

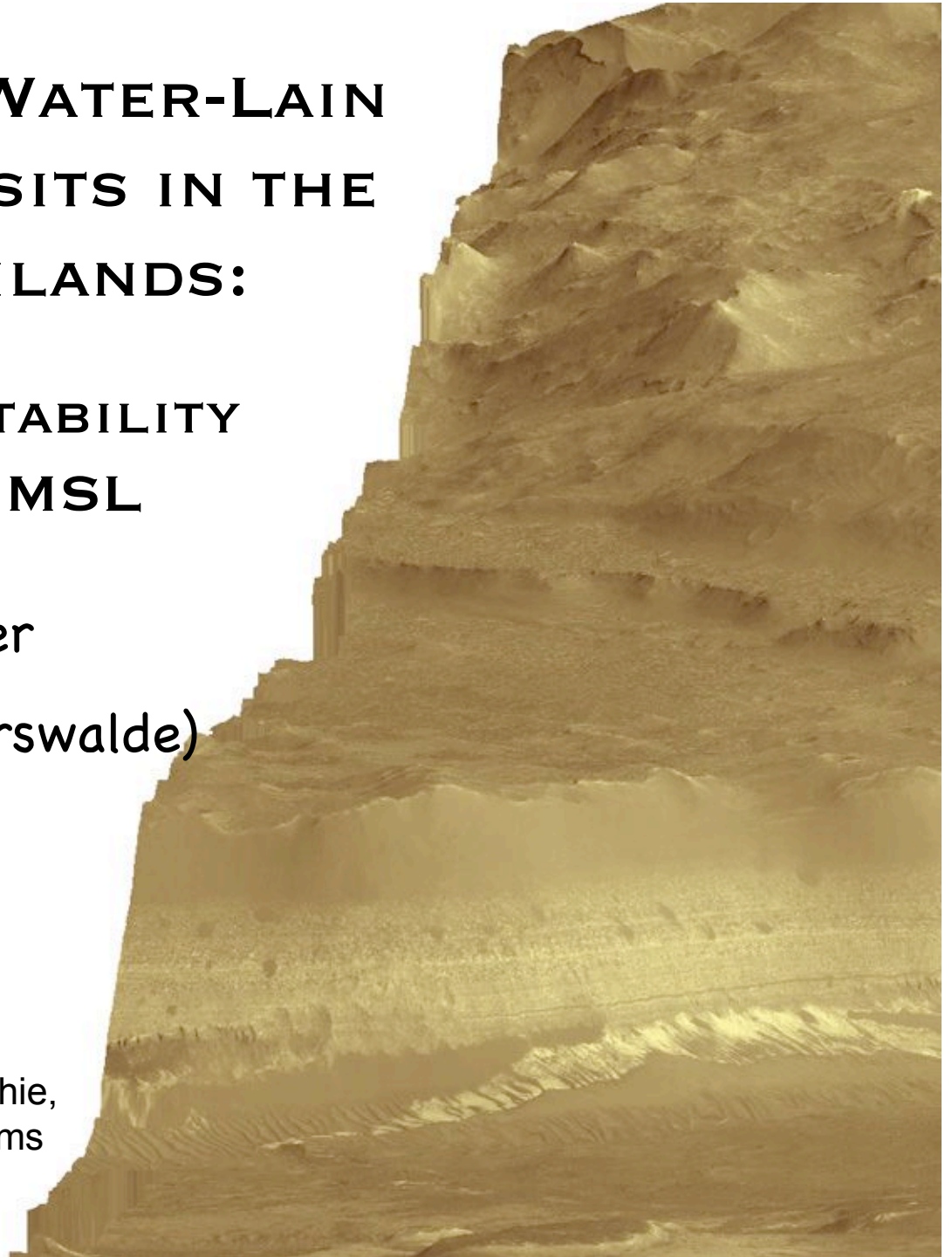
# CLAY MINERALS IN WATER-LAIN SEDIMENTARY DEPOSITS IN THE SOUTHERN HIGHLANDS:

## EVALUATING HABITABILITY ON MARS WITH MSL

Ritchey Crater  
(Holden Crater, Eberswalde)

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JPL/Caltech

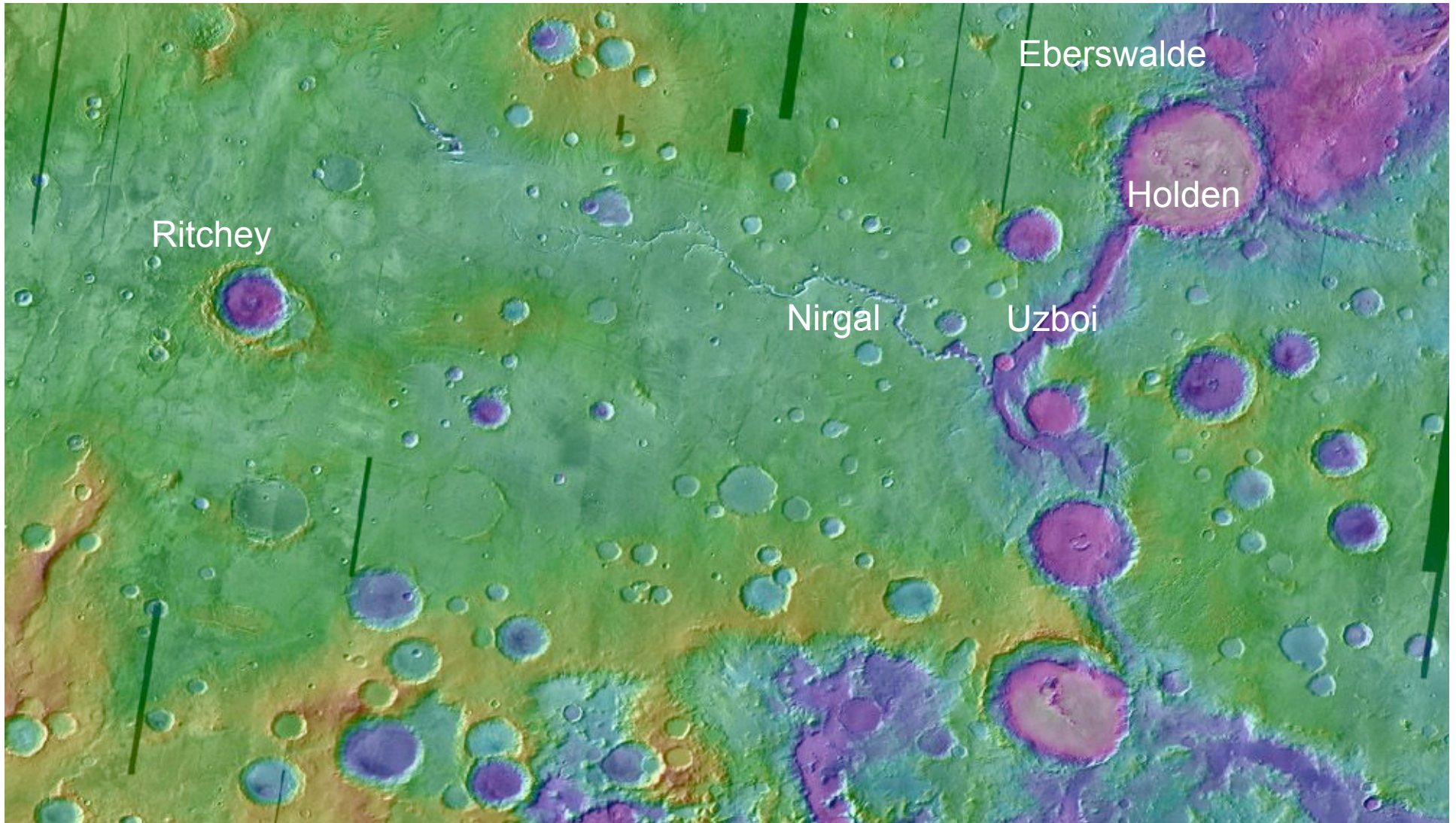
special thanks to  
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Grotzinger, J. Rice, J. Schieber, S. Murchie,  
A. McEwen, and the MRO Science Teams





## Alluvial/Fluvial & Lacustrine Deposits in Ritchey Crater

Ritchey Crater is west of the Uzboi-Ladon-Margaritifer system, but it shares many of the morphological and mineralogical traits as deposits in Eberswalde and Holden Crater.



# Why Ritchey Crater?

- Morphologic evidence for alluvial/fluvial units (*sedimentary deposits*).
- Possible lacustrine deposits (long-lived body of water).
- Deposits are similar to those found in nearby Holden and Eberswalde fans; therefore the *same processes may be recorded in these sediments*, but the landing ellipse appears safer.
- Clays are present within the landing ellipse!
- Impacted into Noachian crust, which likely contained phyllosilicates formed earlier in Mars history.
- Evidence for Fe/Mg smectites (CRISM); nearby regions as yet unmeasured by MRO may contain other phyllosilicates.
- Central peak is near landing ellipse.
  - diversity* in mafic mineralogy (Noachian crust?)
  - alteration* of Noachian crust (impact glass, phyllosilicates, alteration of mafic material)
  - can study *impact processes*
  - can be used to determine *stratigraphy* and compare pre- and post-impact clays

