e-mars.geologie-lyon.fr

Laboratoire de Géologie de Lyon
Terre Planètes Environnement

UNIVERSITÉ DE LYON

Mawrth Vallis: probing the early Mars Habitability

D. Loizeau, N. Mangold, J. Michalski, J. Bishop, J. Carter, S. Werner

Mars 2020 Landing Site Workshop

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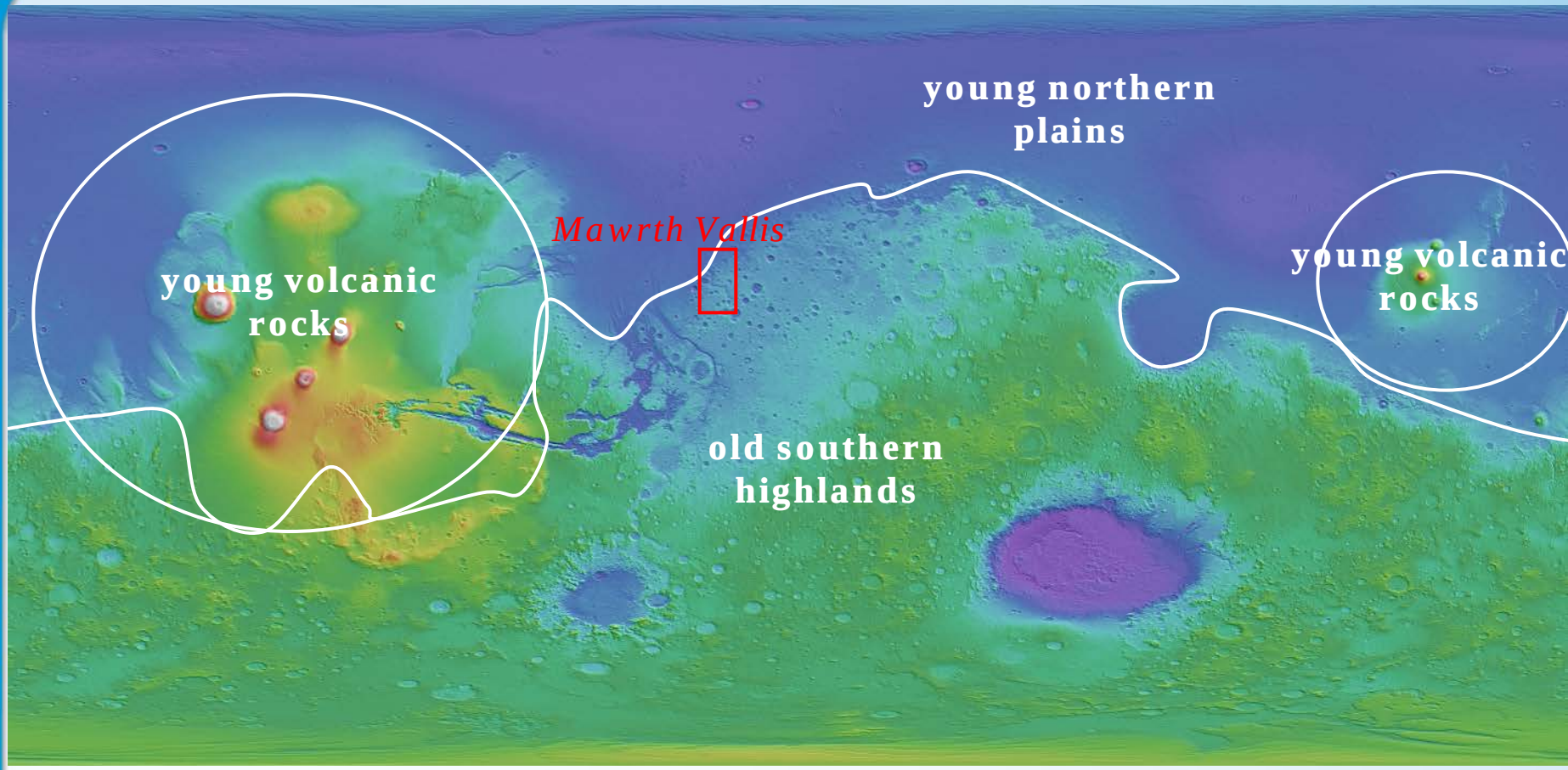
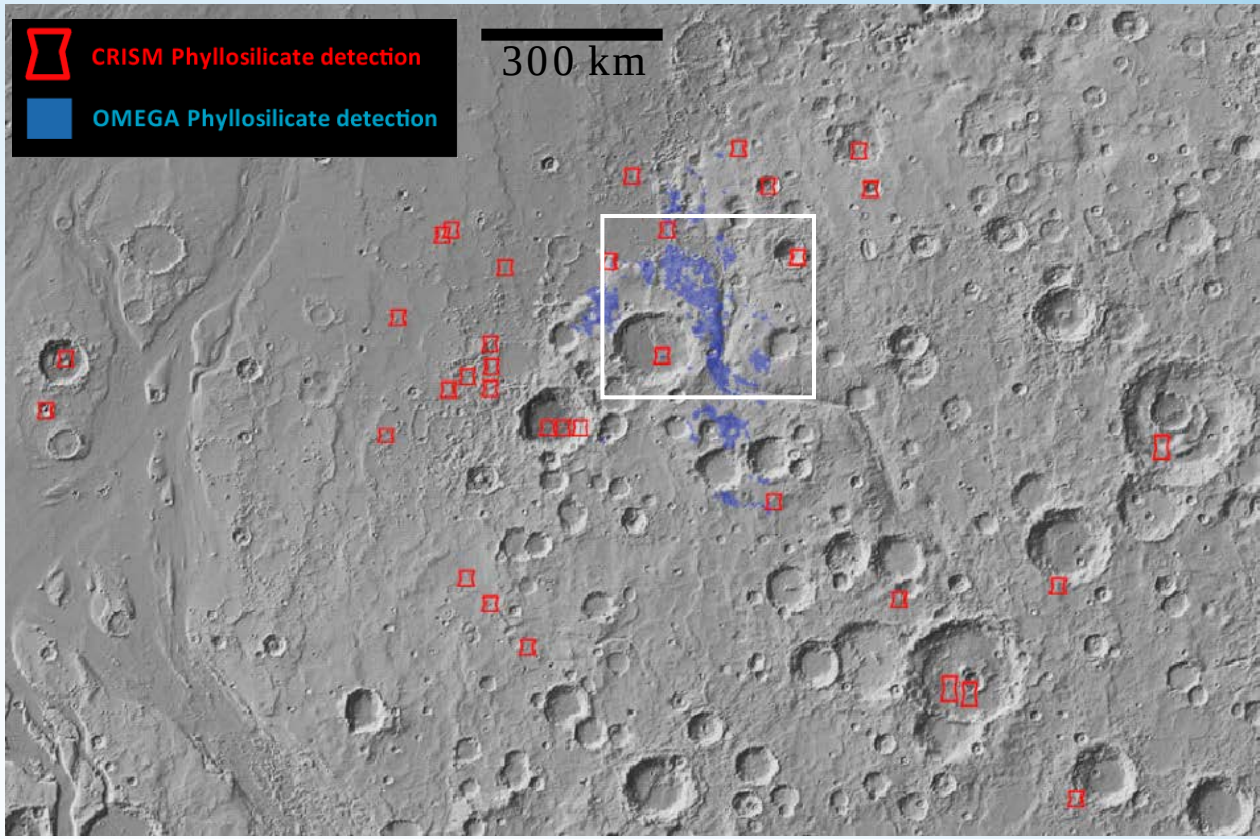
THE SURFACE OF MARS



REGIONAL CONTEXT

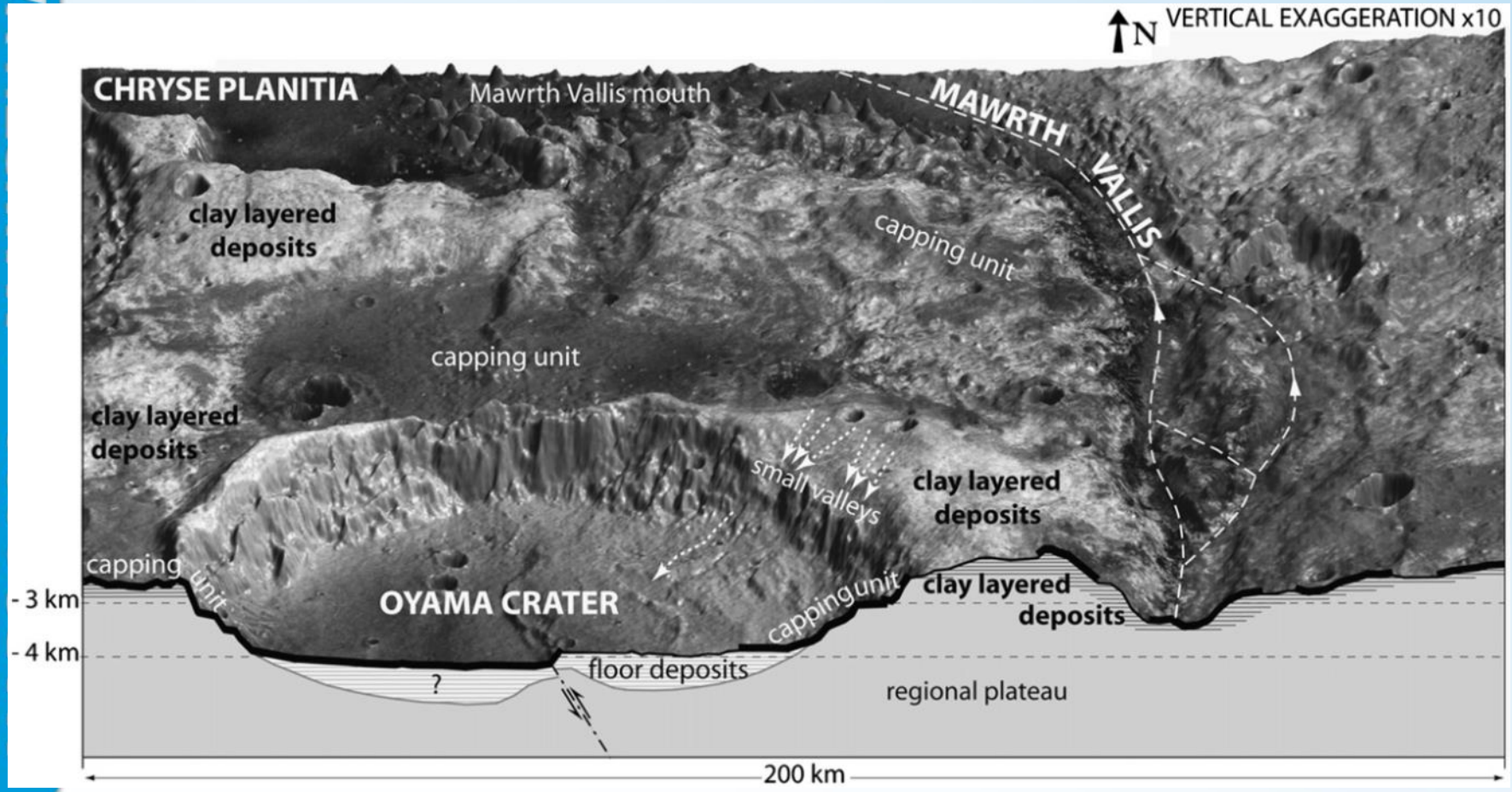
- Extended unit with similar clay mineralogy
- highest clay content identified on Mars



after Noe Dobrea et al. (2010)

