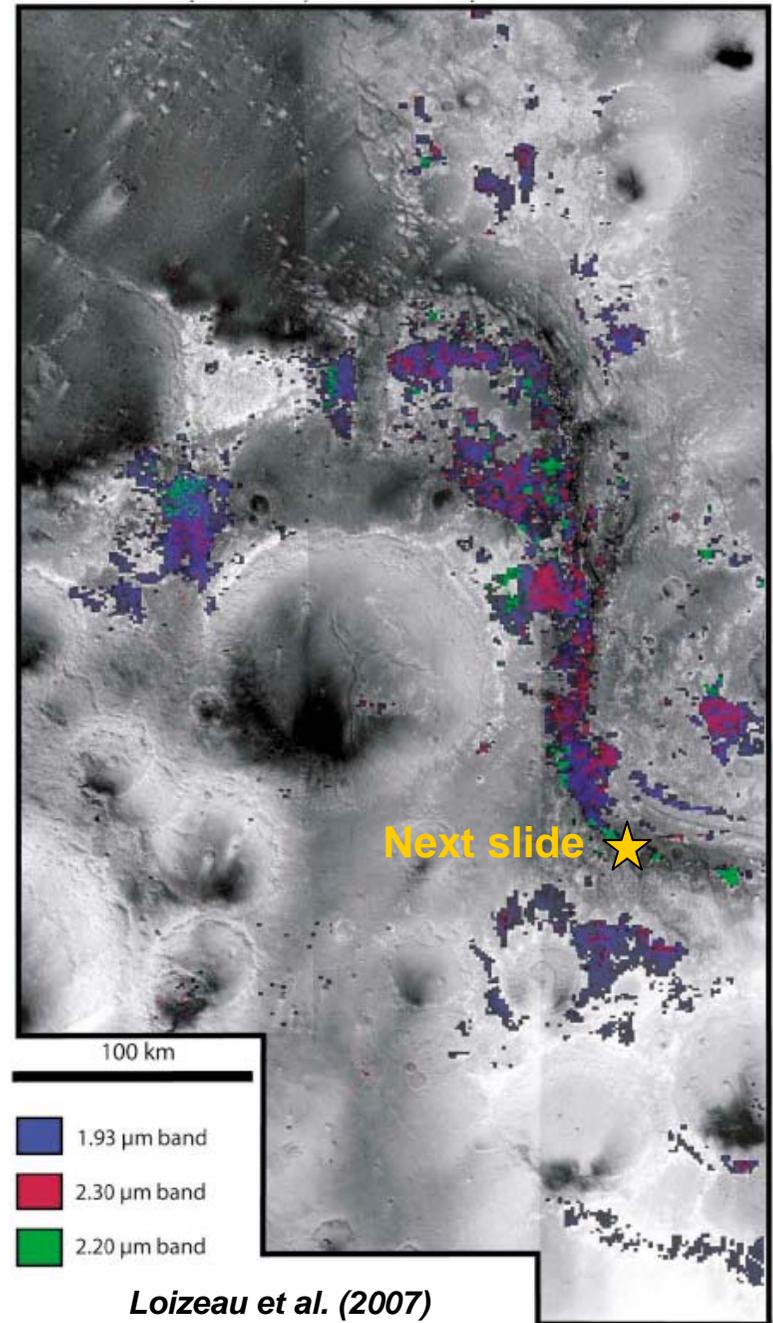
relatively rough
at **MOC** scale
meter scale roughness
Requires **HIRISE**