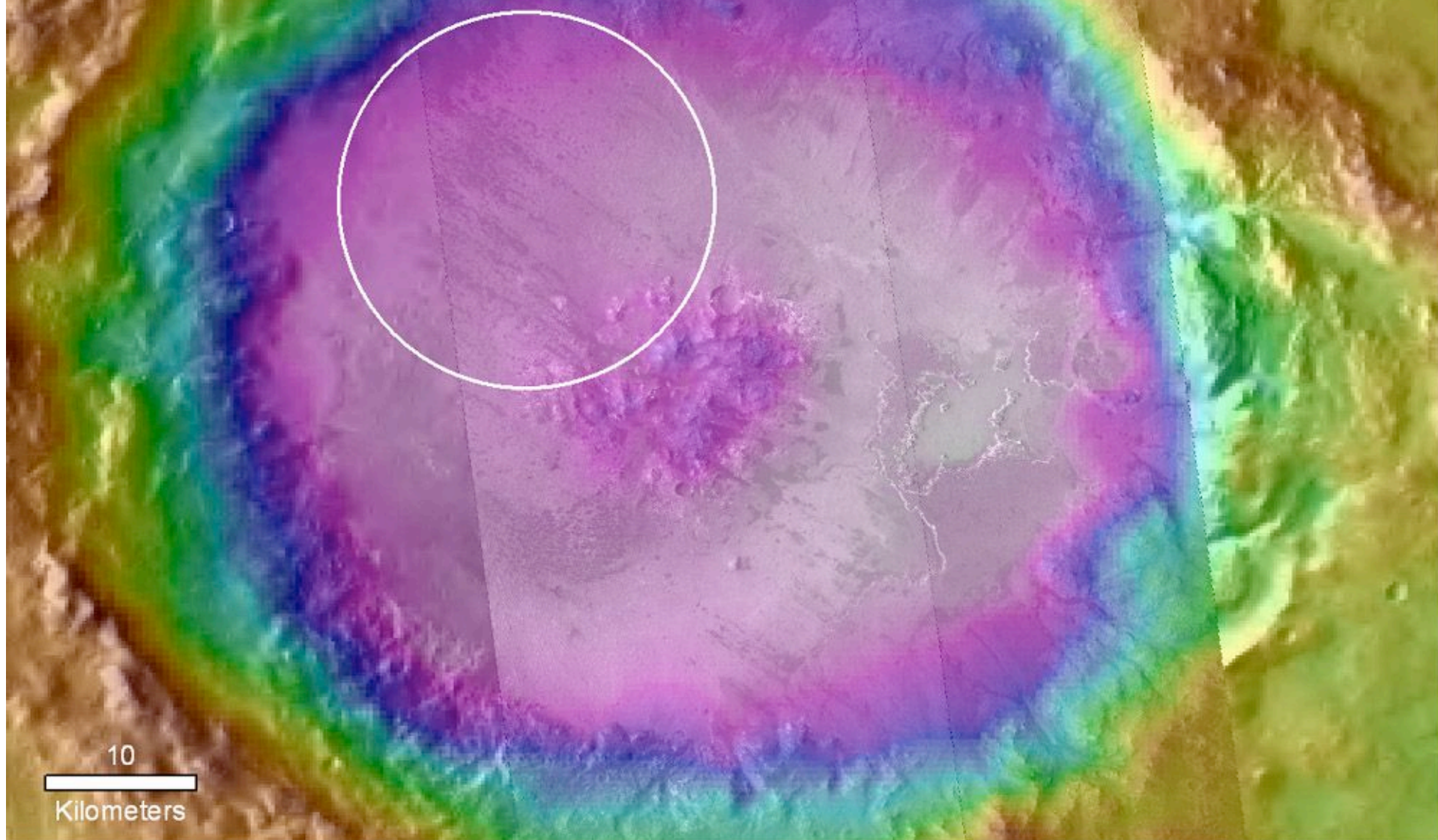


MOLA DEM

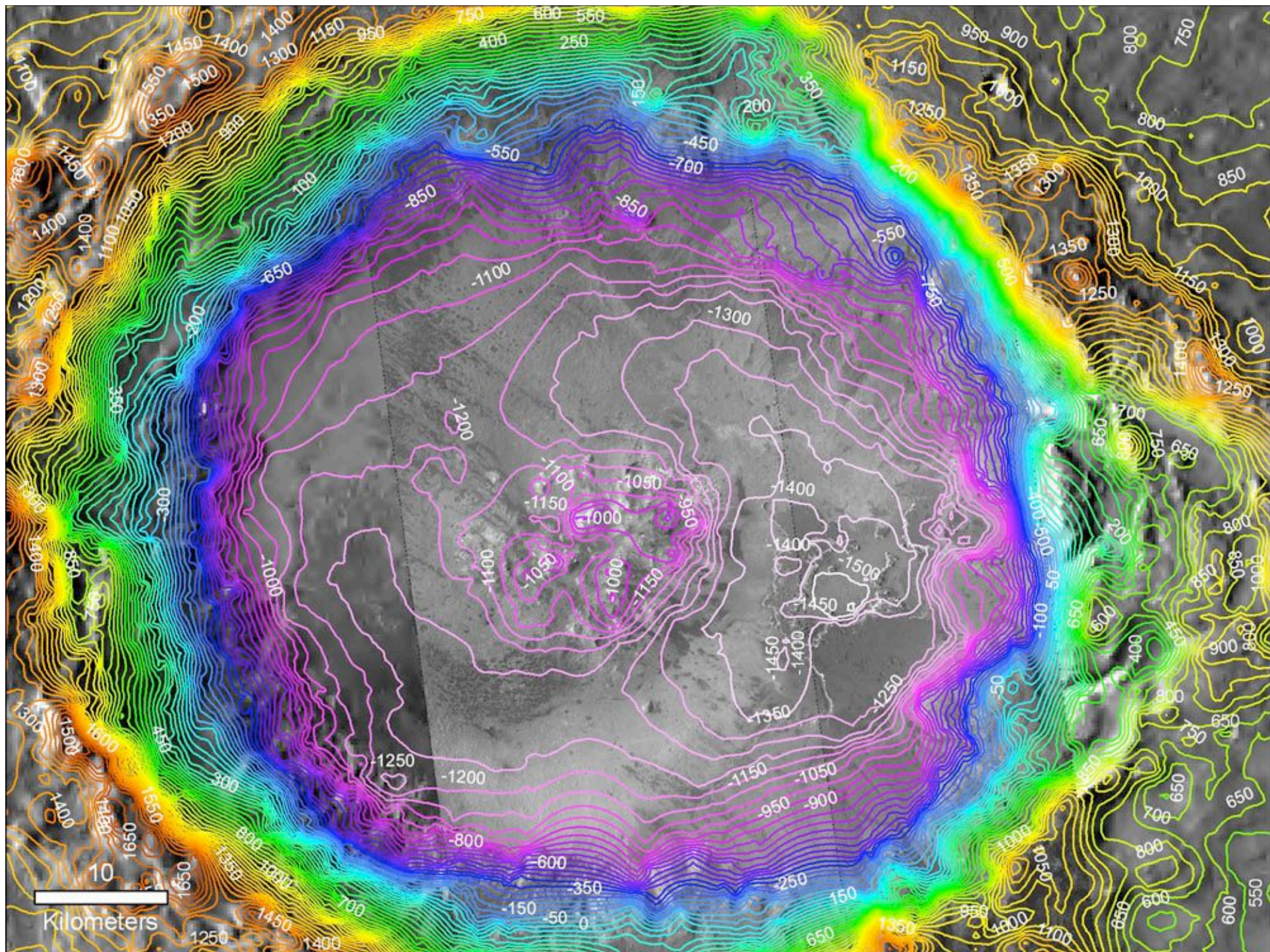
Value

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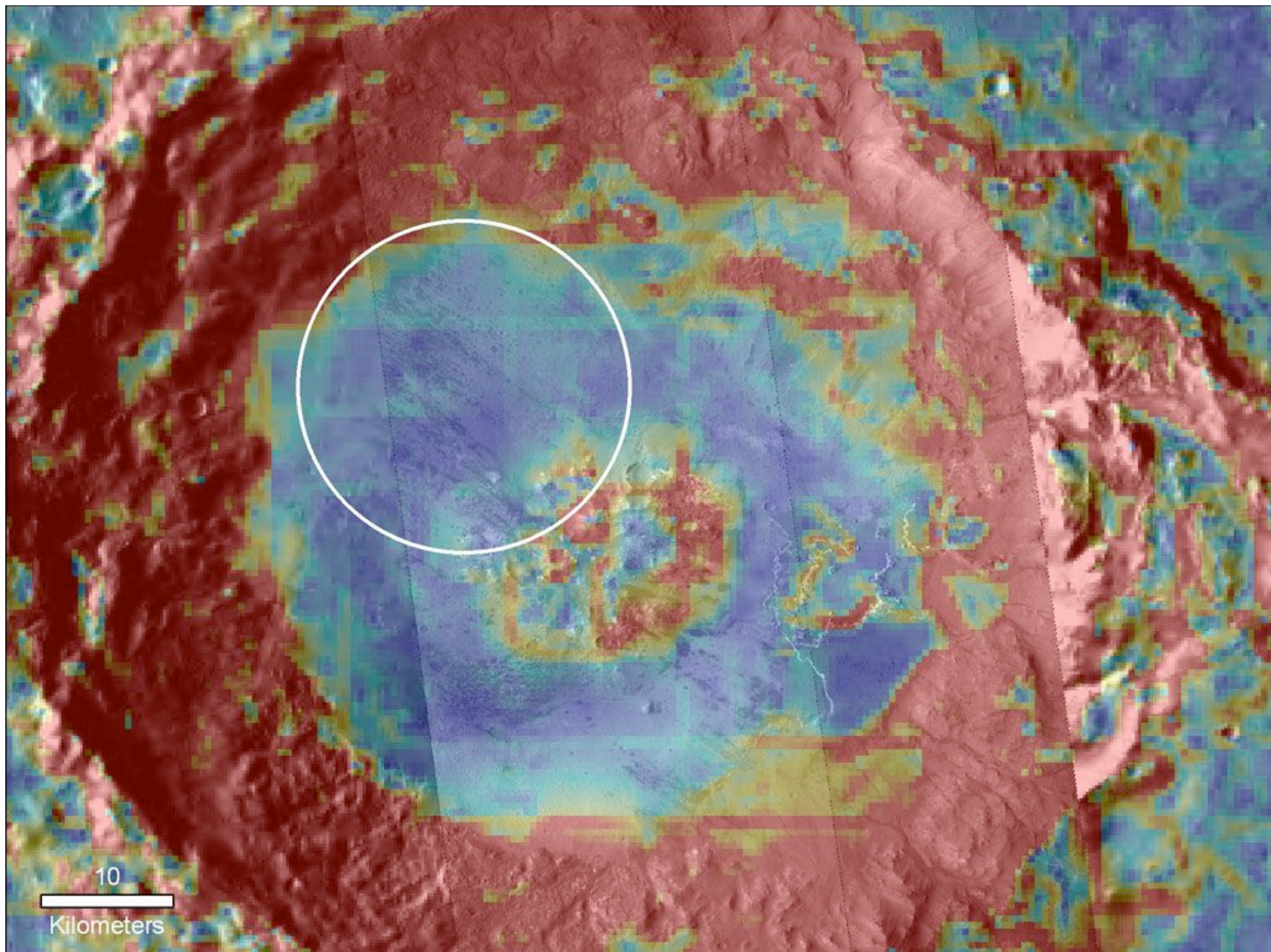
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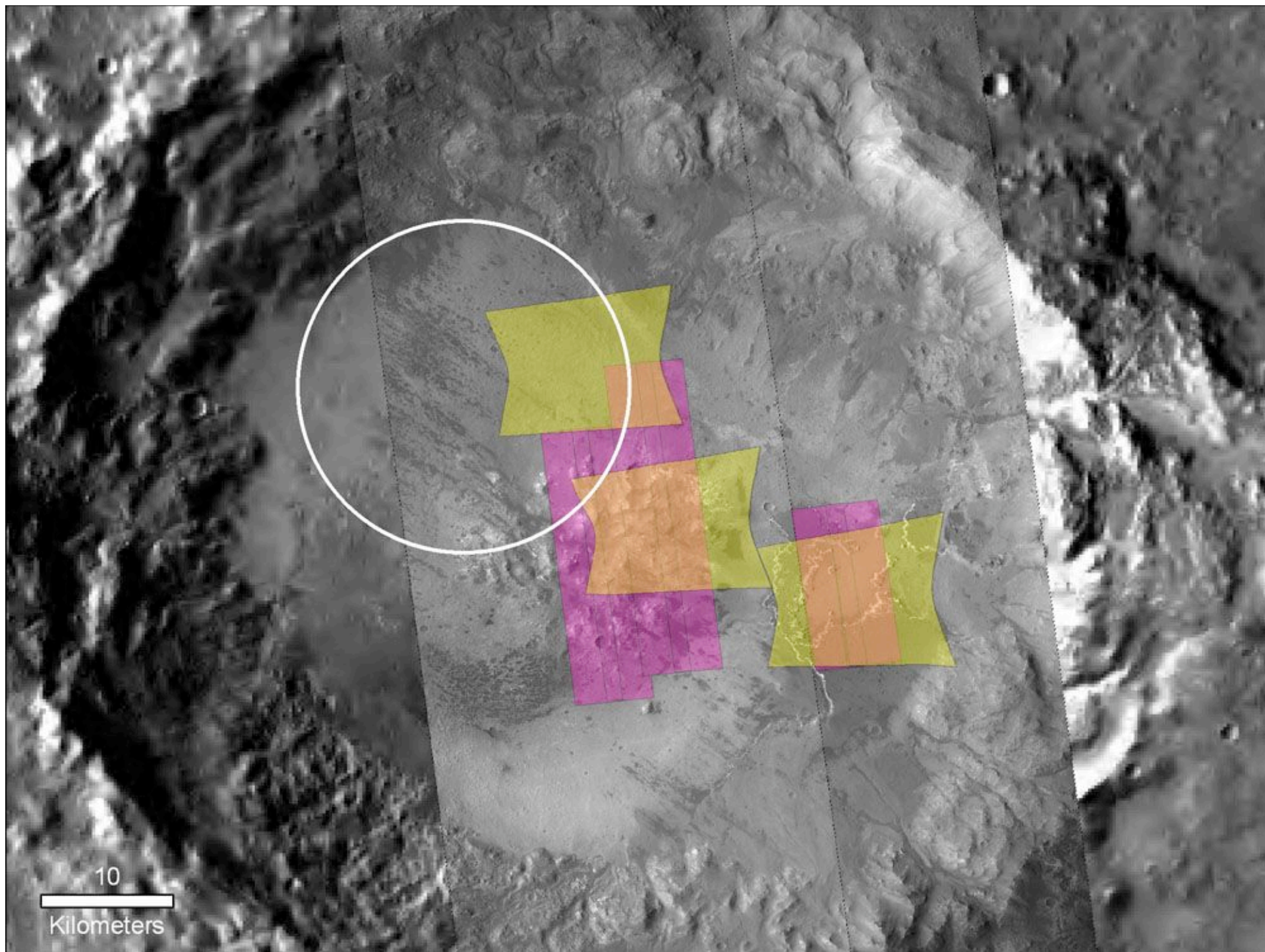