REGIONAL CONTEXT

- largest clay-rich outcrops
- surface alteration episodes
- old rocks > 3.8 Ga



REGIONAL CONTEXT

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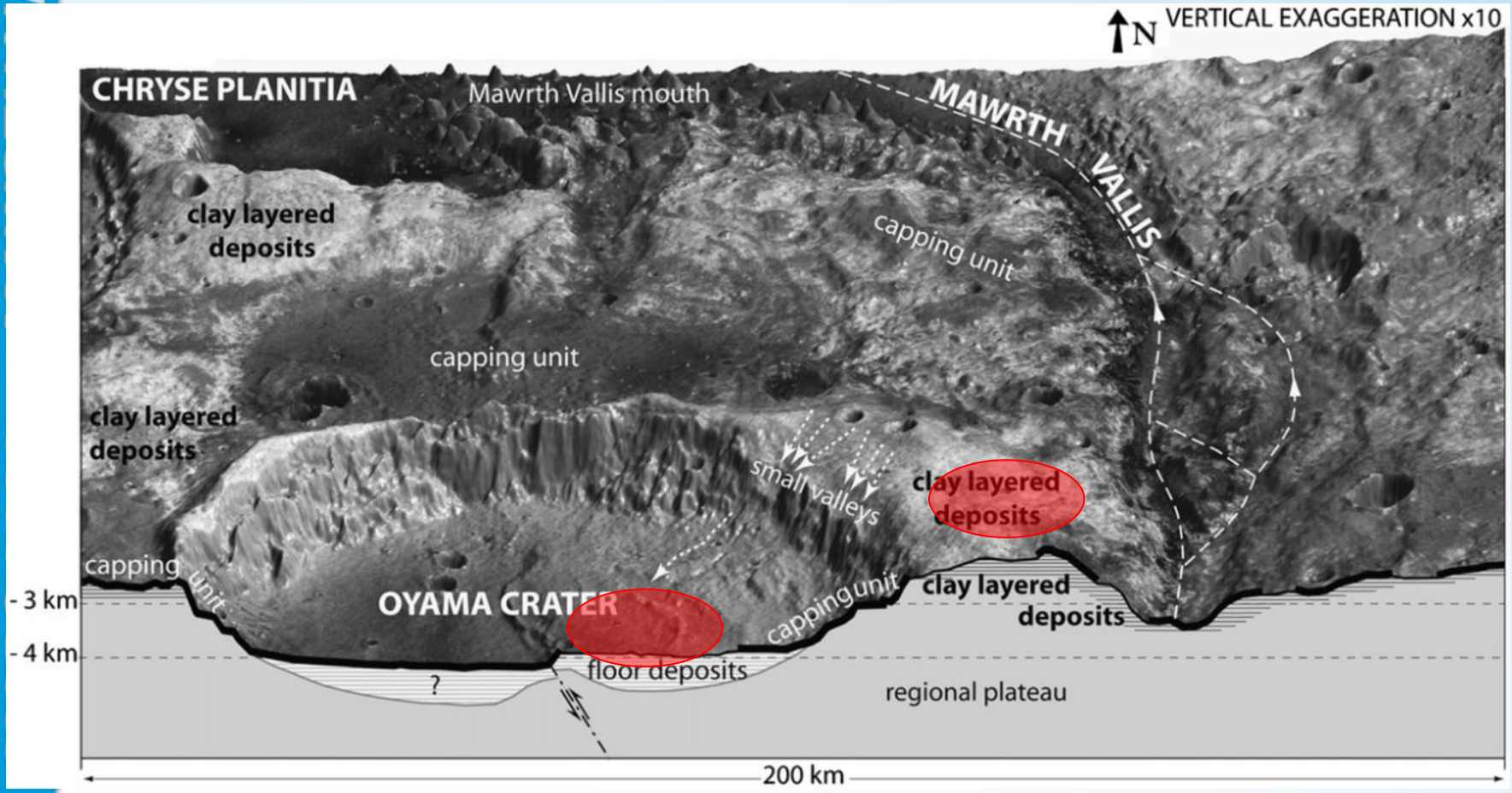
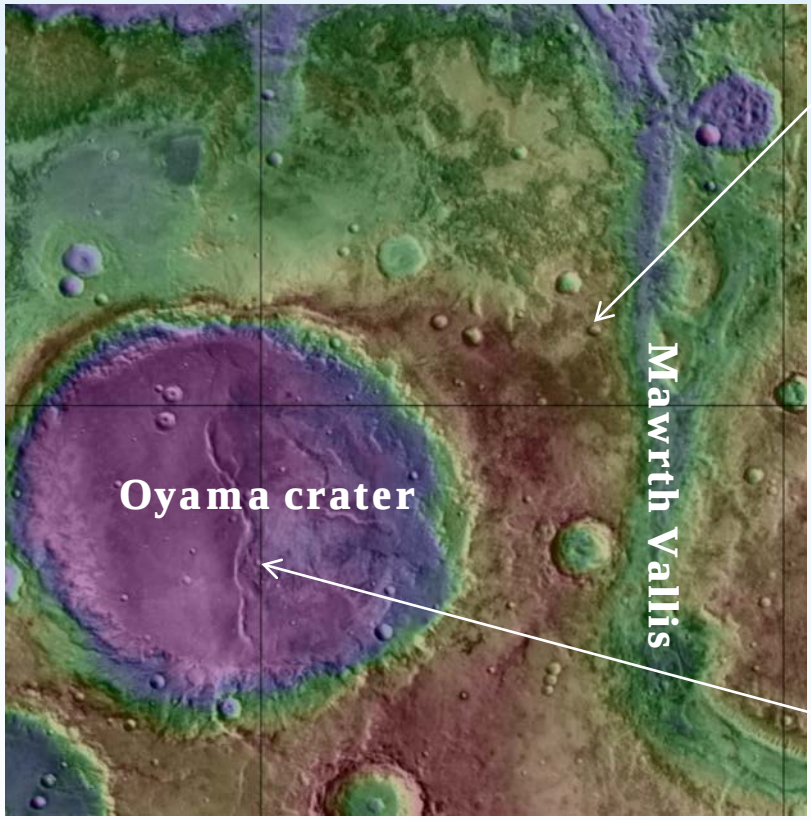
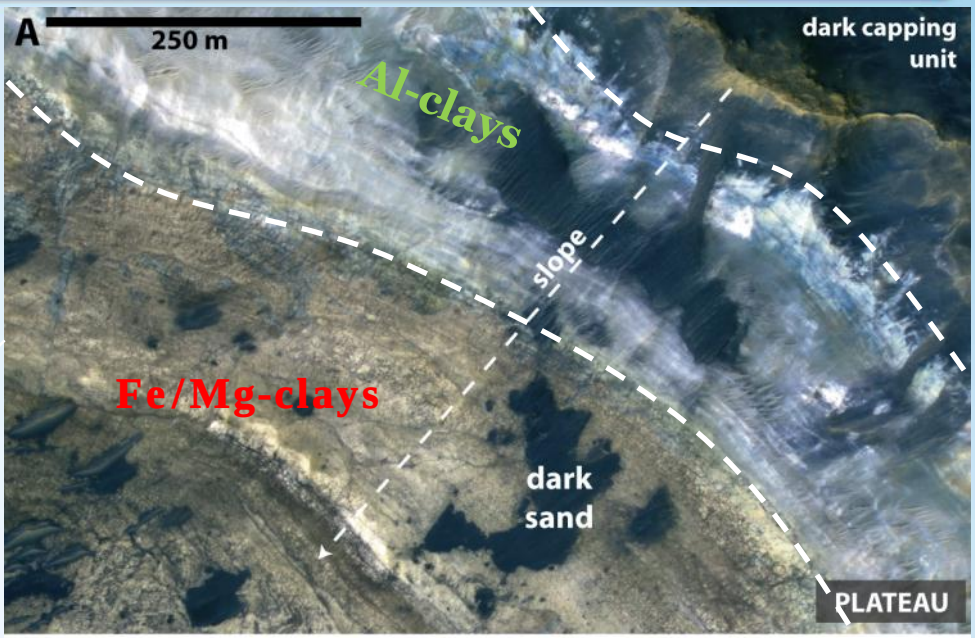
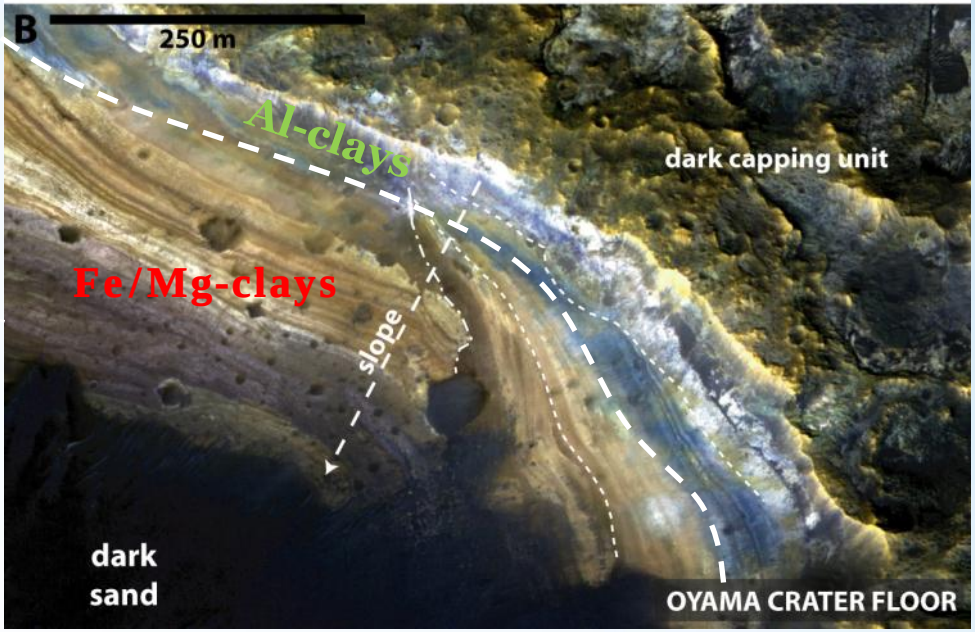