OMEGA proposed sites in Mawrth Vallis

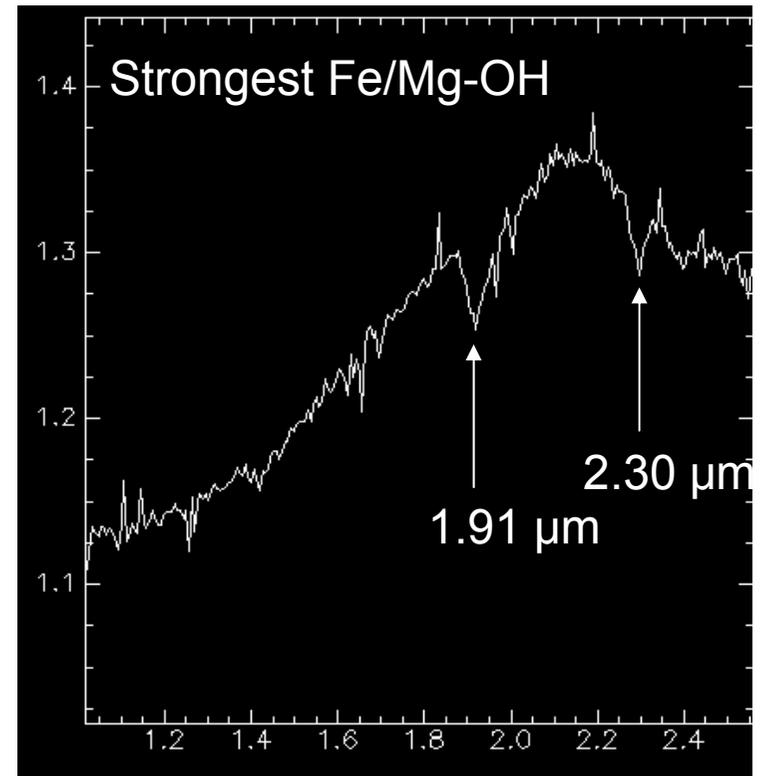
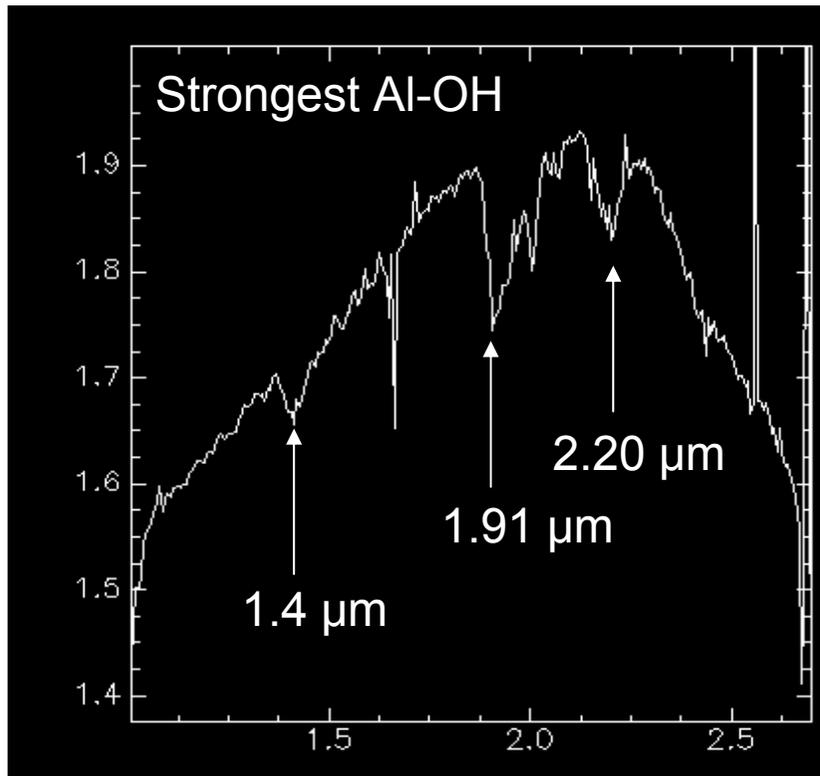
Mawrth Vallis constitutes the region at the surface of Mars where one finds

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

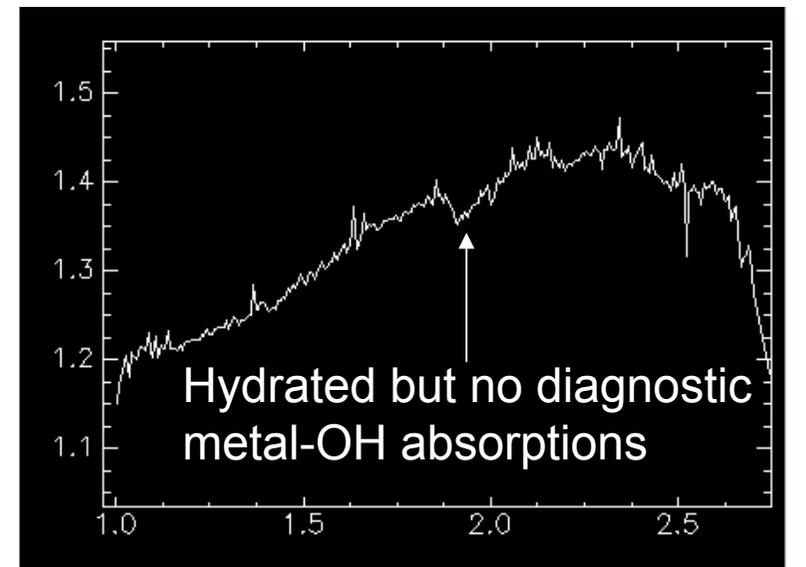
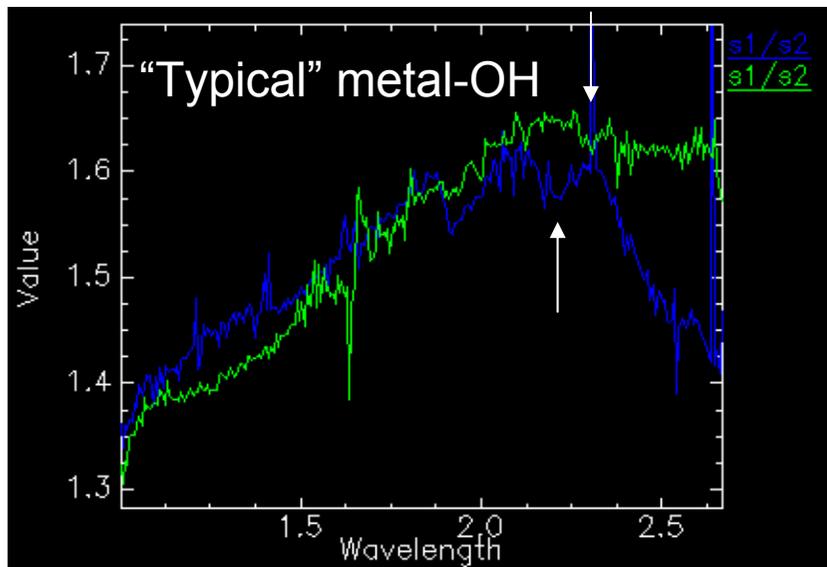