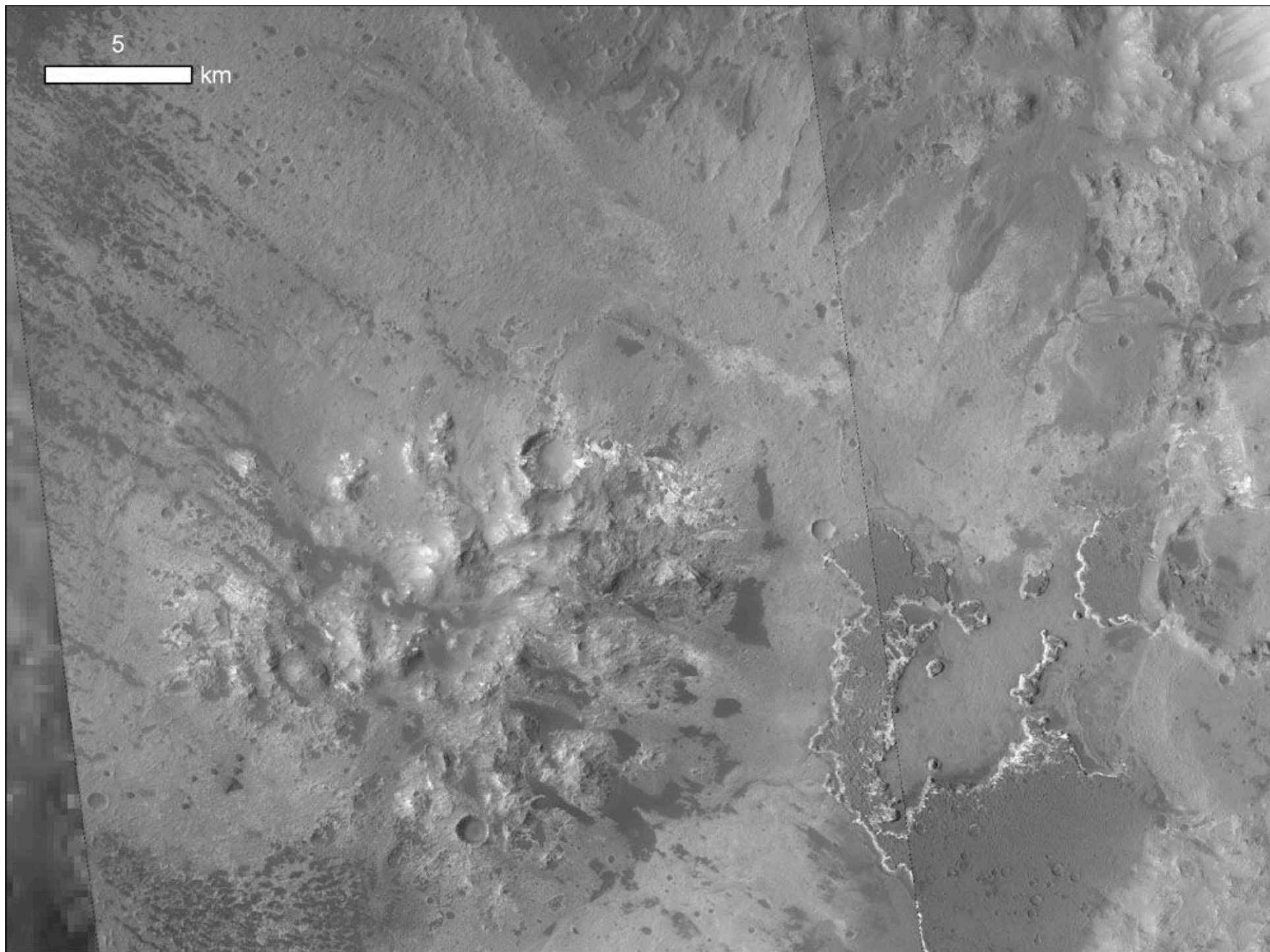




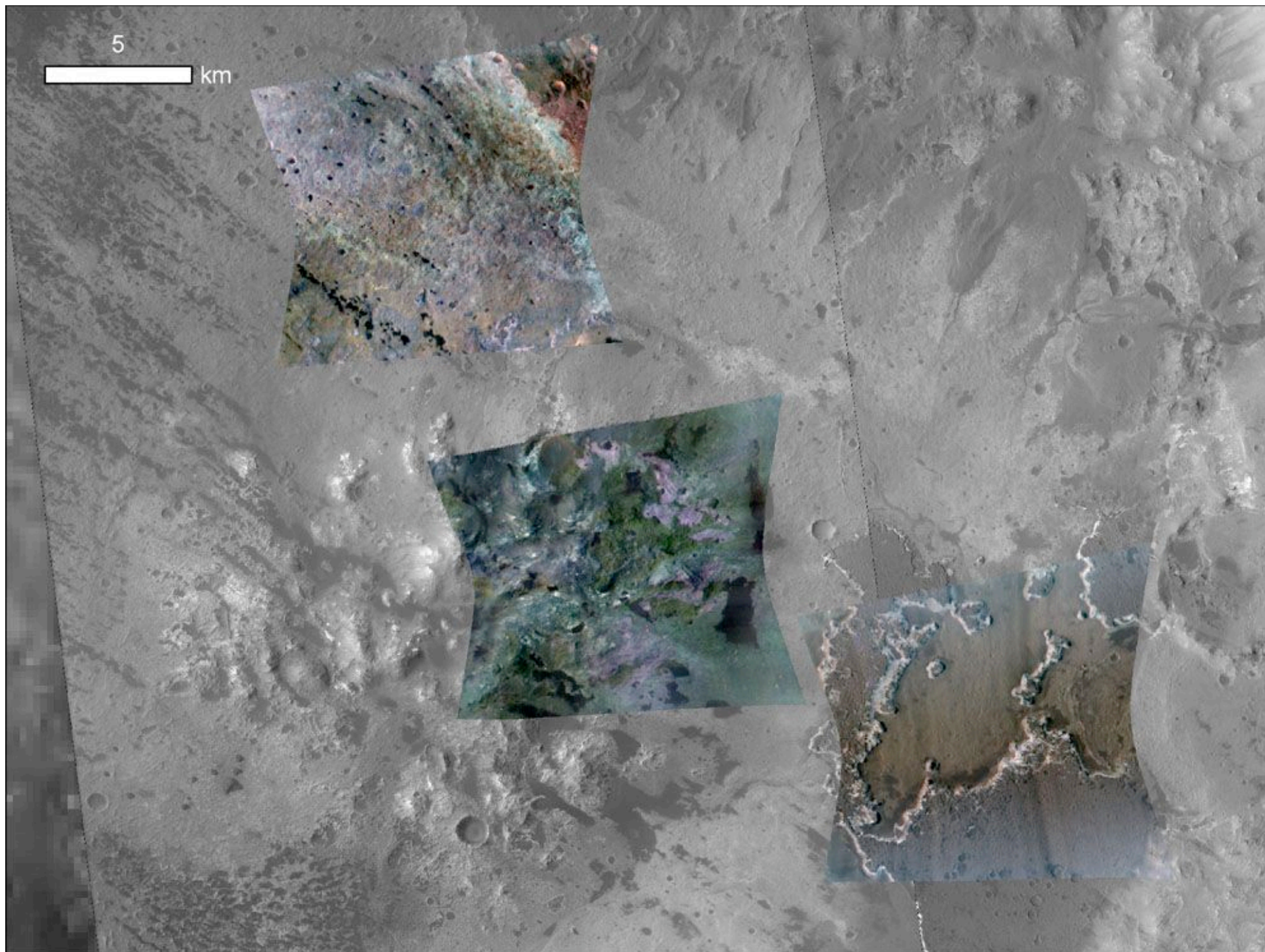






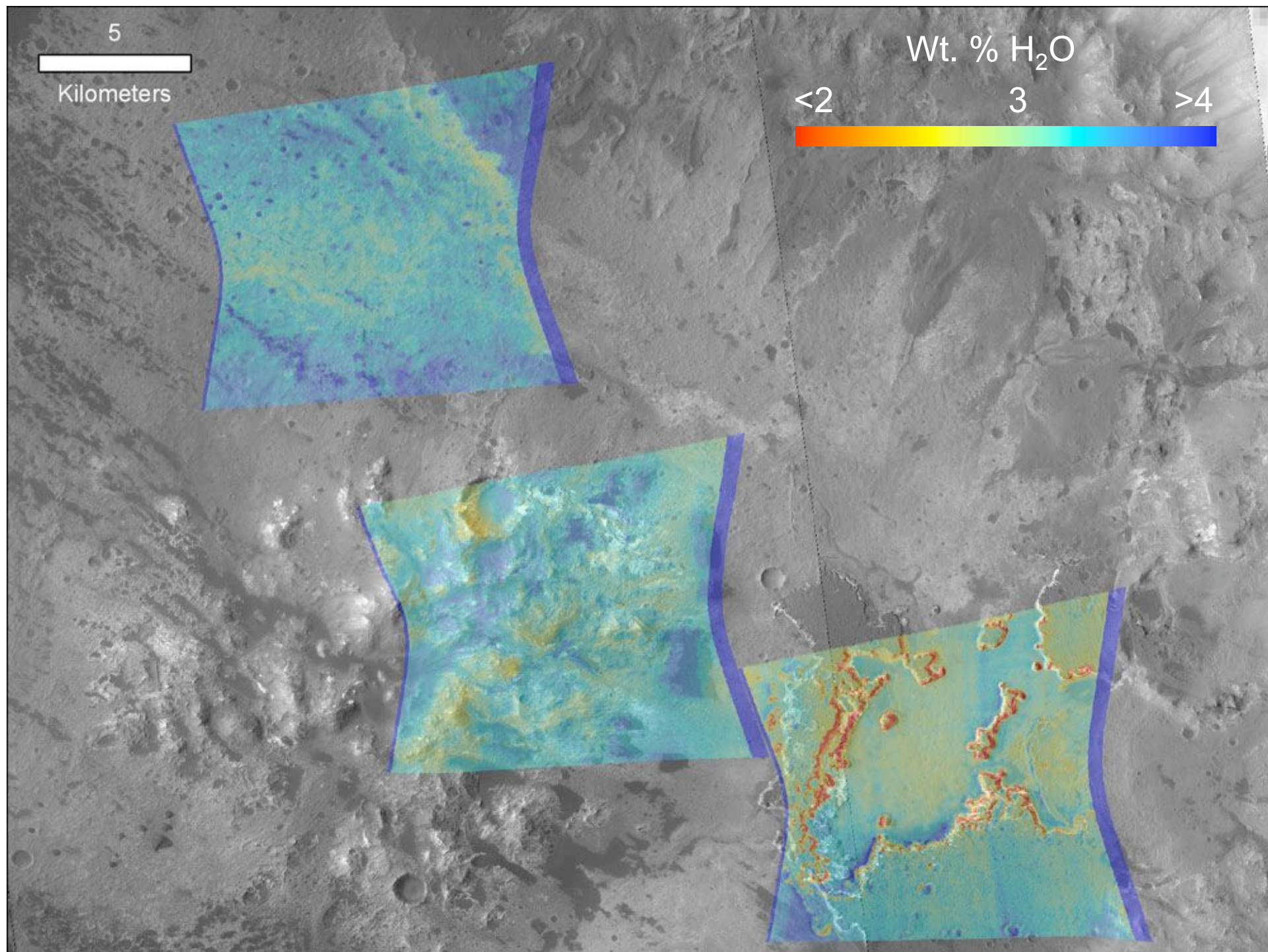




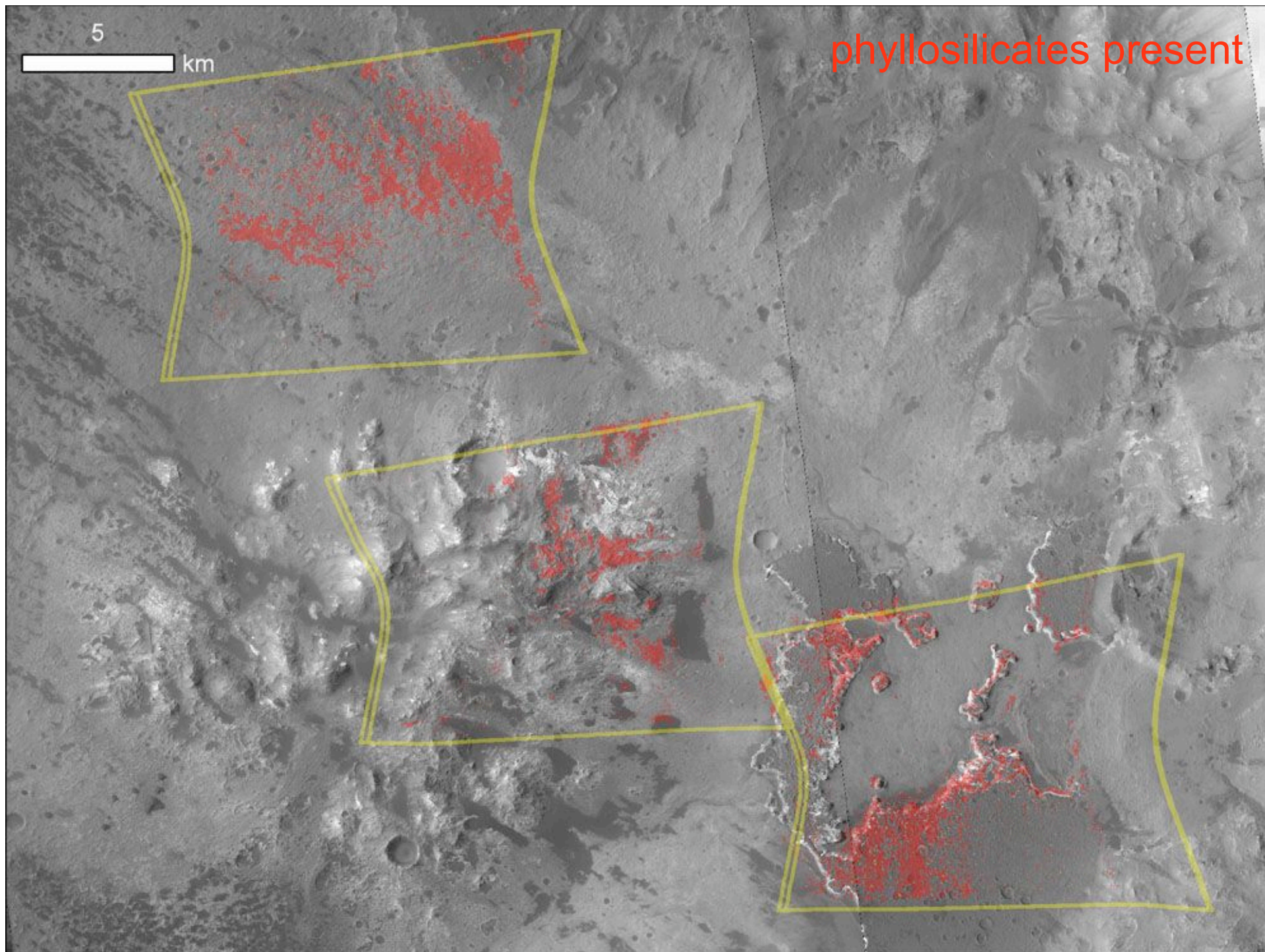




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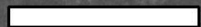