STRATIGRAPHY

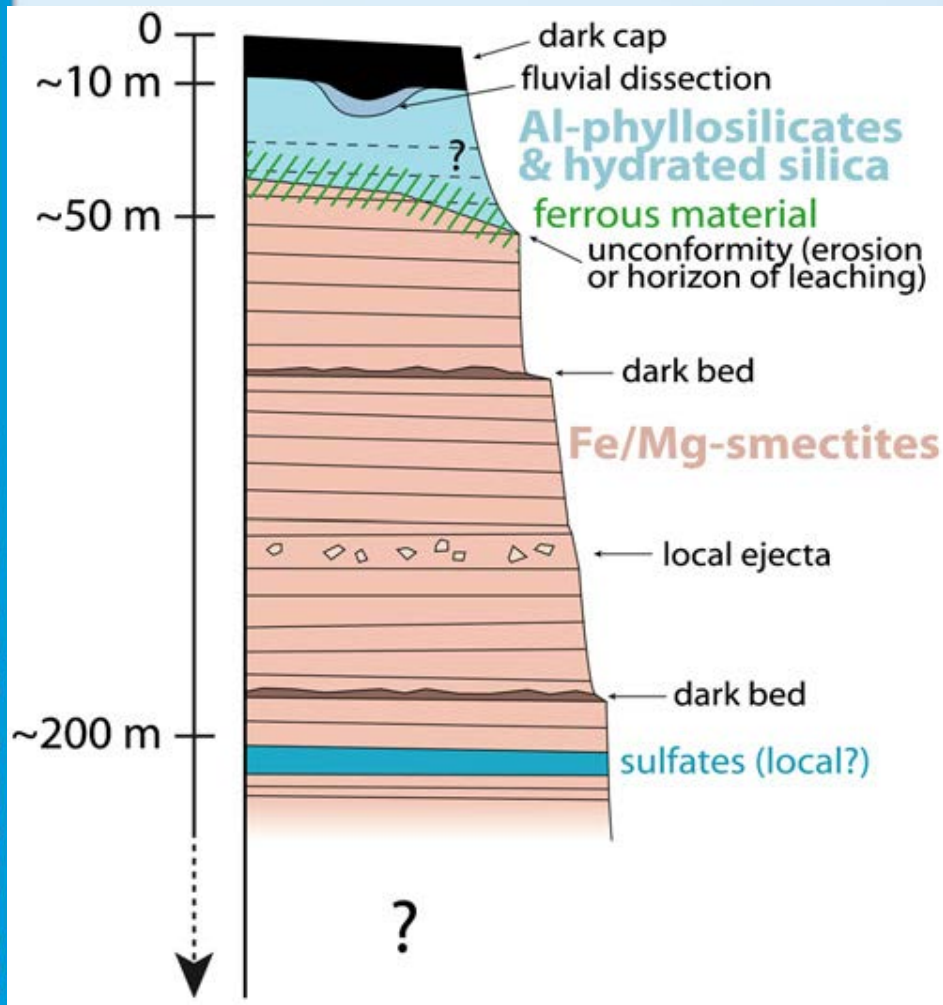


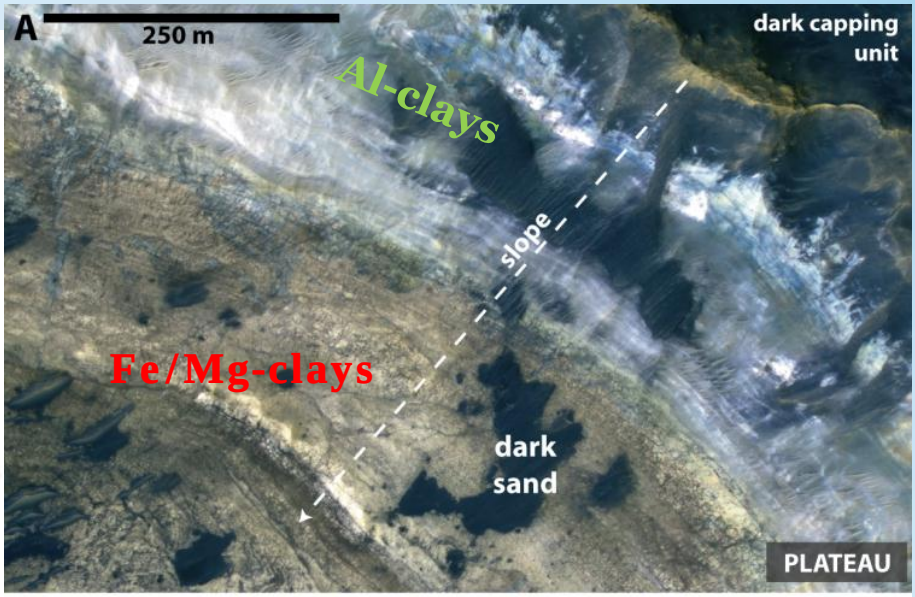


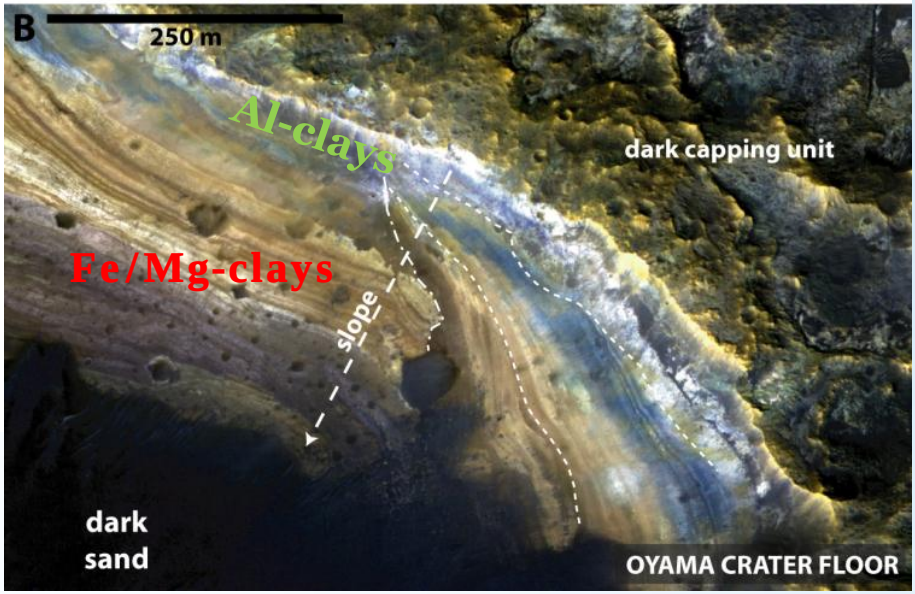


Loizeau et al., 2012

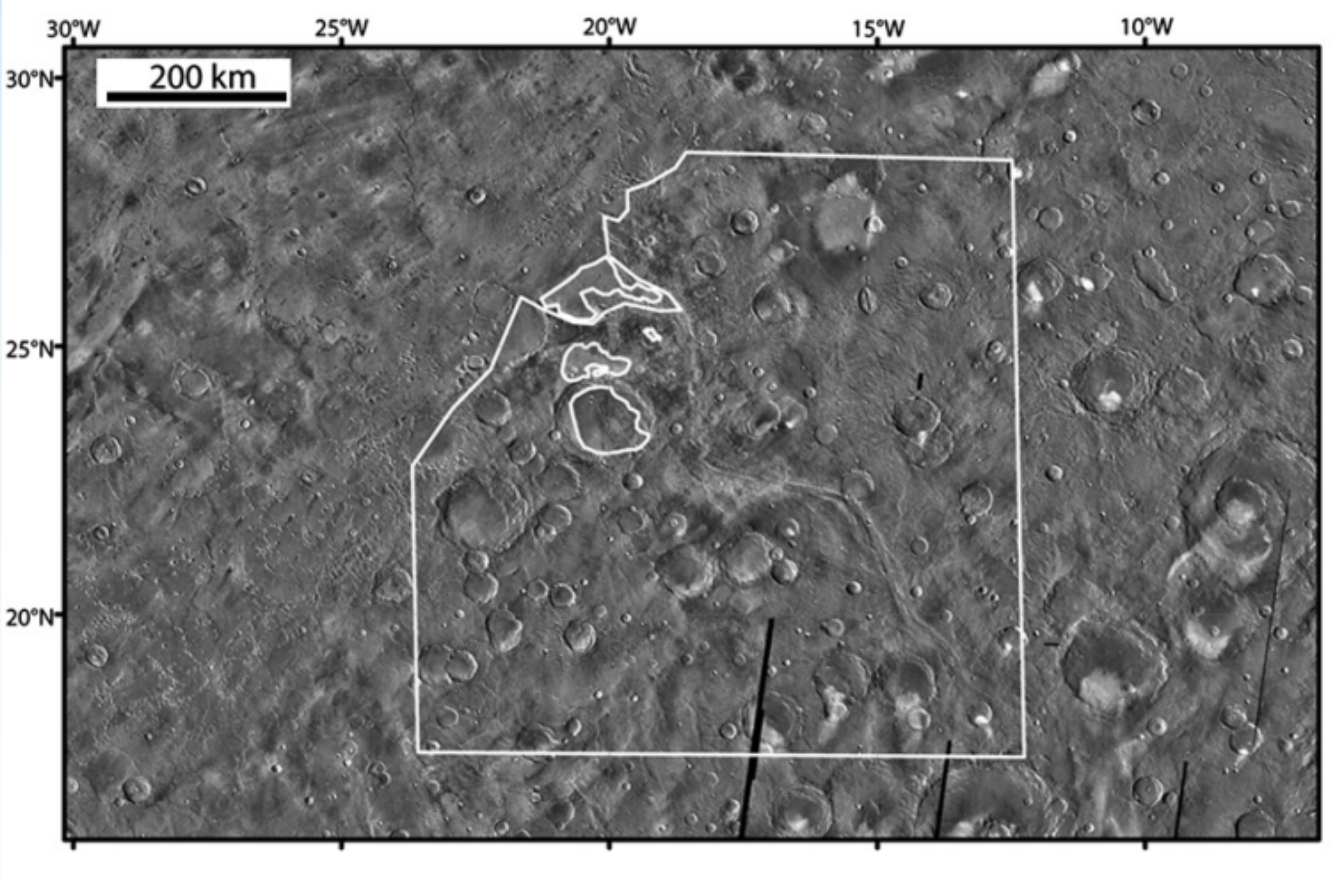
STRATIGRAPHY

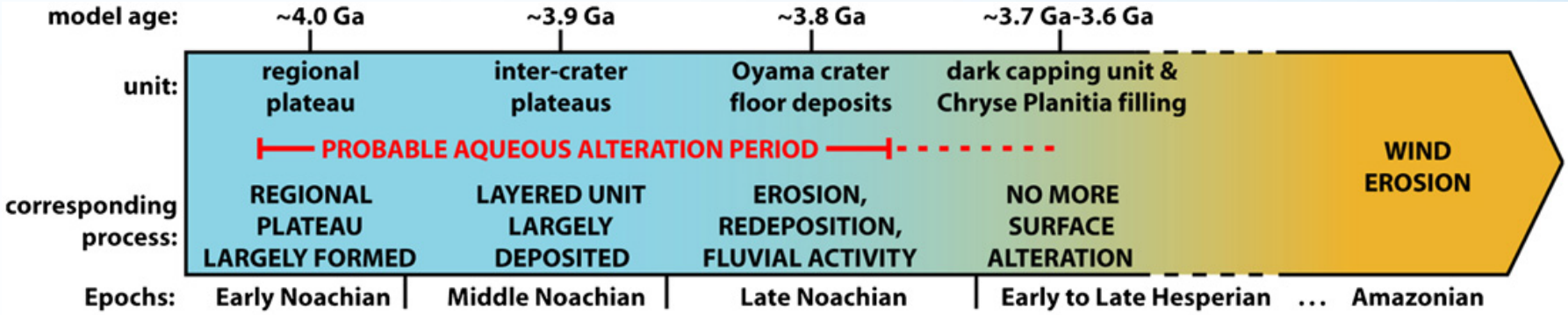




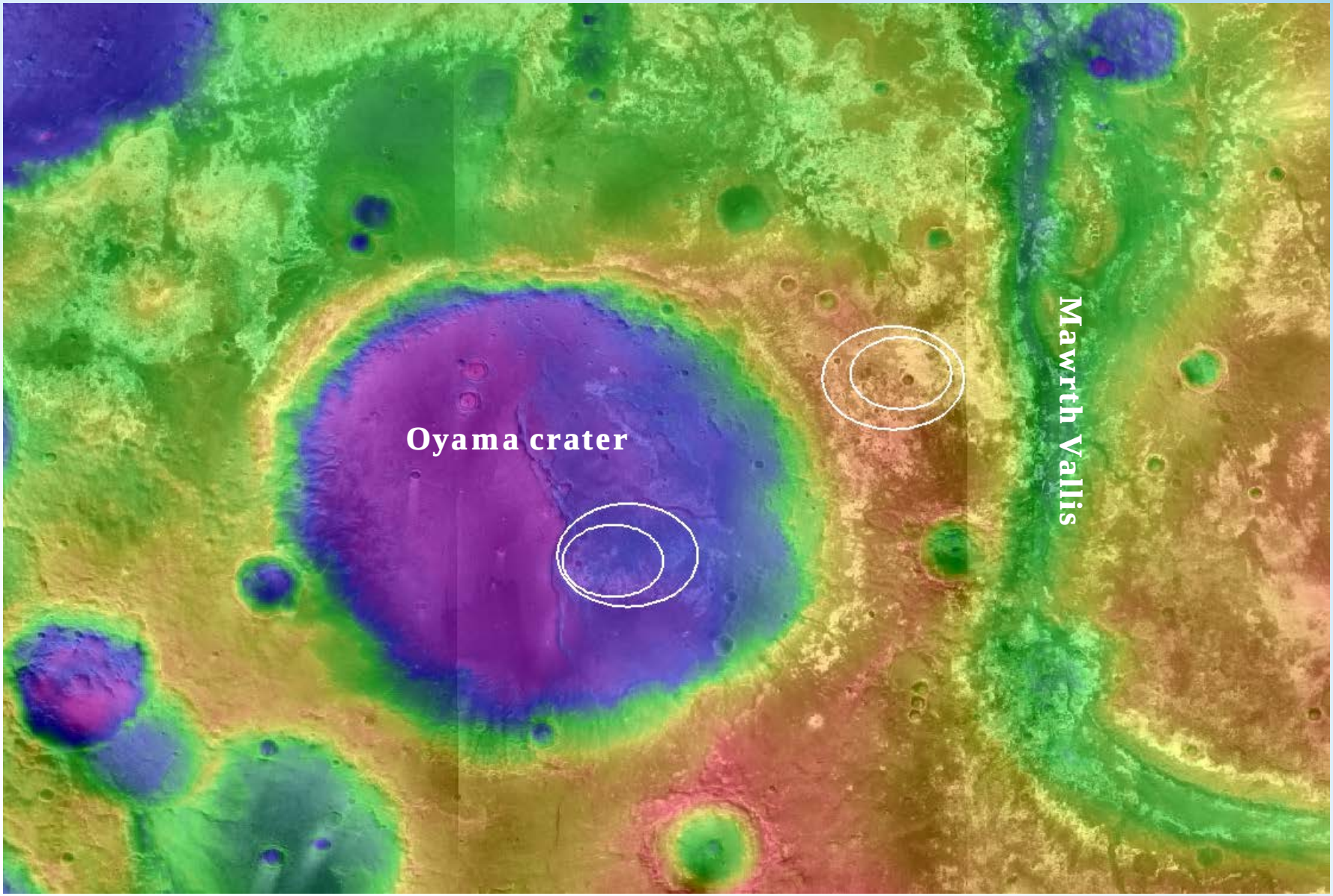


AGE CONSTRAINTS

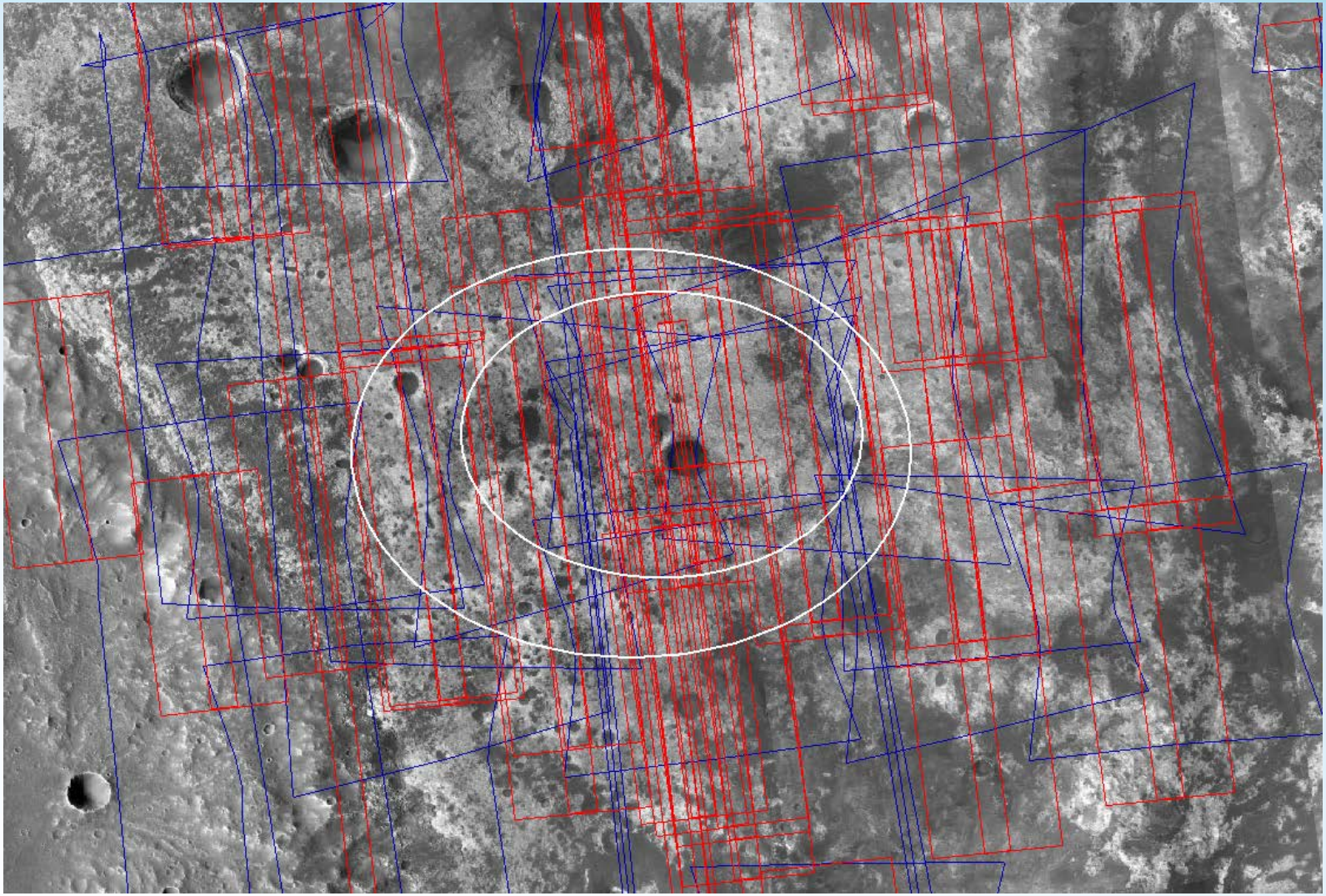




PLATEAU ELLIPSE



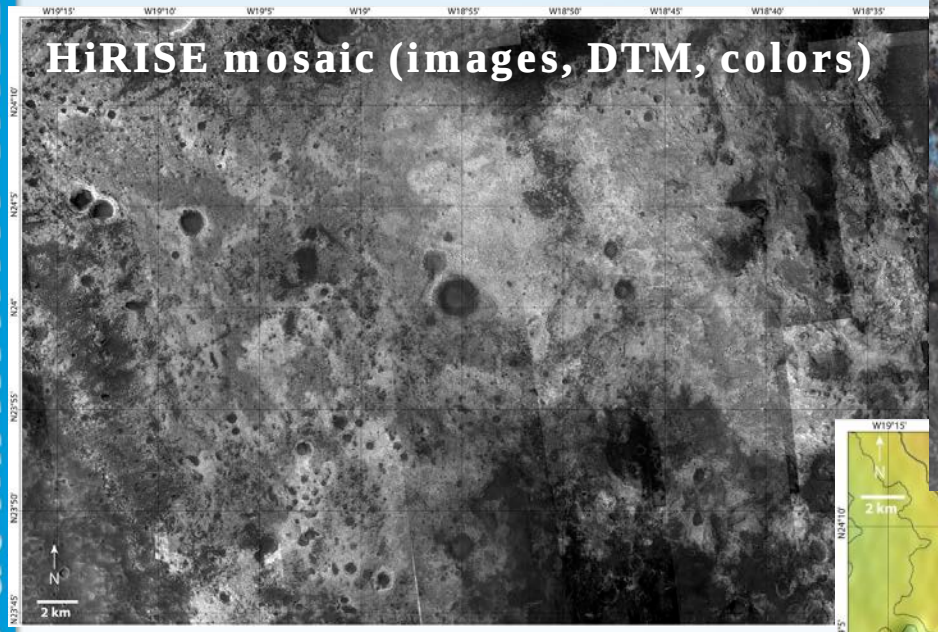
DATASETS

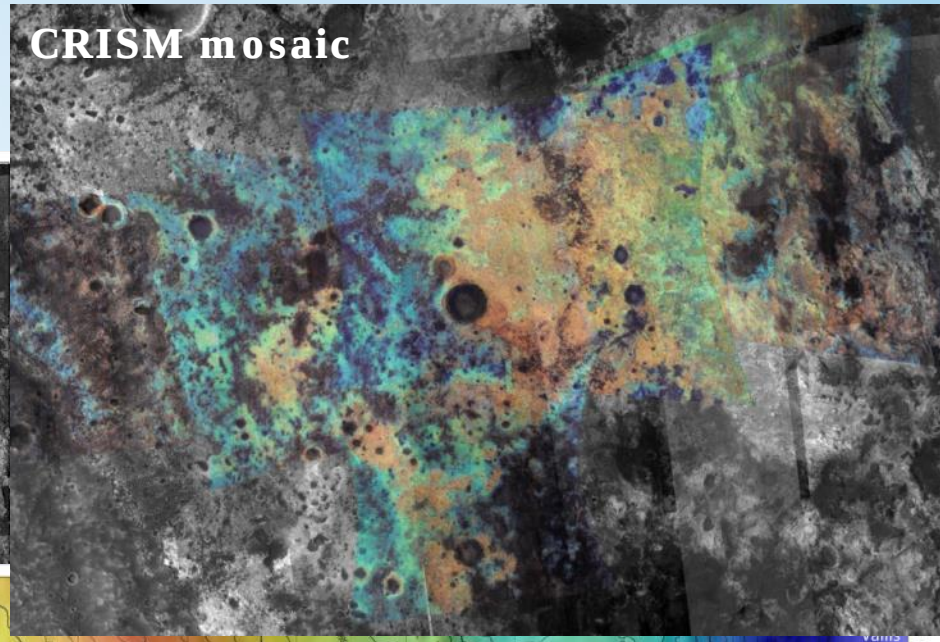