Loizeau et al. (2007)

by courtesy of James Wray



CRISM
Ratio
Spectra



CRISM FRT_3BFB on
HiRISE PSP_2140_2025

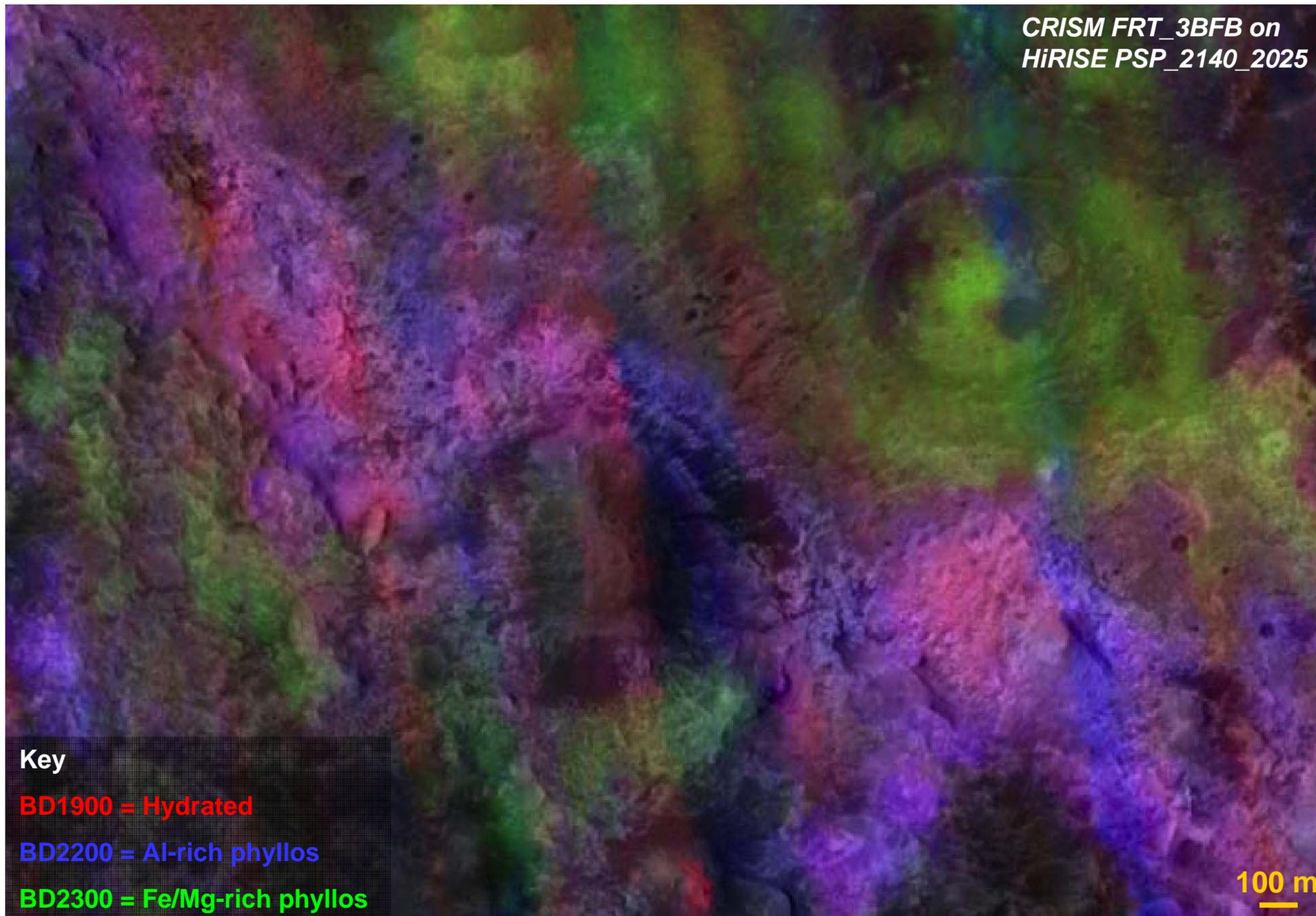
Key

BD1900 = Hydrated

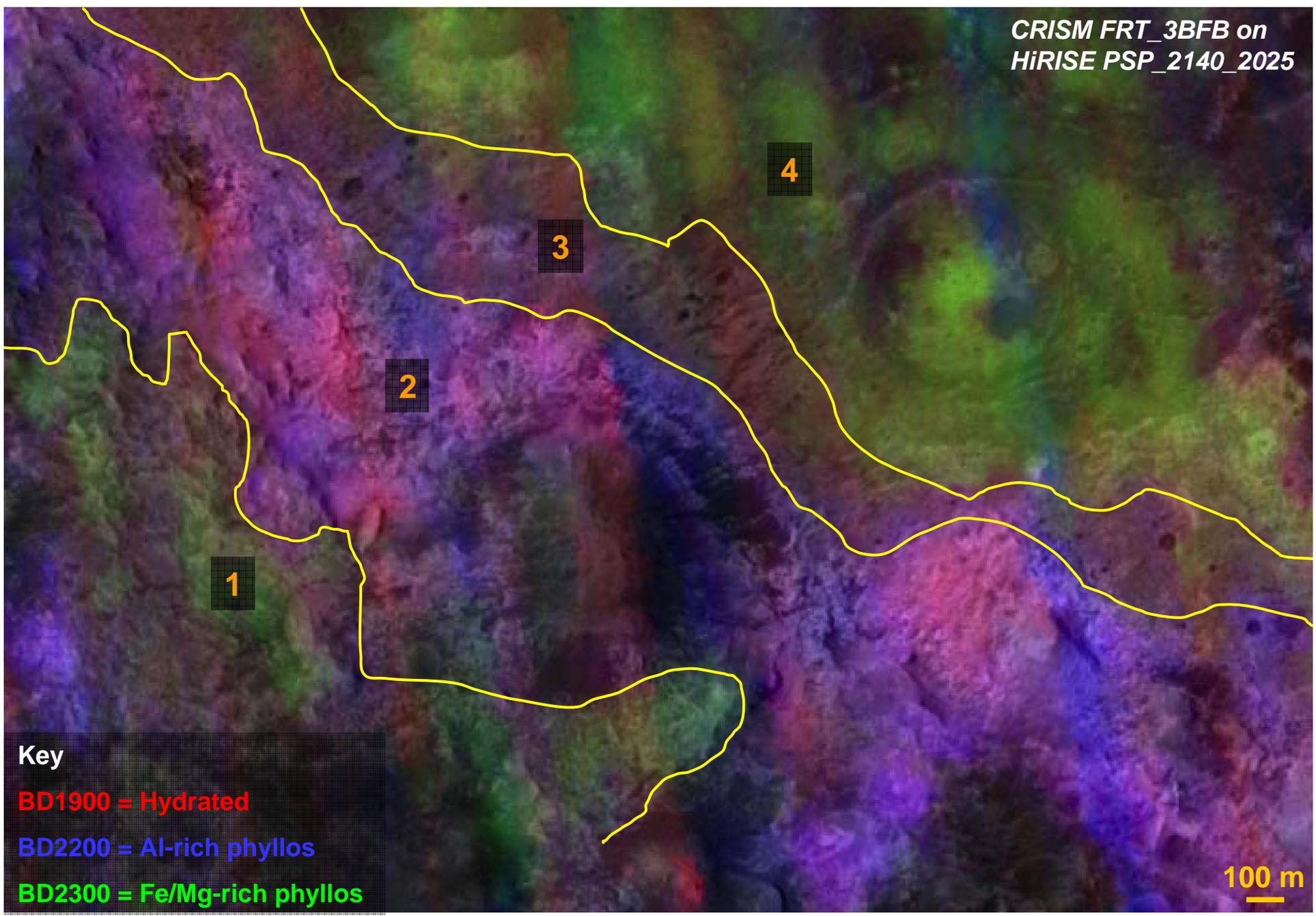
BD2200 = Al-rich phyllos

BD2300 = Fe/Mg-rich phyllos

100 m



CRISM FRT_3BFB on
HiRISE PSP_2140_2025



Key

BD1900 = Hydrated

BD2200 = Al-rich phyllos

BD2300 = Fe/Mg-rich phyllos

100 m

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.

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.

OMEGA proposed sites in Mawrth Vallis

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