50



Meters

## Representative Portion of Landing Ellipse: HiRISE

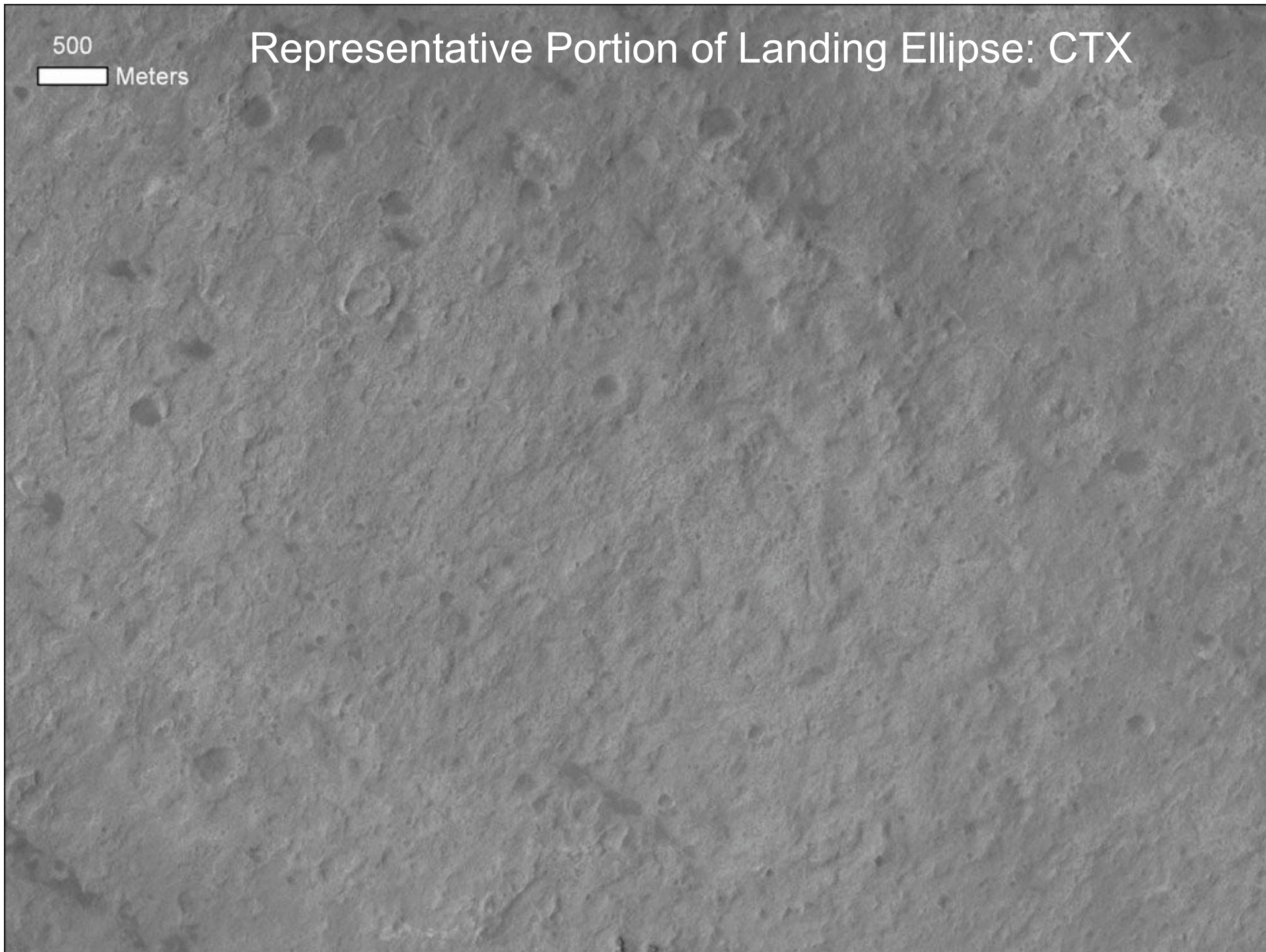




500

Meters

## Representative Portion of Landing Ellipse: CTX

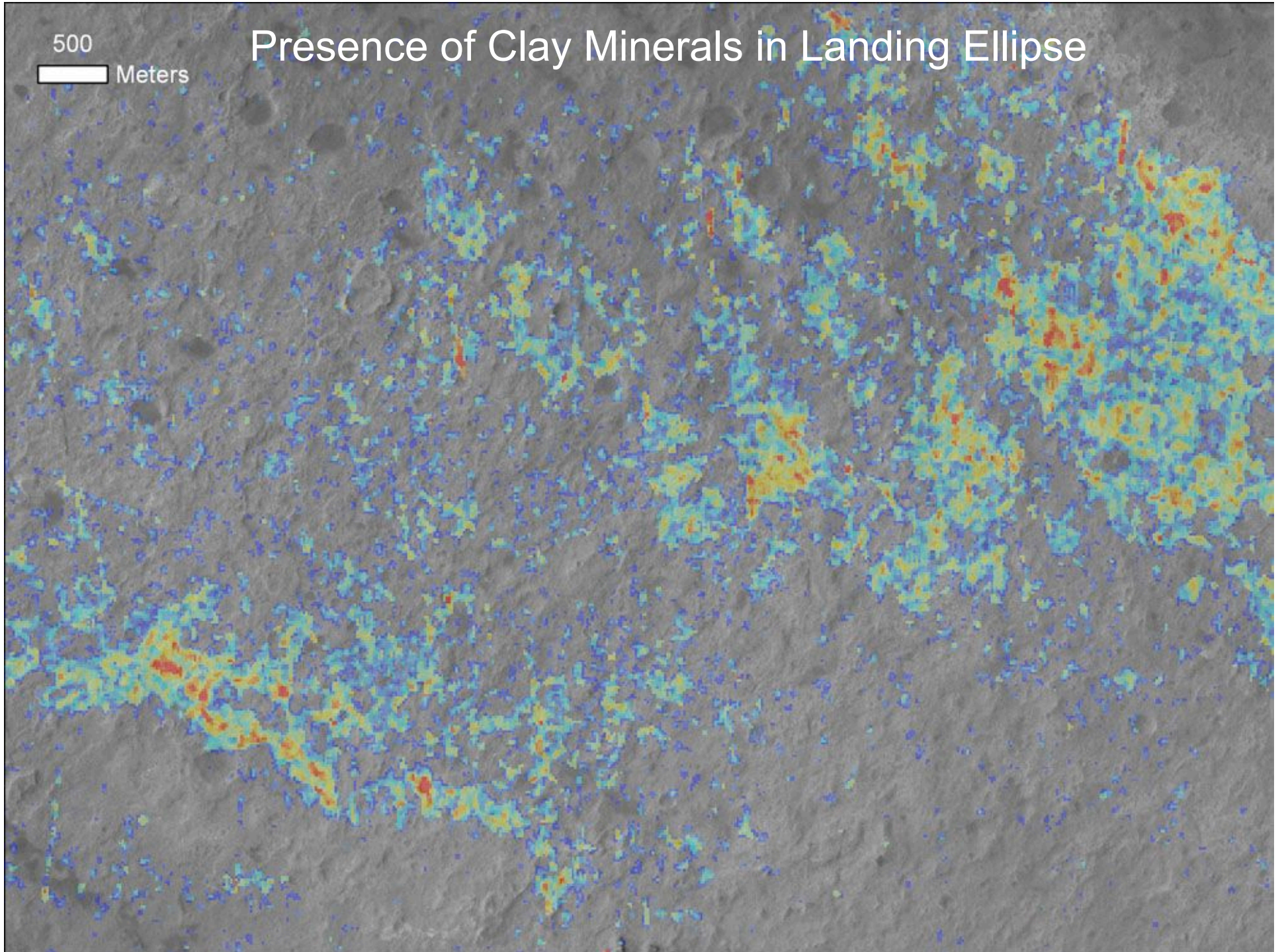




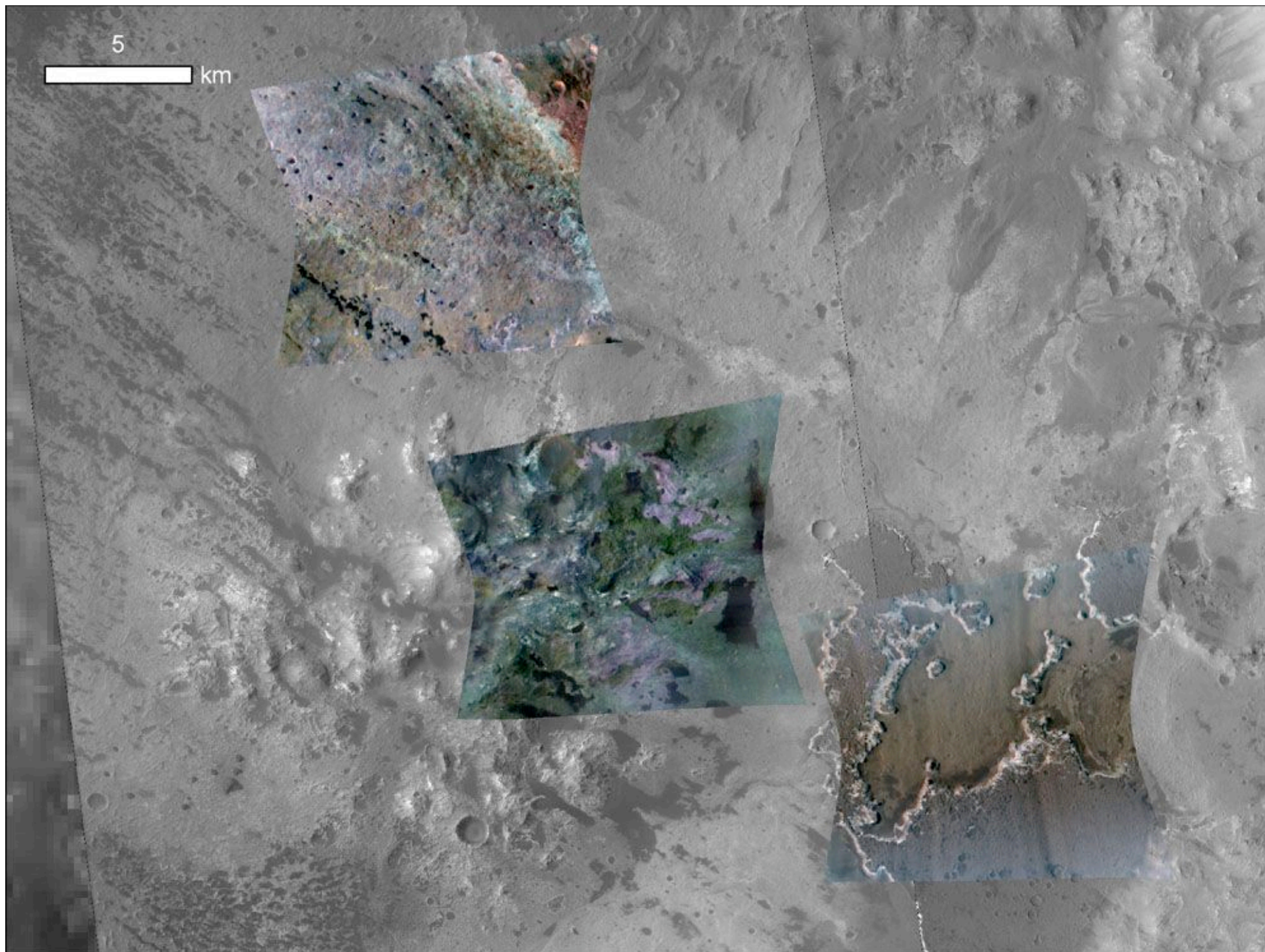
# Presence of Clay Minerals in Landing Ellipse