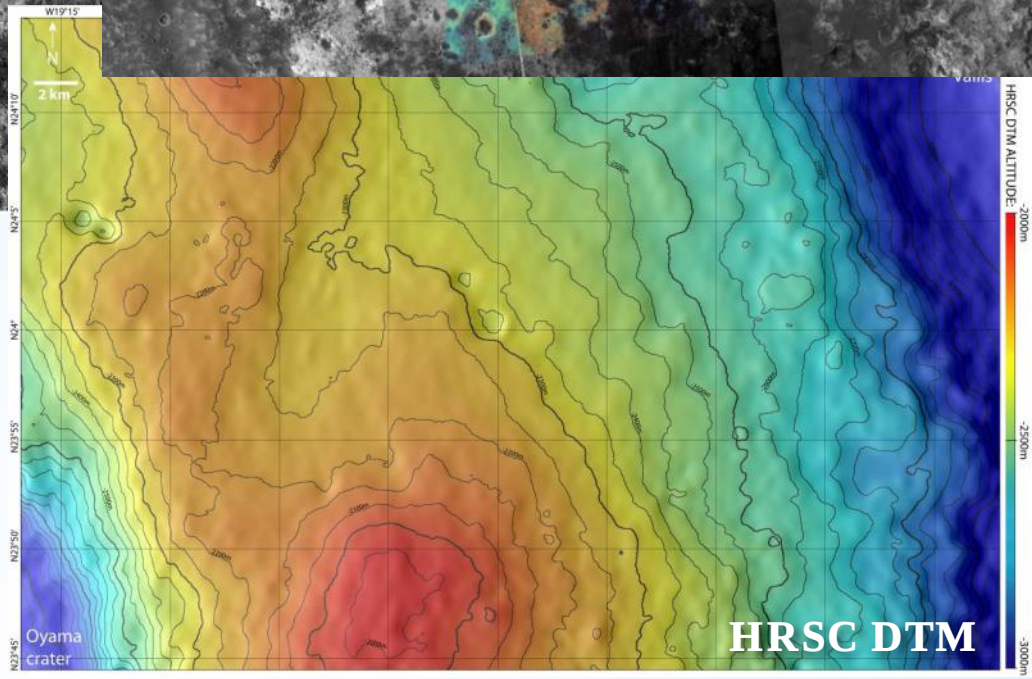
	Center Lat	Center Long	Elevation
Plateau ellipse	341.03°E	24.01°N	Avg: -2290 m (max: -2223 m, min: -2576 m)

DATASETS

MARS 2020 at MAWRTH VALLIS



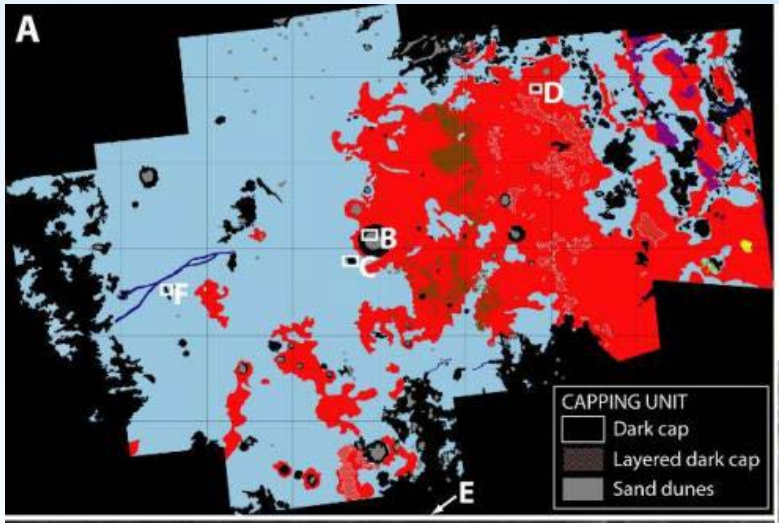


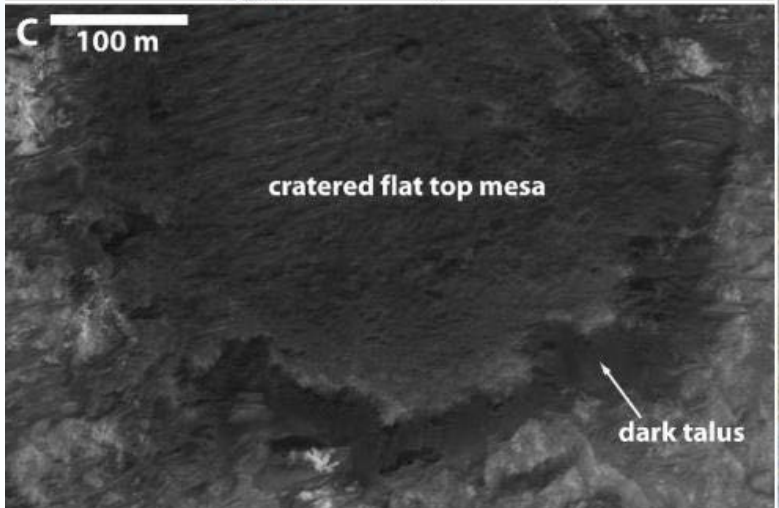


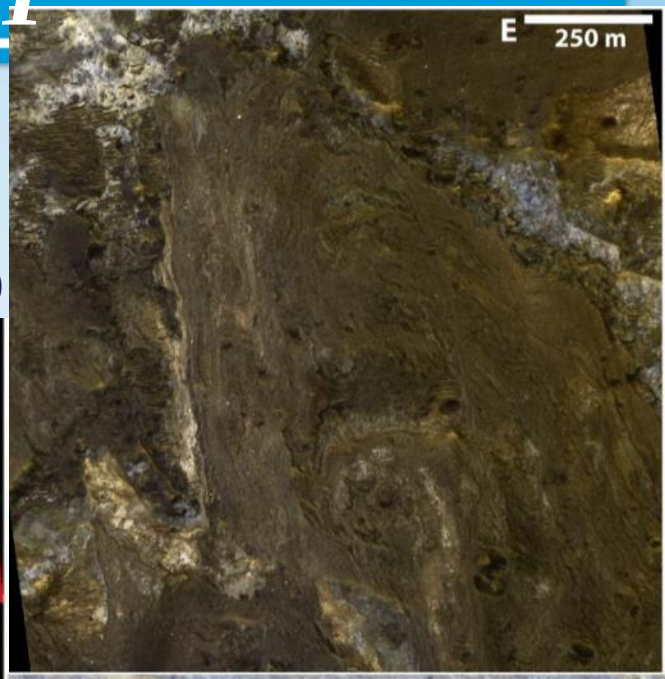
CAPPING UNIT

MARS 2020 at MAWRTH VALLIS

- probably over the whole region in the past
- eroded and redeposited (tallus, layered filling)
- rests of ejecta (15 km fresh crater south of the site)