500

Meters

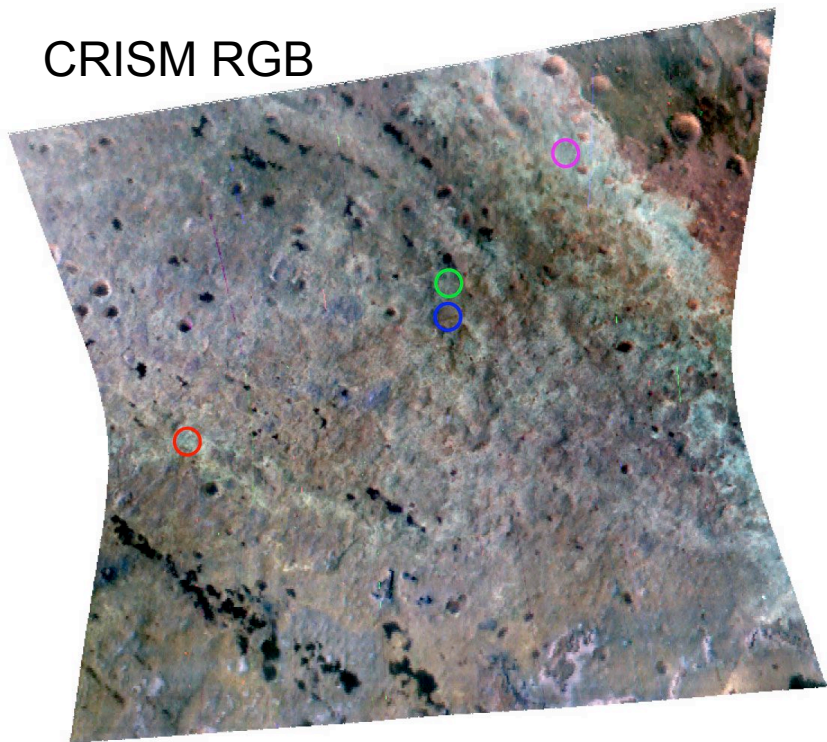




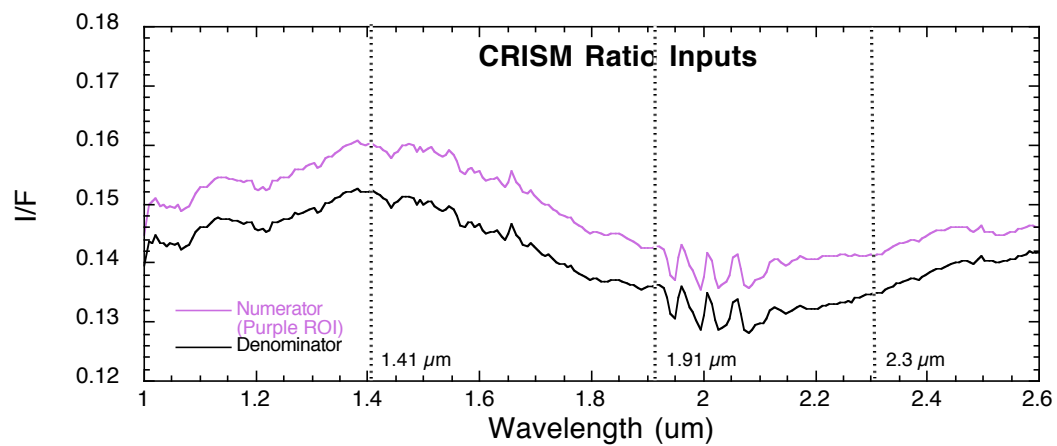
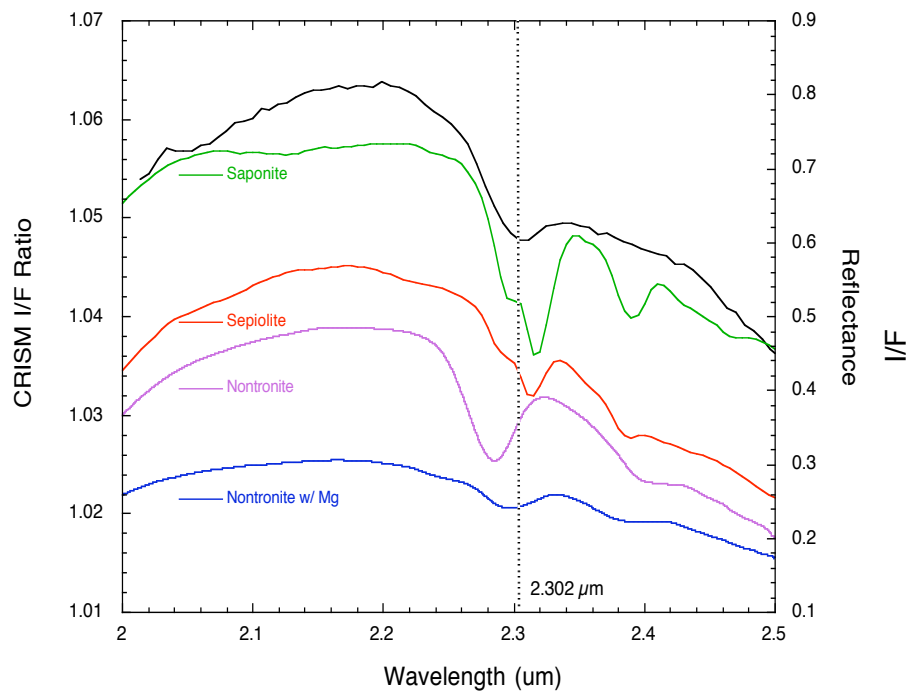
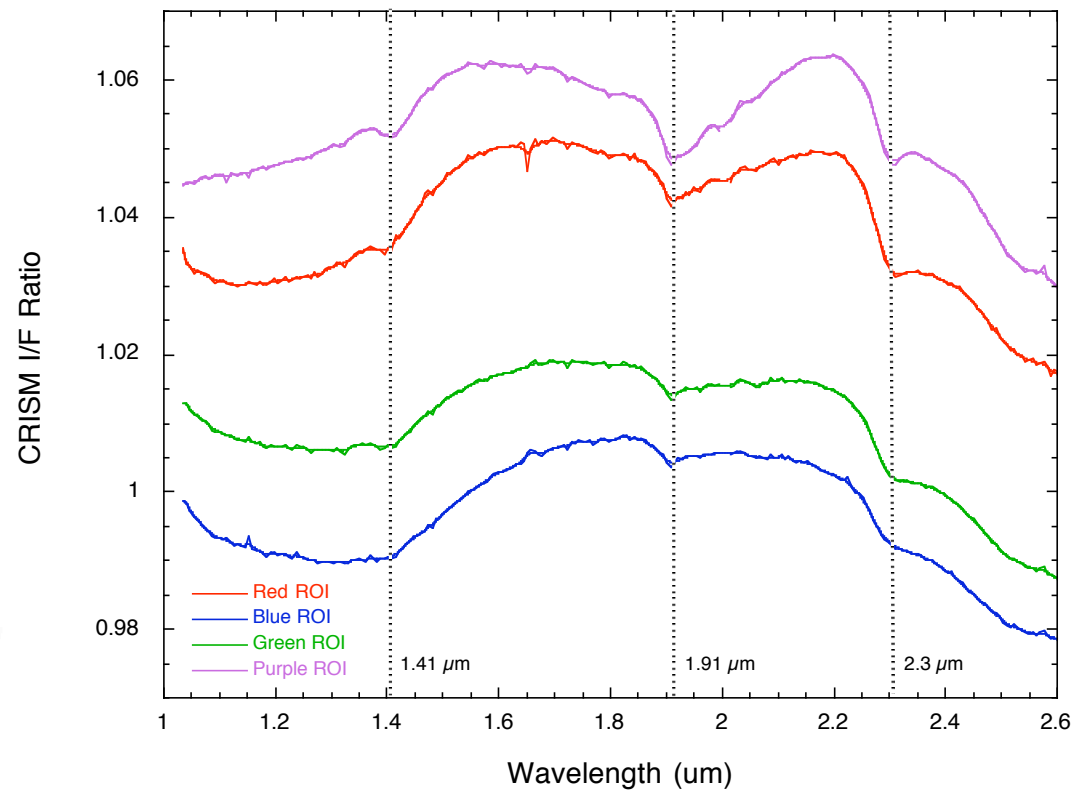




## CRISM RGB

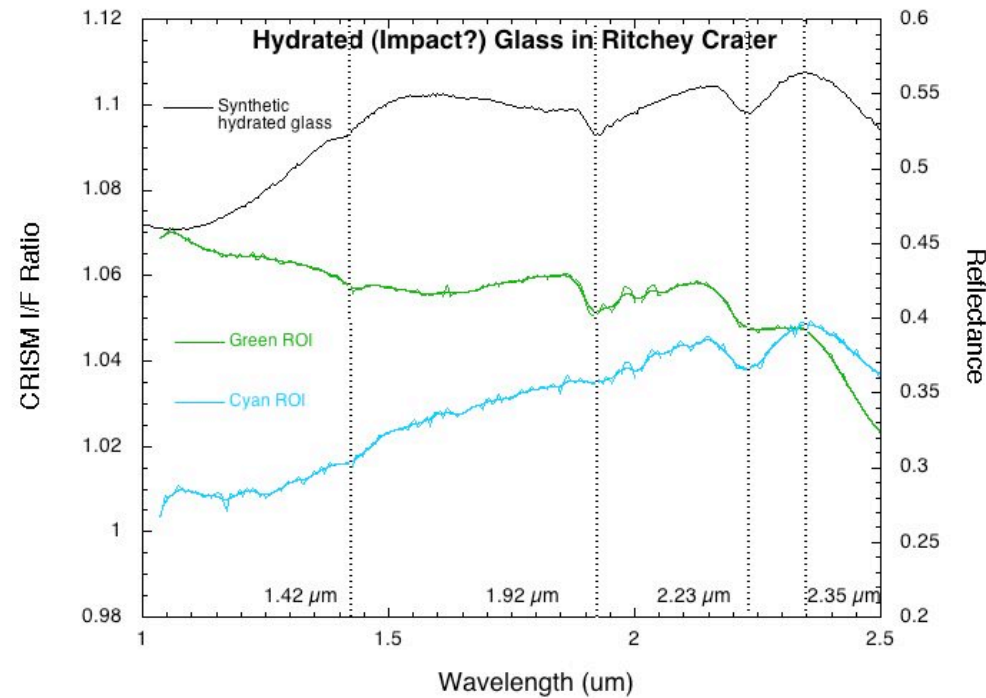
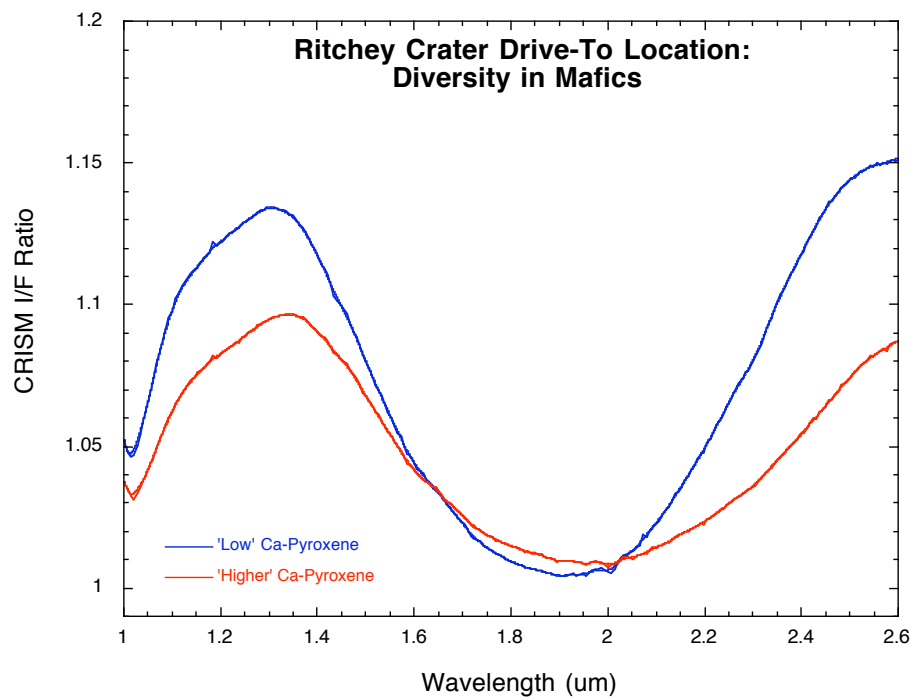
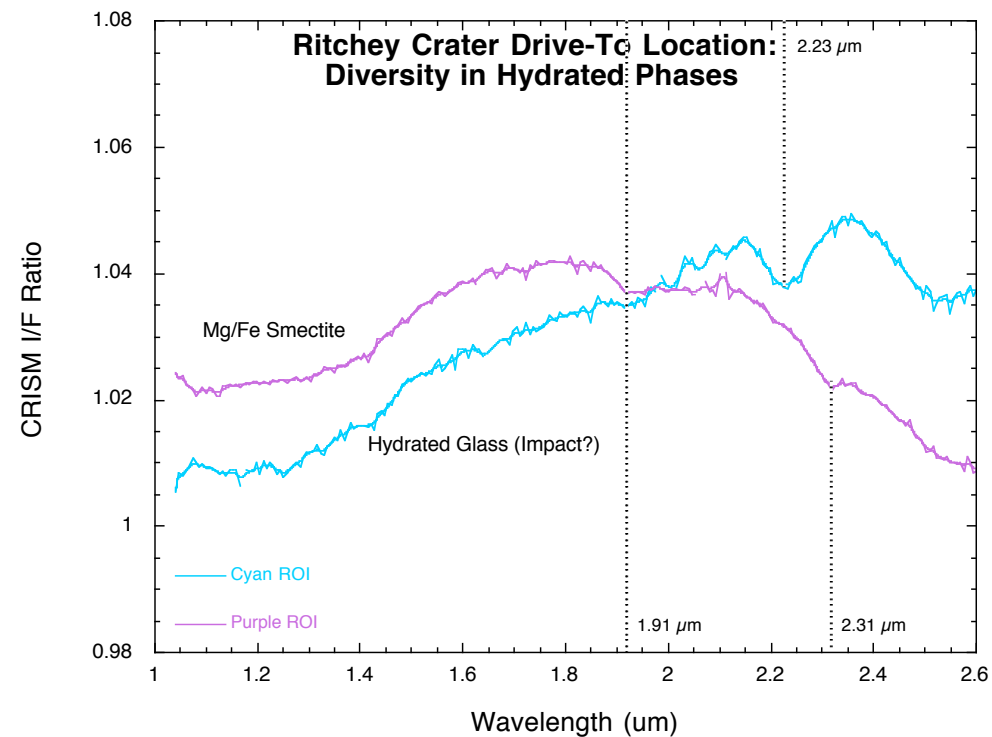
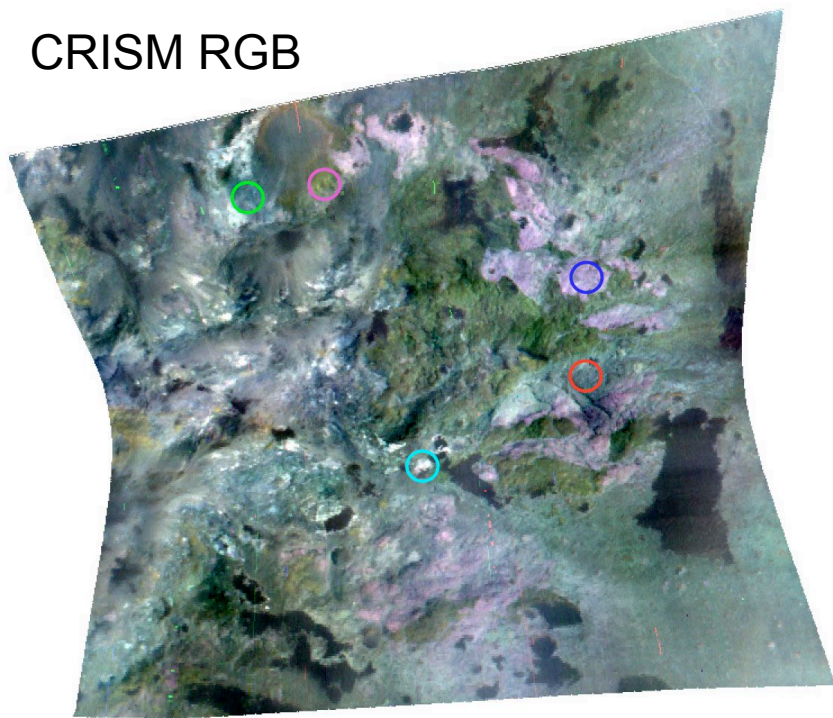


## Ritchey Crater Landing Ellipse: Mg/Fe Clays



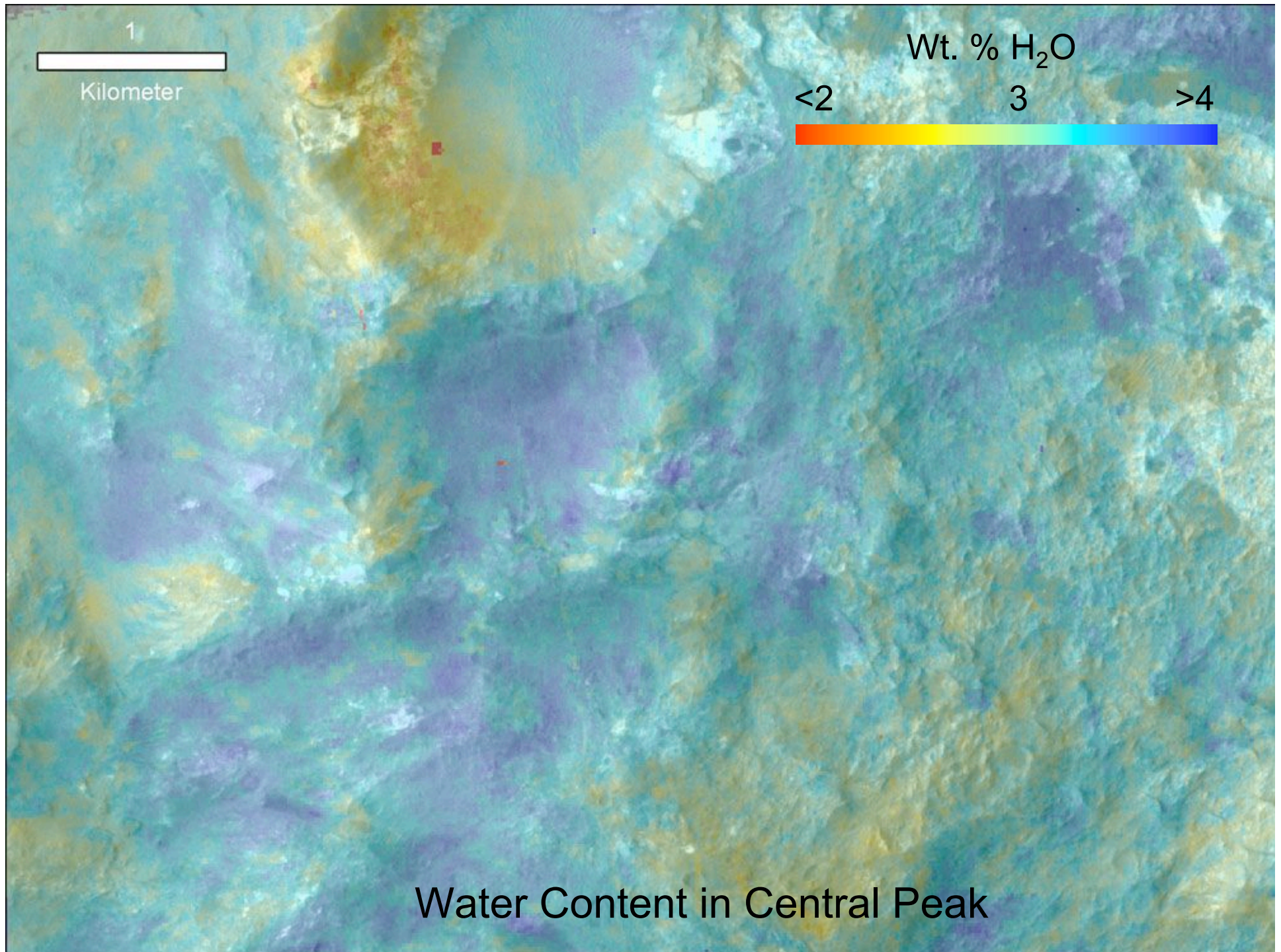


# CRISM RGB

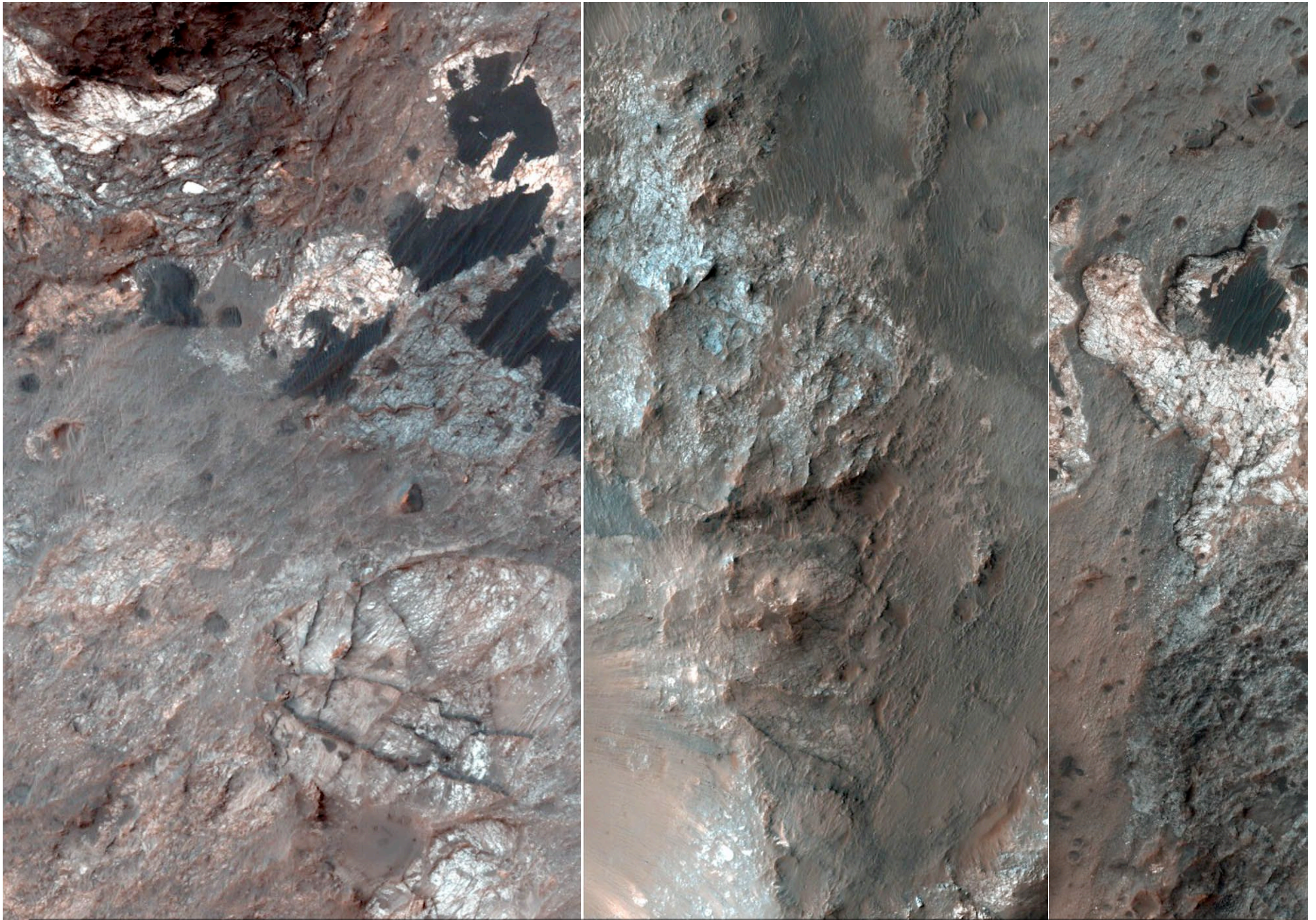




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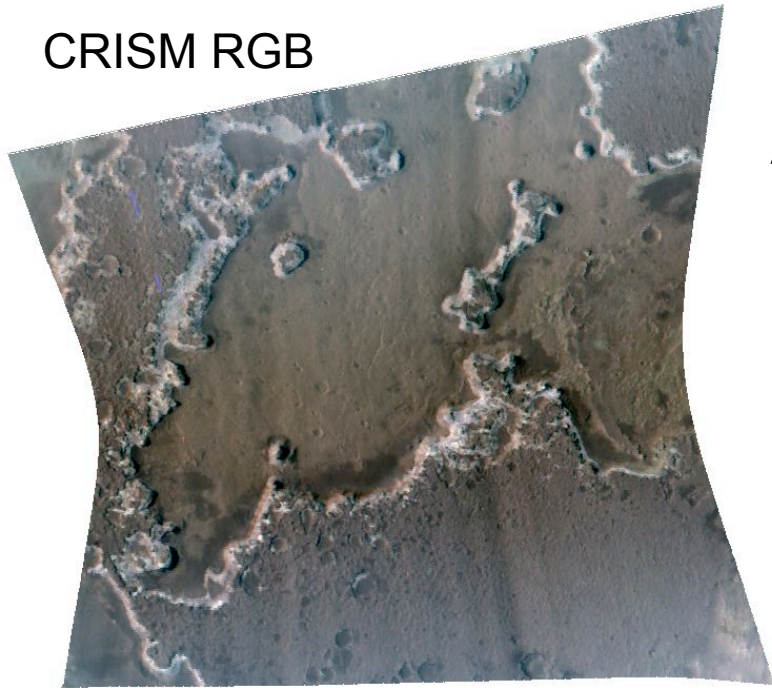