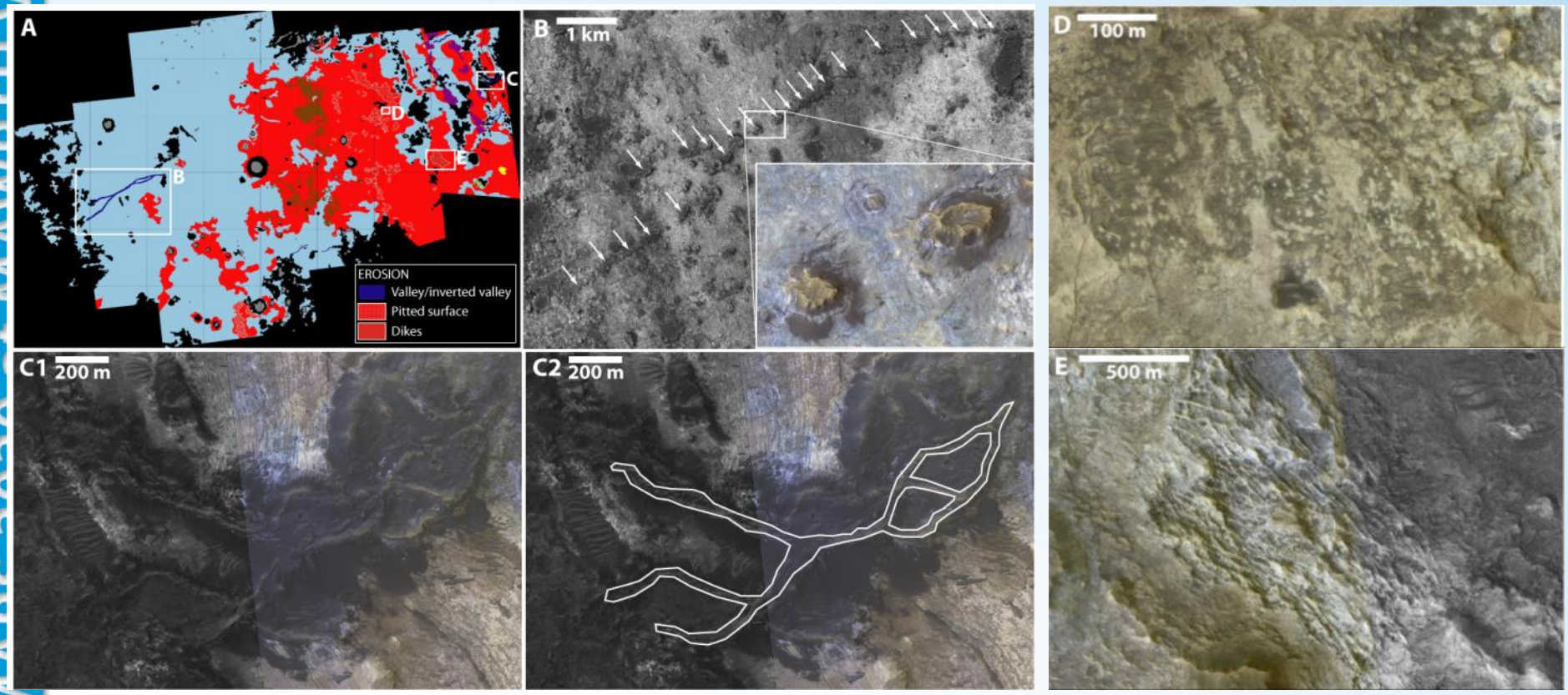






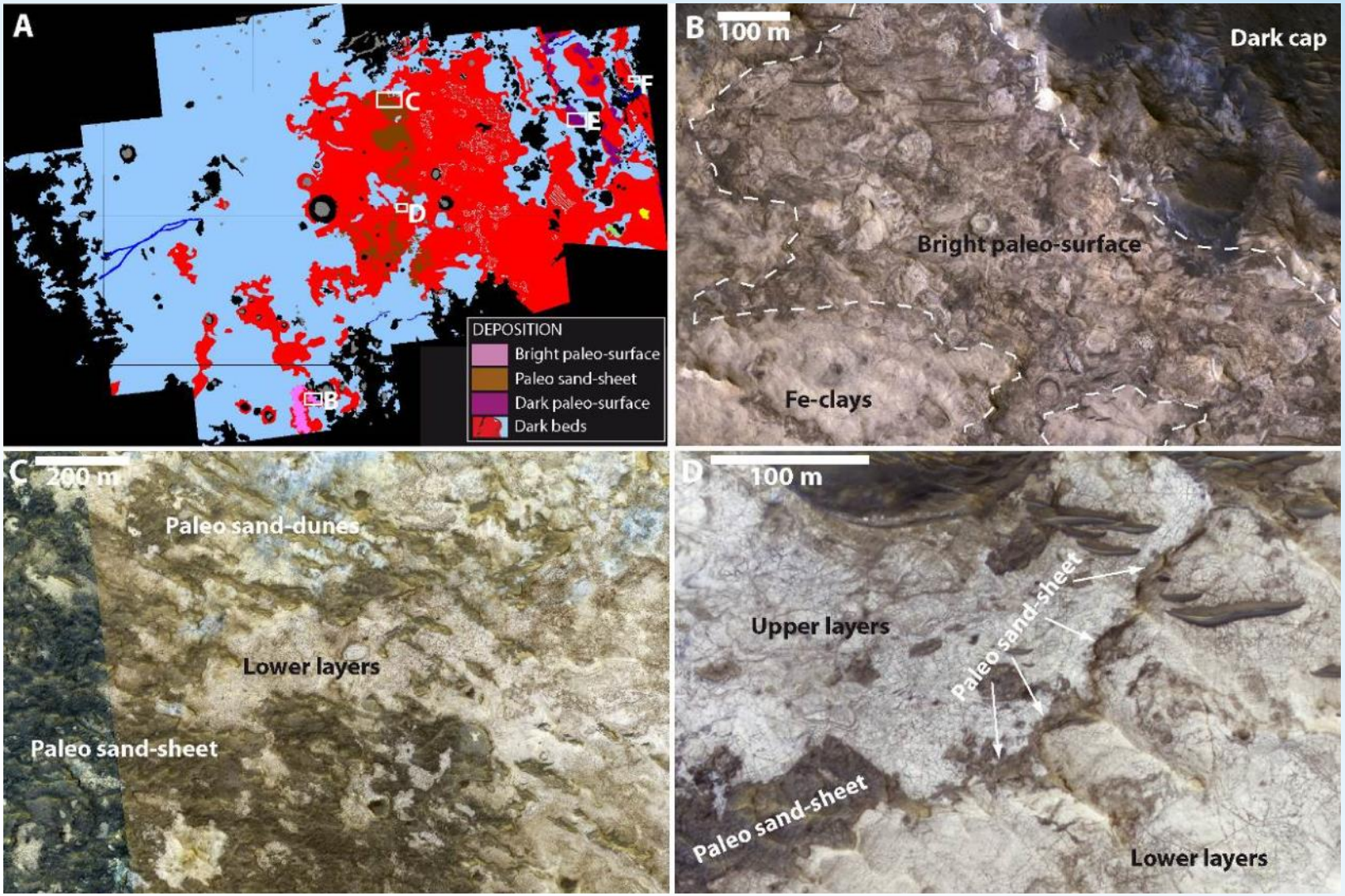
EROSION

- fluvial features
- wind erosion (revealing probable sub-surface fluid circulation)



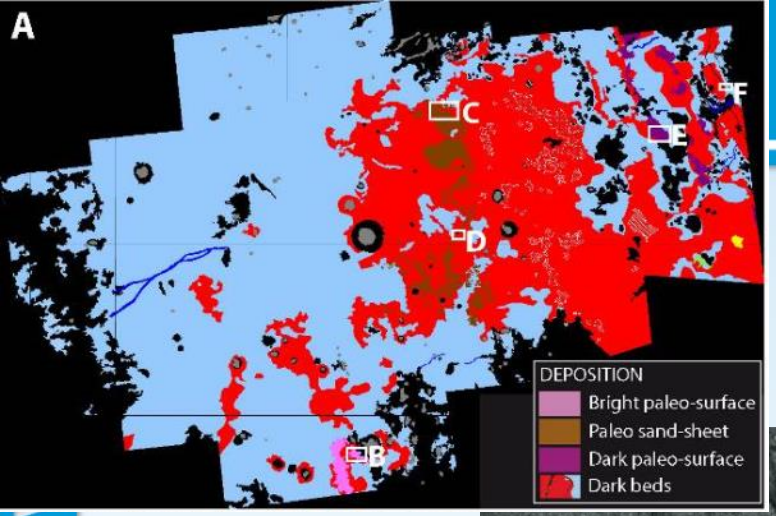
DEPOSITION

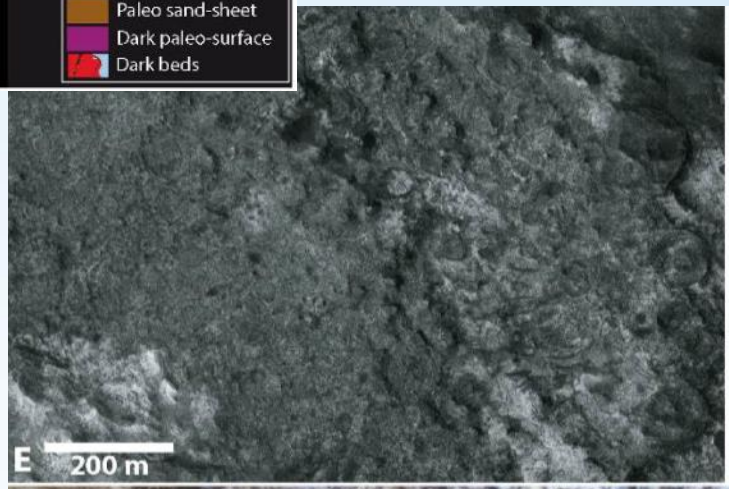
- rounded deposits
- paleo-sand sheet (parallel dunes)

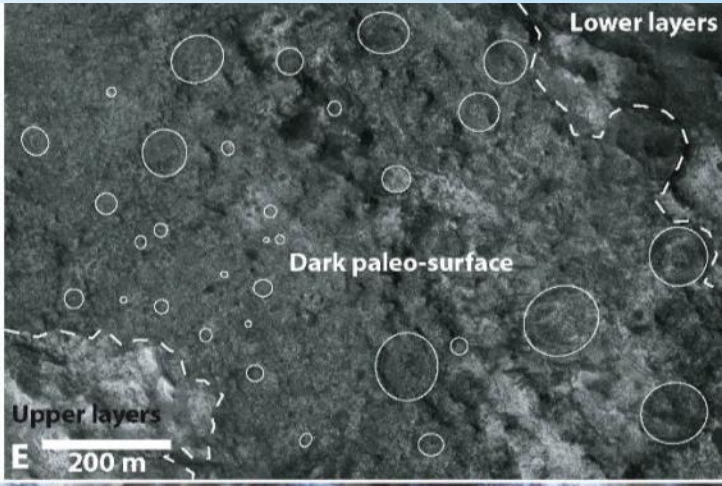


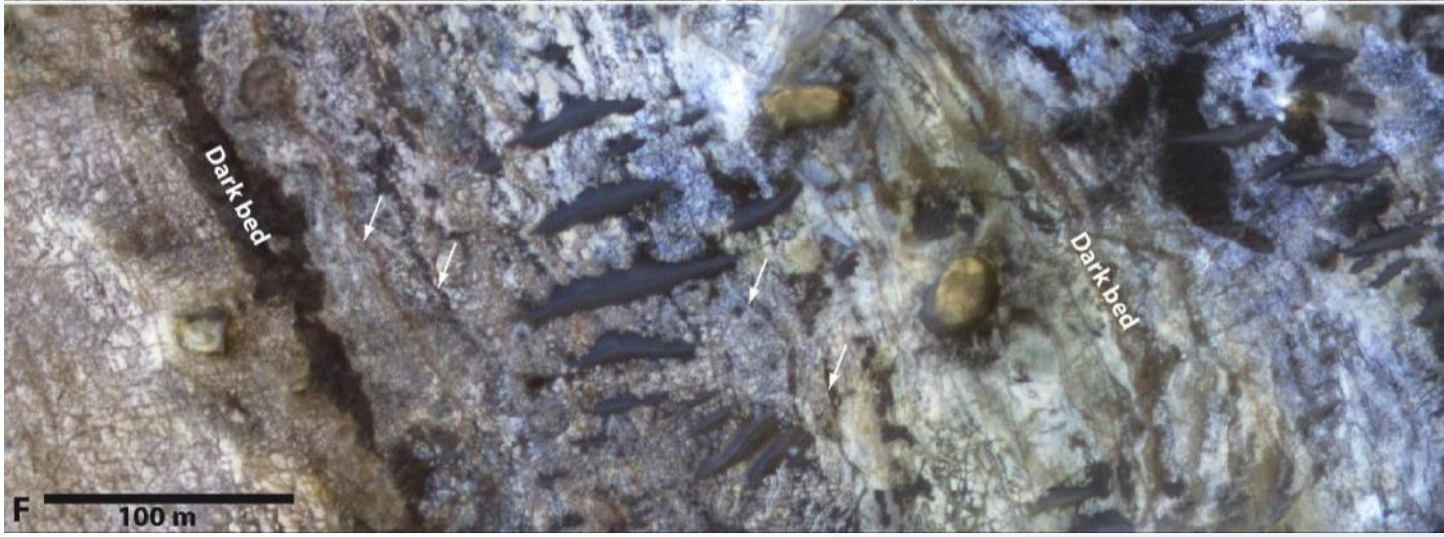
DEPOSITION

- and paleo-surfaces
- dark beds

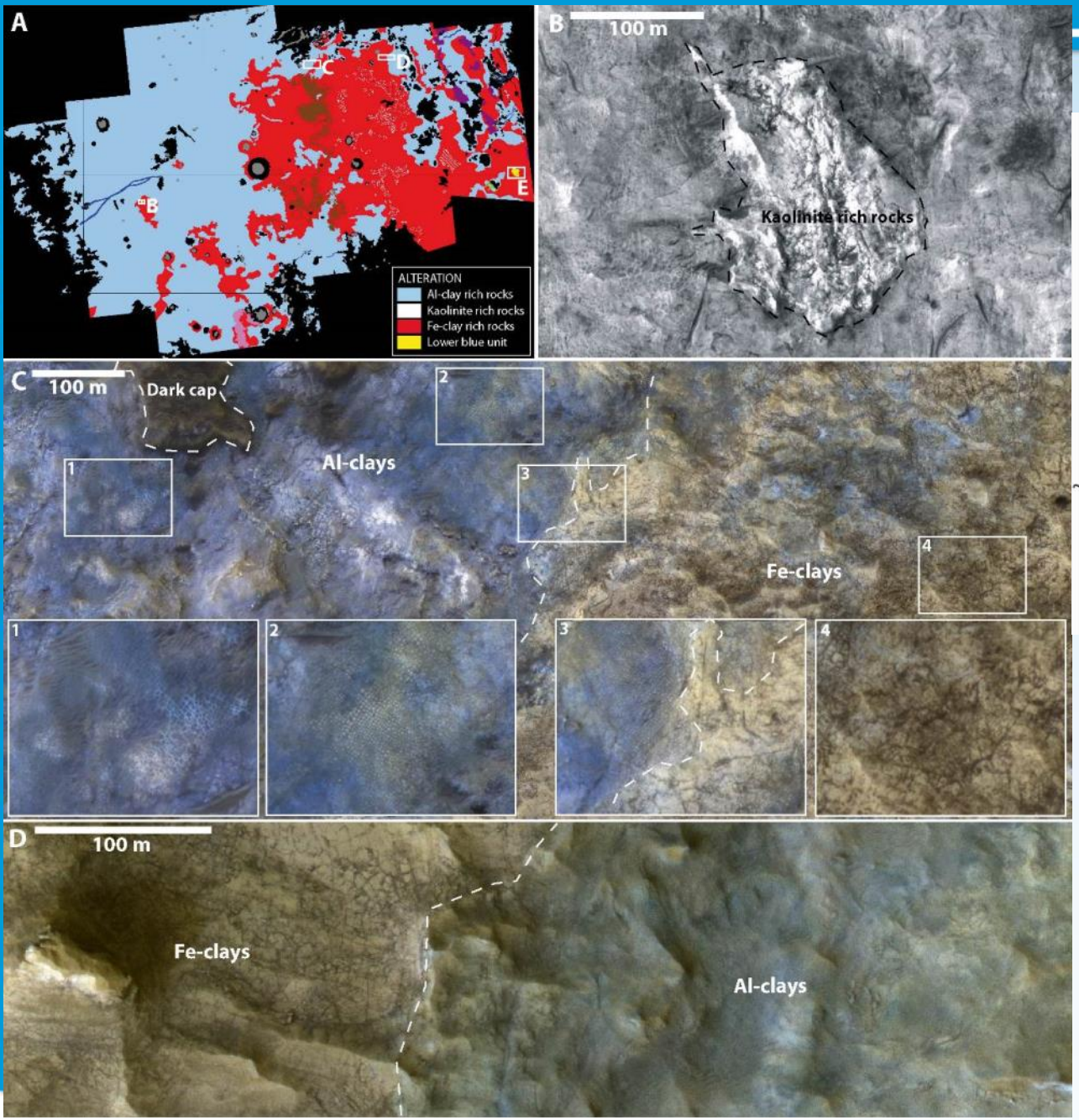


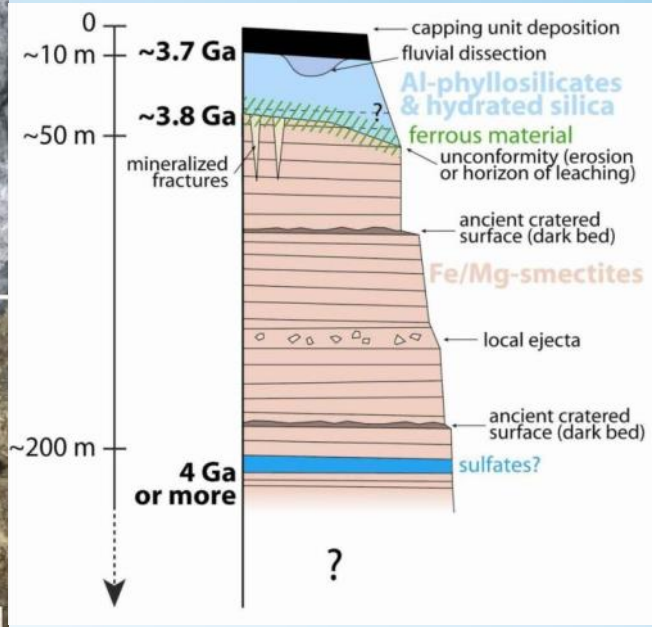




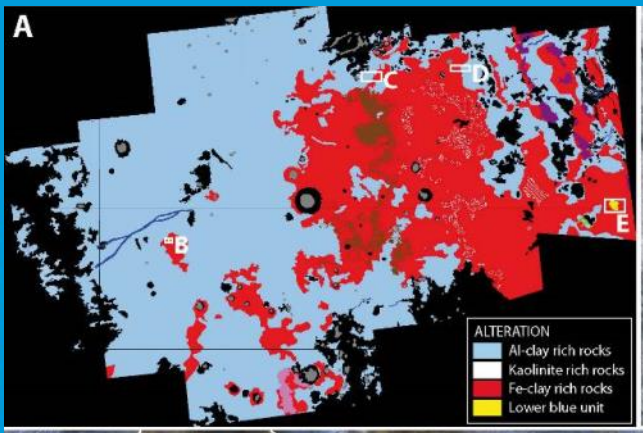


ALTERATION


A
B
C
D
E
ALTERATION
Al-clay rich rocks
Kaolinite rich rocks
Fe-clay rich rocks
Lower blue unit
B
100 m
Kaolinite rich rocks
C
100 m
Dark cap
Al-clays
Fe-clays
1
2
3
4
D
100 m
Fe-clays
Al-clays


0
~10 m
~50 m
~200 m
~3.7 Ga
~3.8 Ga
4 Ga
or more
capping unit deposition
fluvial dissection
Al-phyllosilicates
& hydrated silica
ferrous material
unconformity (erosion
or horizon of leaching)
mineralized
fractures
ancient cratered
surface (dark bed)
Fe/Mg-smectites
local ejecta
ancient cratered
surface (dark bed)
sulfates?
?

ALTERATION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B
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Kaolinite rich rocks
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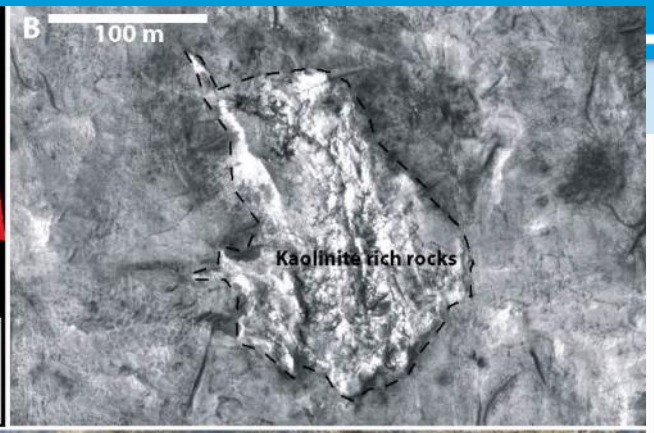
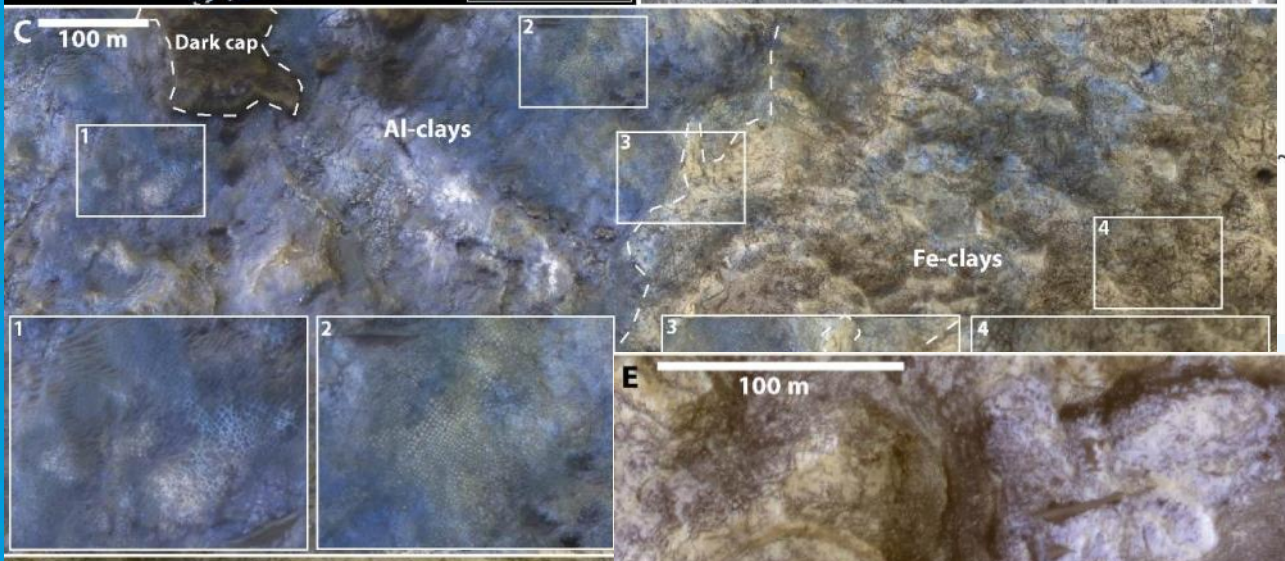
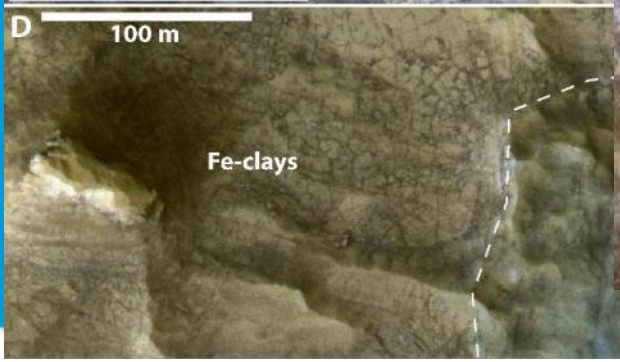
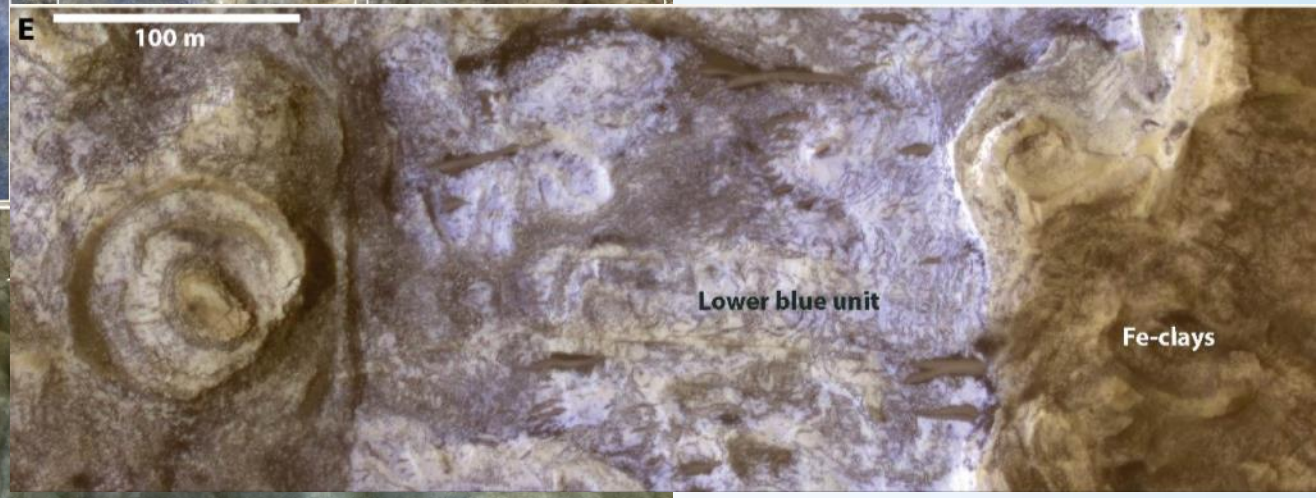
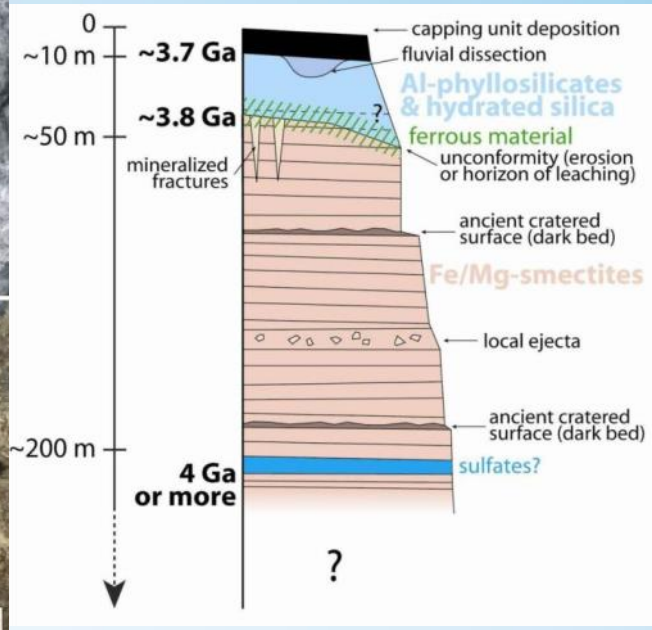