HiRISE Color Reveals Diversity in Composition of Central Peak

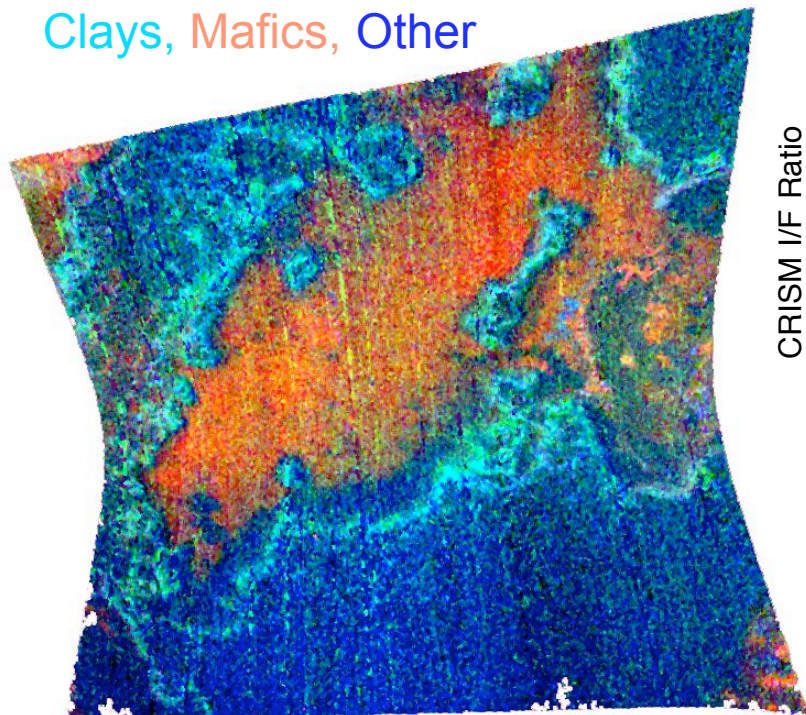


CRISM RGB

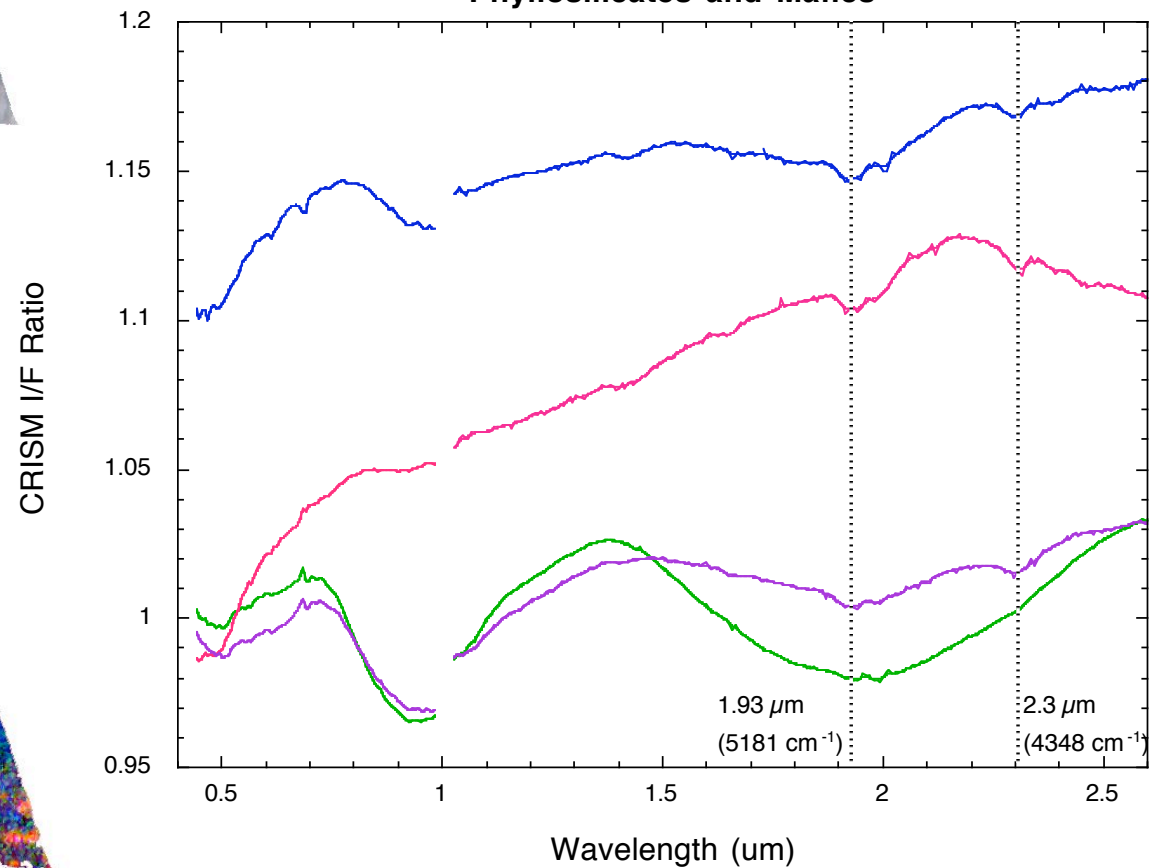


Alluvial/Fluvial (& possible lacustrine) units exhibit spectral diversity indicative of mafic minerals and phyllosilicates (Fe/Mg smectites).