B
100 m
Kaolinite rich rocks


C
100 m
Dark cap
Al-clays
Fe-clays
1
2
3
4


D
100 m
Fe-clays


E
100 m
Lower blue unit
Fe-clays


0
~10 m
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~3.8 Ga
4 Ga
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& hydrated silica
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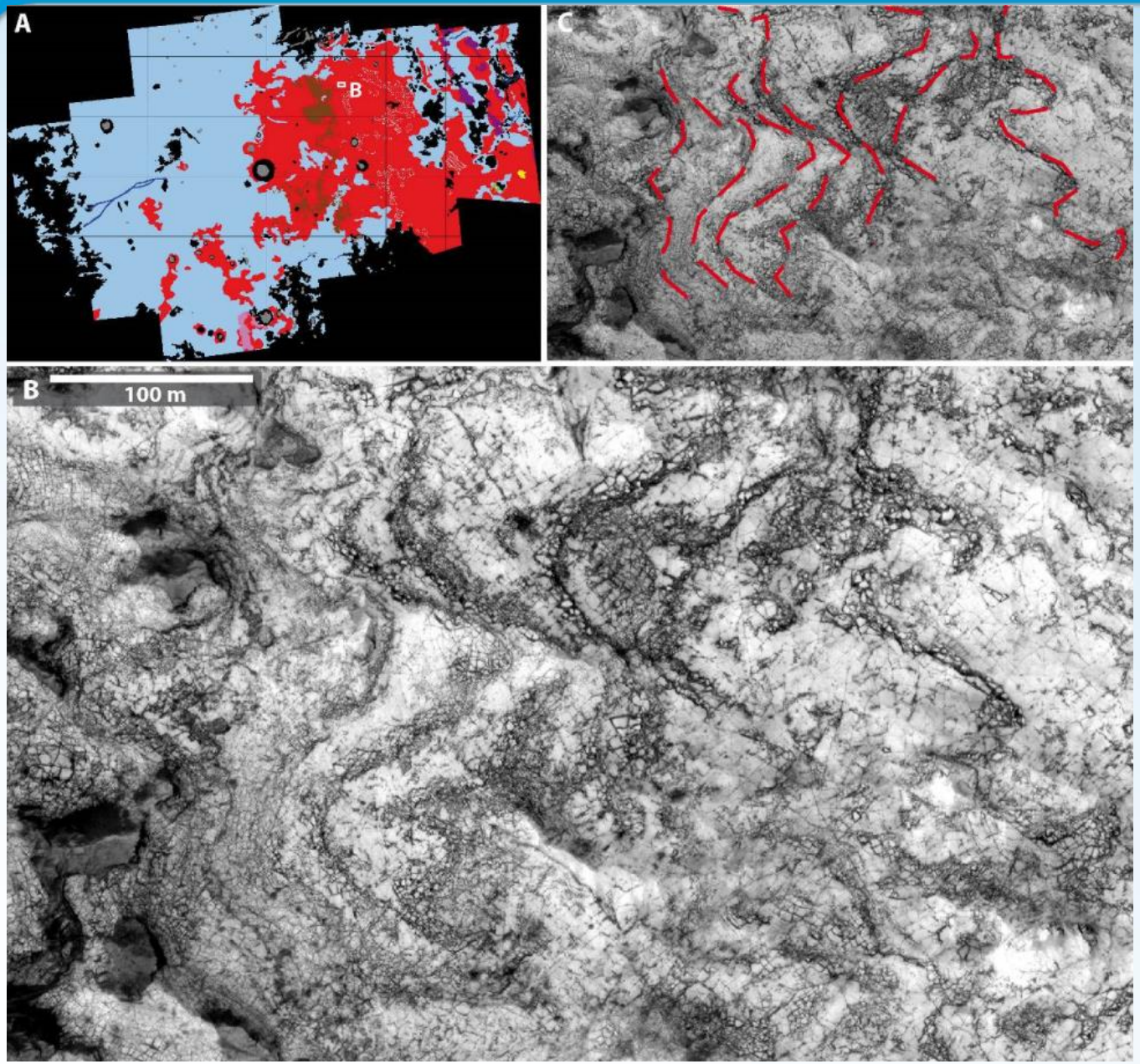
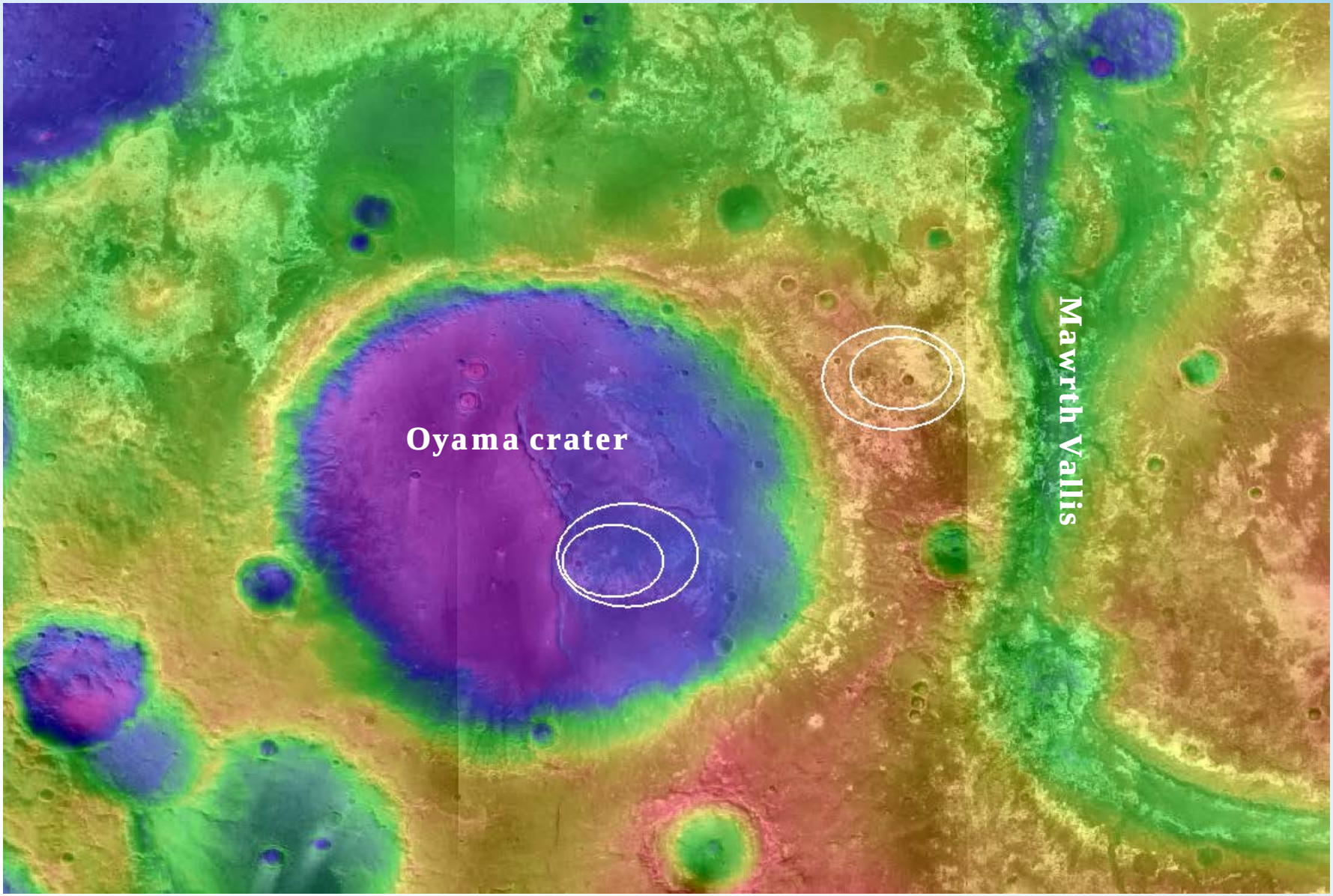
or horizon of leaching)
mineralized
fractures
ancient cratered
surface (dark bed)
Fe/Mg-smectites
local ejecta
ancient cratered
surface (dark bed)
sulfates?
?

LAYER FRACTURATION

MARS 2020 at MAWRTH VALLIS



OYAMA ELLIPSE



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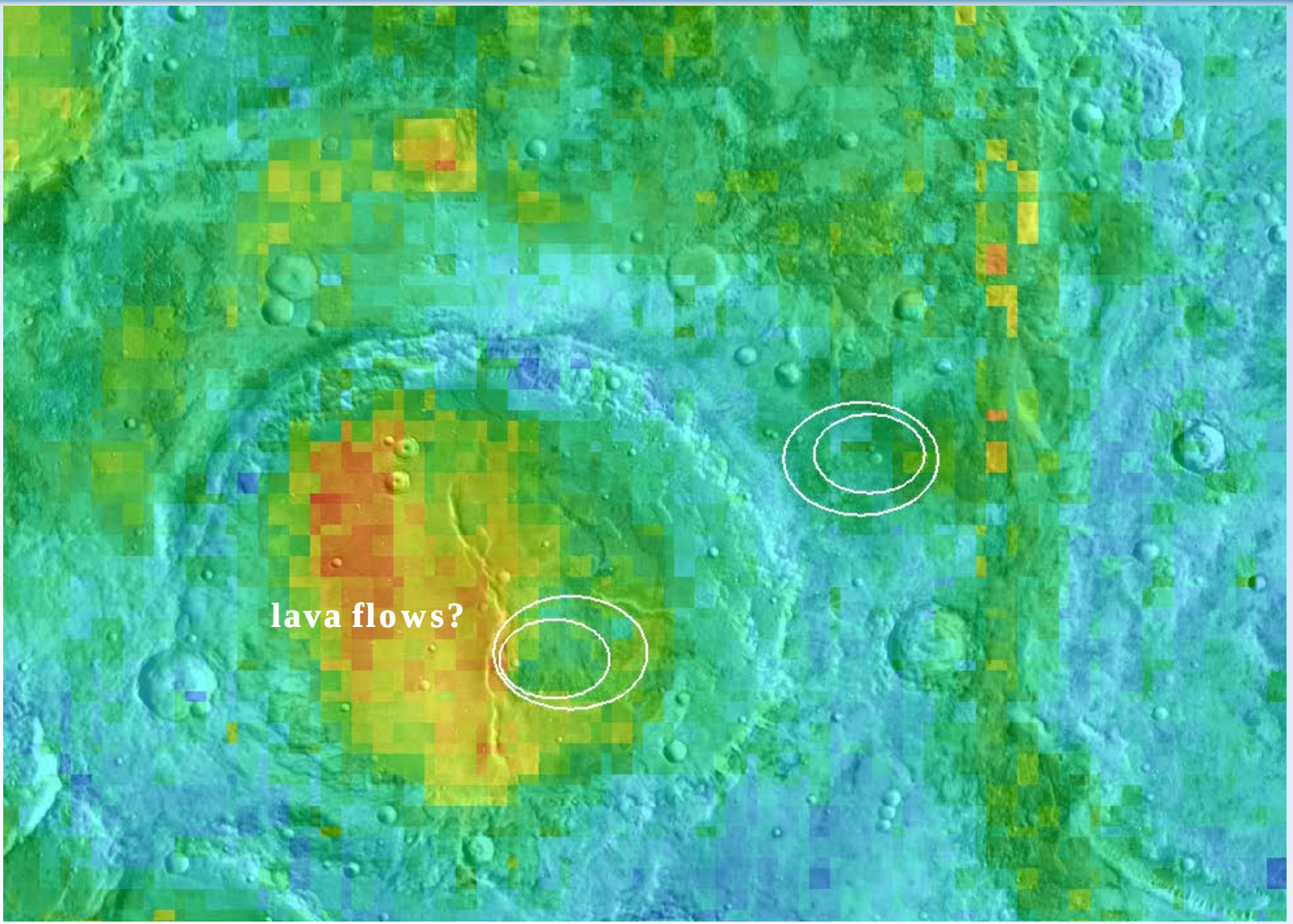
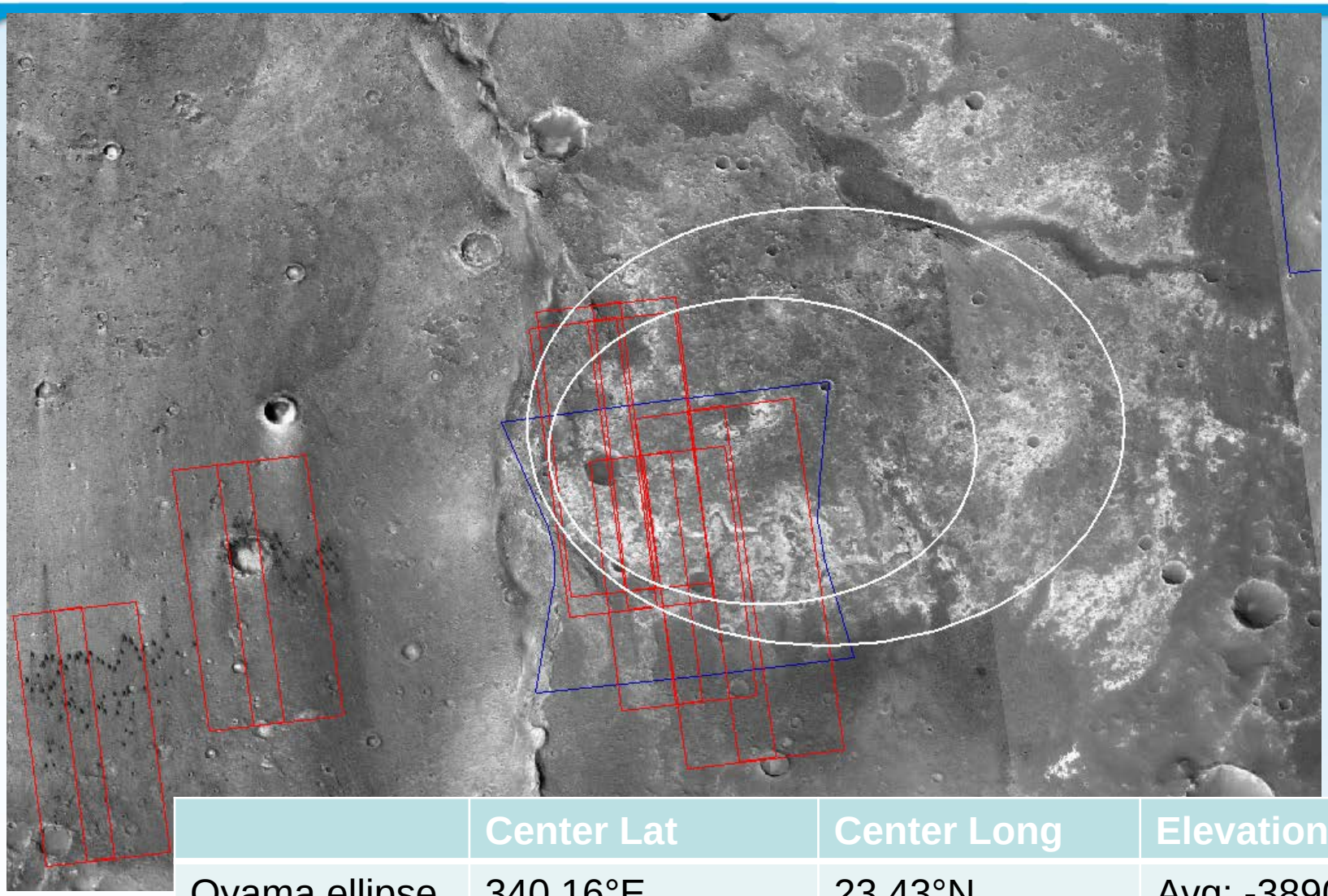


TES nighttime thermal inertia (Putzig et al. 2007)

DATASETS

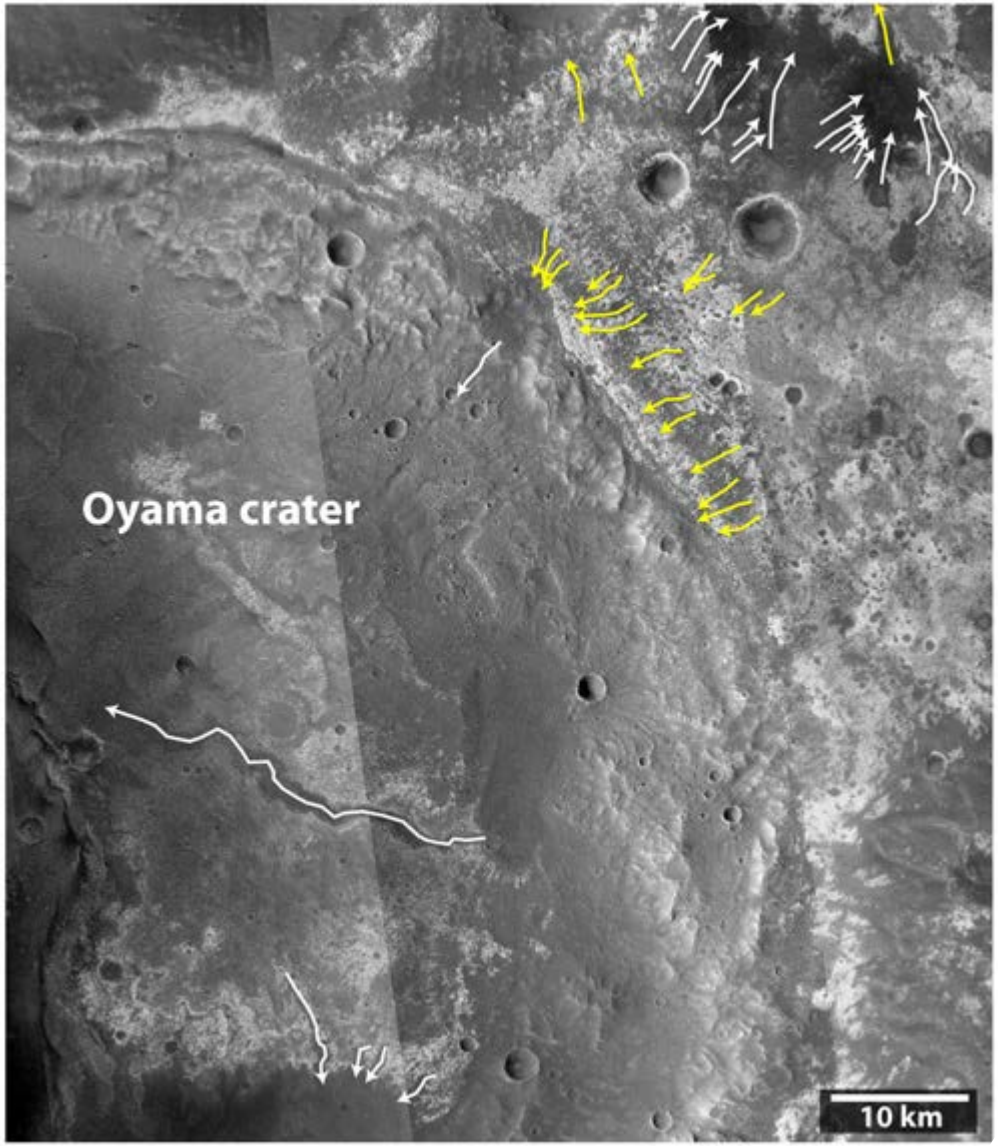
MARS 2020 at MAWRTH VALLIS

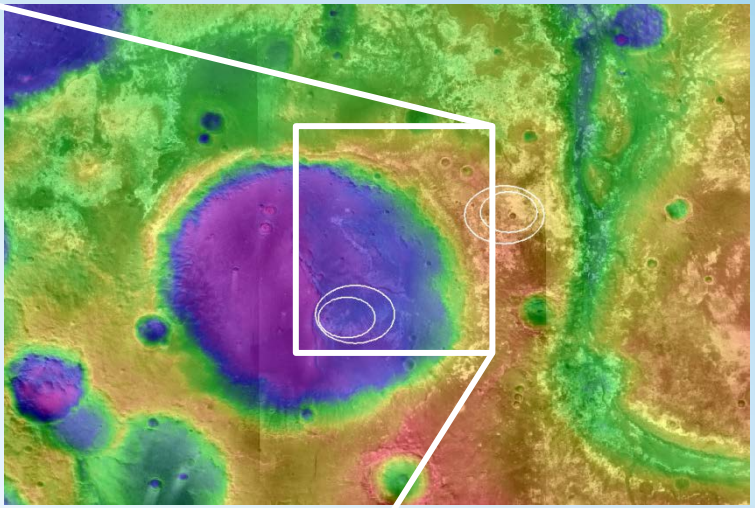


	Center Lat	Center Long	Elevation
Oyama ellipse (25 km x 20 km)	340.16°E	23.43°N	Avg: -3890 m (max: -3758 m, min: -4090 m)
Oyama ellipse (18 km x 14 km)	340.11°E	23.41°N	Avg: -3895 m (max: -3795 m, min: -4090 m)

OYAMA ELLIPSE

MARS 2020 at MAWRTH VALLIS

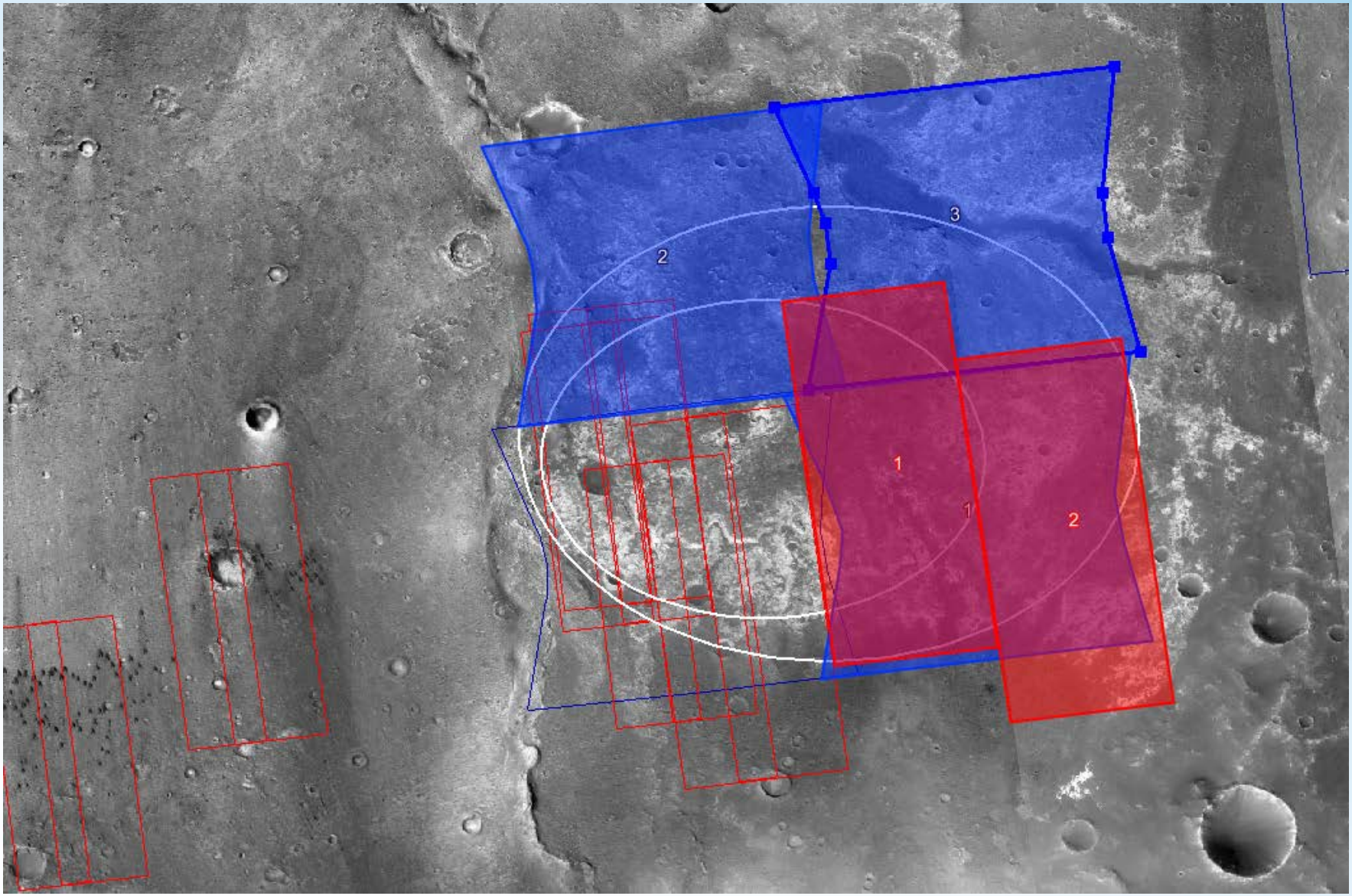




- fluvial deposits from the plateau
- organic concentration

DATA REQUESTS

MARS 2020 at MAWRTH VALLIS



TO SUMMARIZE

- strong aqueous alteration
- high geological variety (due to deposition, erosion & alteration)
- fresh surfaces (continuous erosion of clays)
- long and continuous stratigraphic section
- early Mars characterization
- clays: probably less sharp rocks!

THANK YOU!