Clays, Mafics, Other

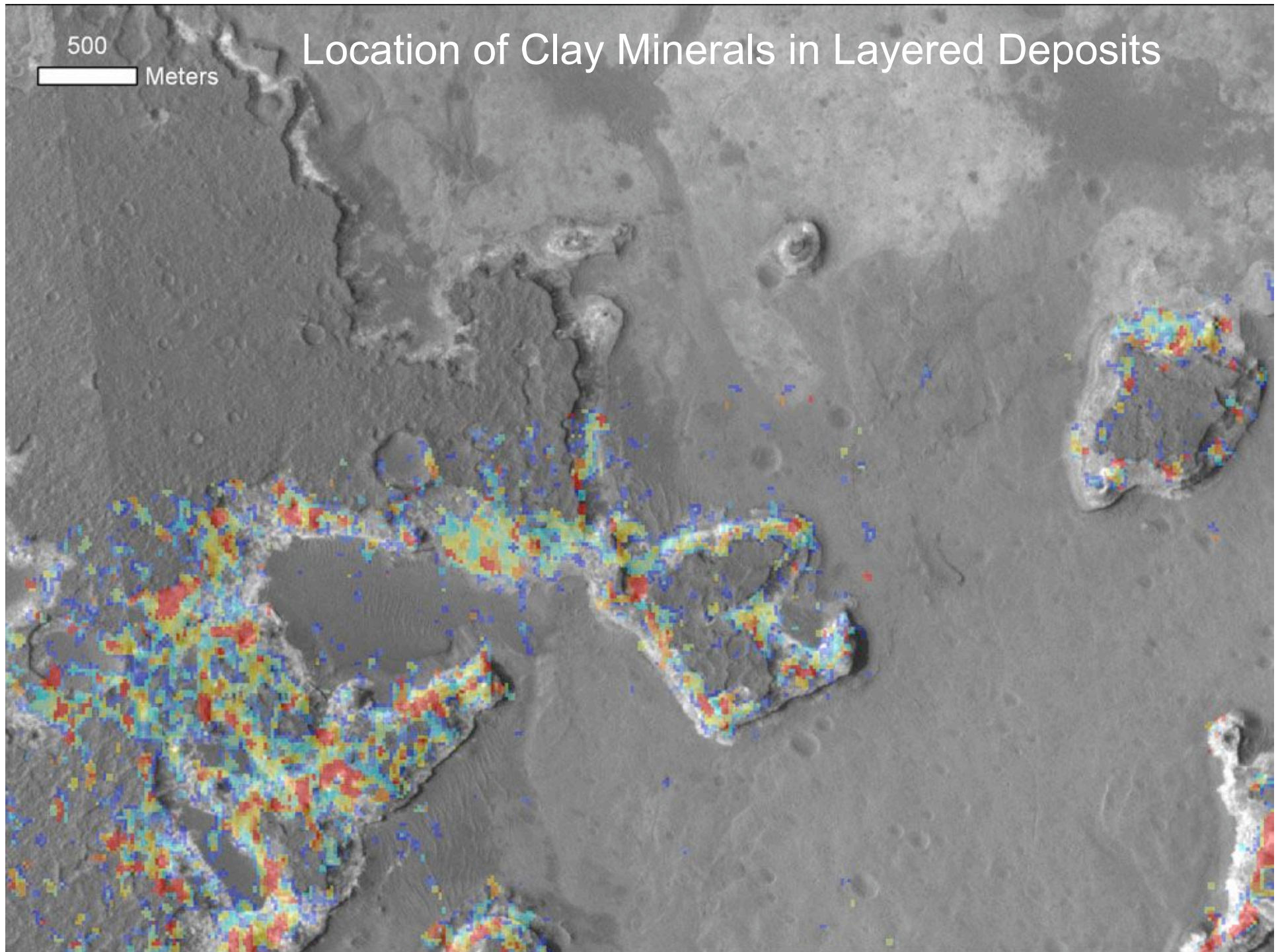


Ritchey Crater Drive-To Location:  
Phyllosilicates and Mafics



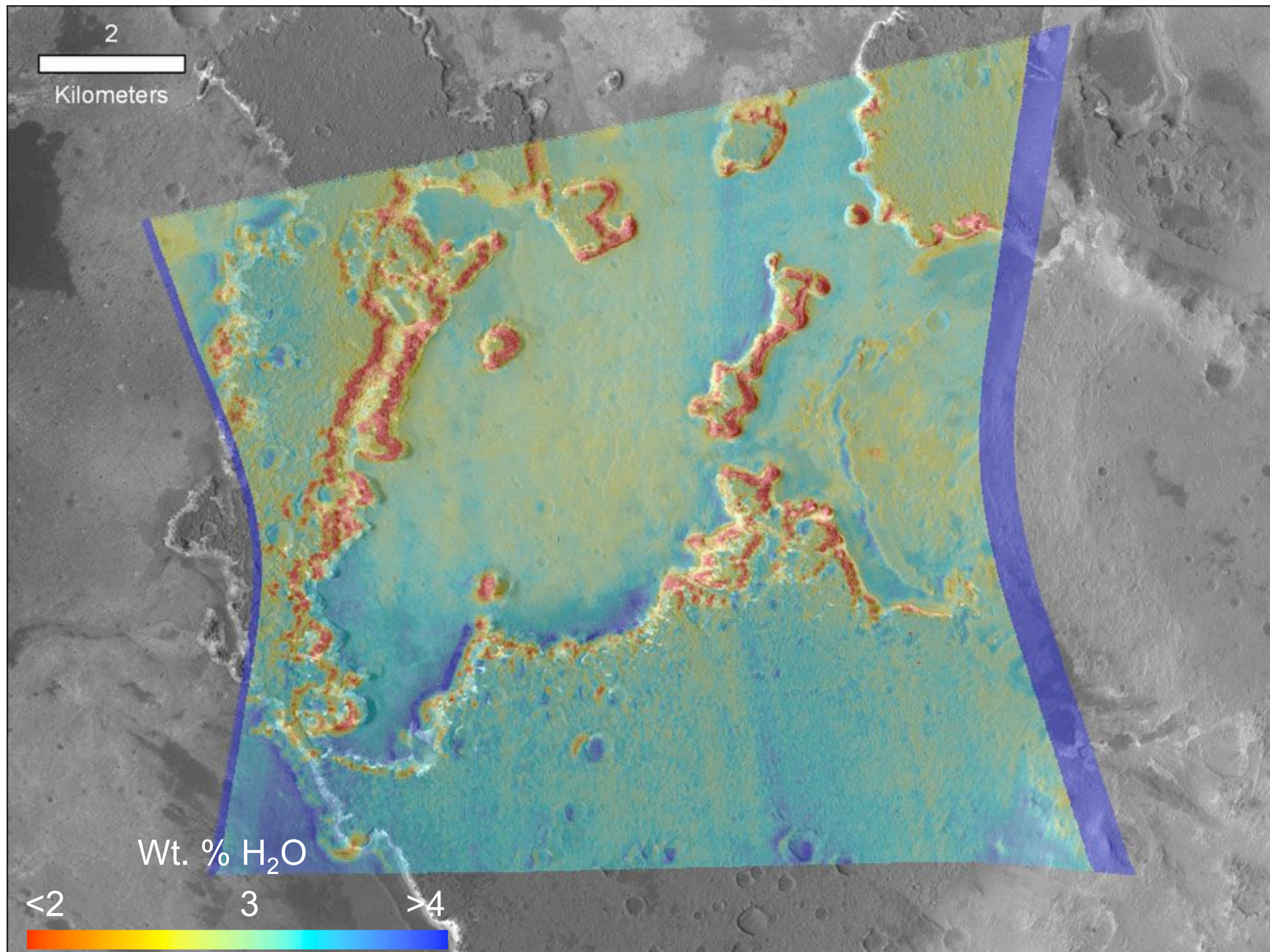


# Location of Clay Minerals in Layered Deposits





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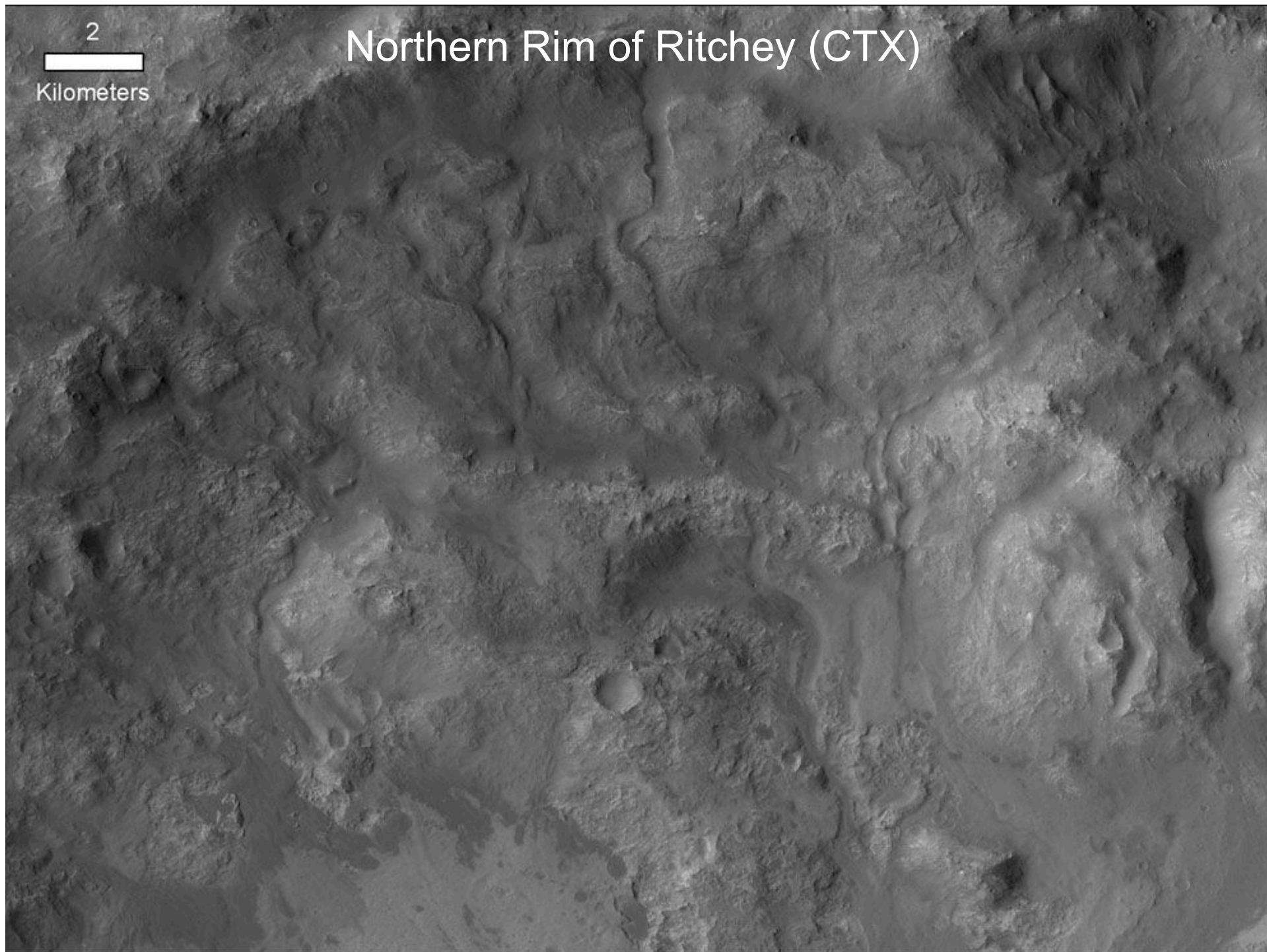


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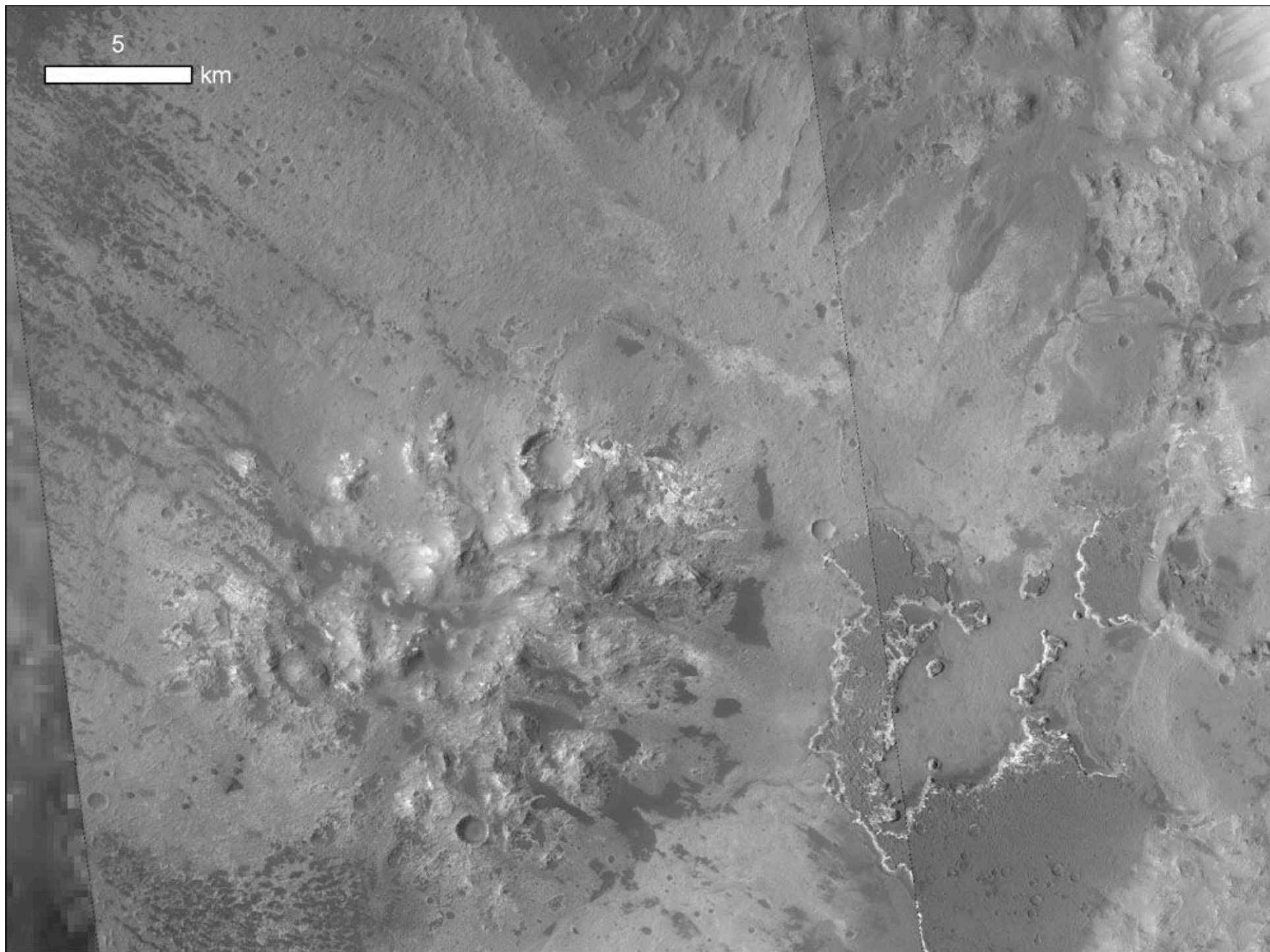


Kilometers

# Northern Rim of Ritchey (CTX)

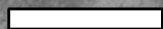






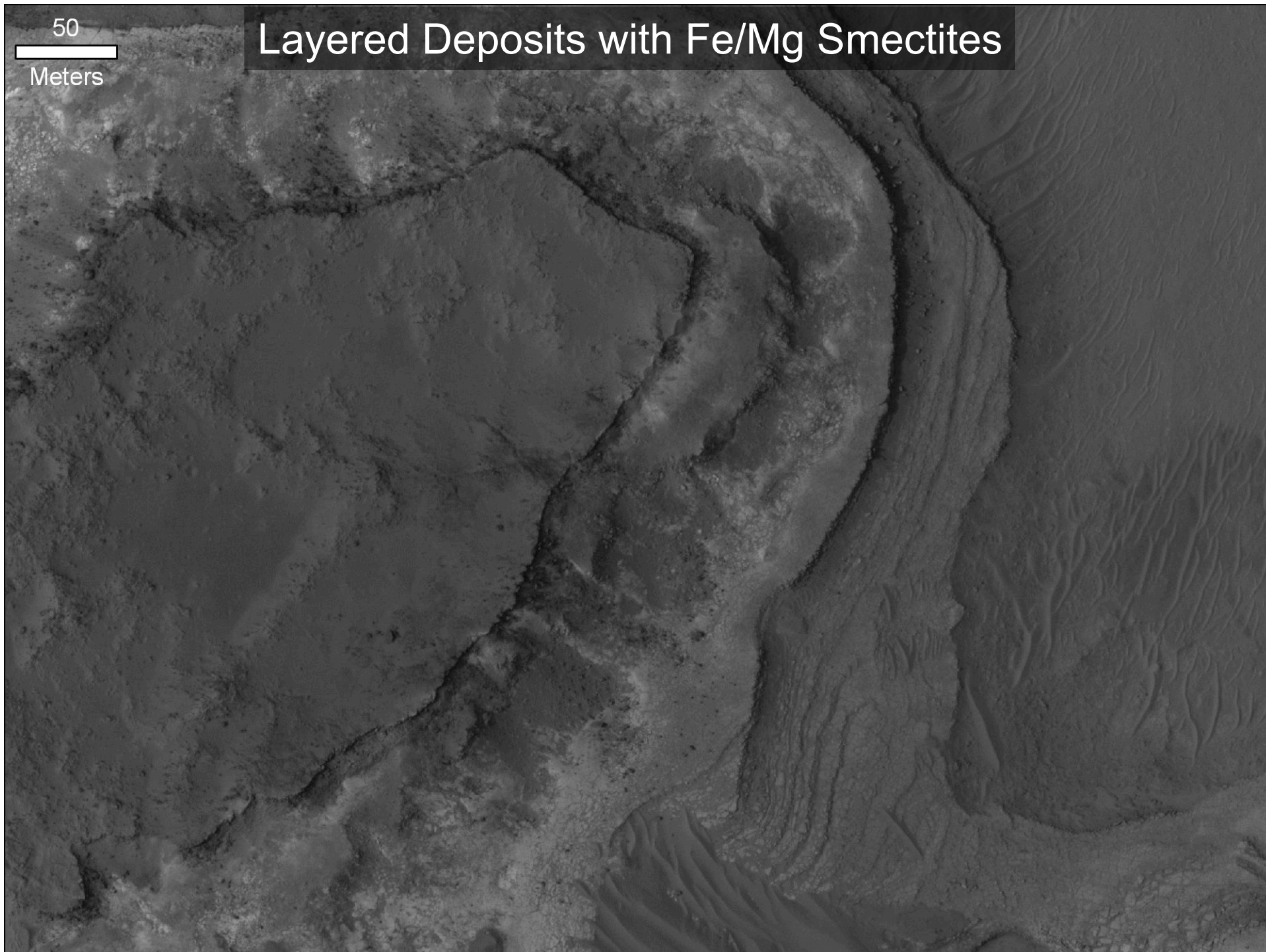


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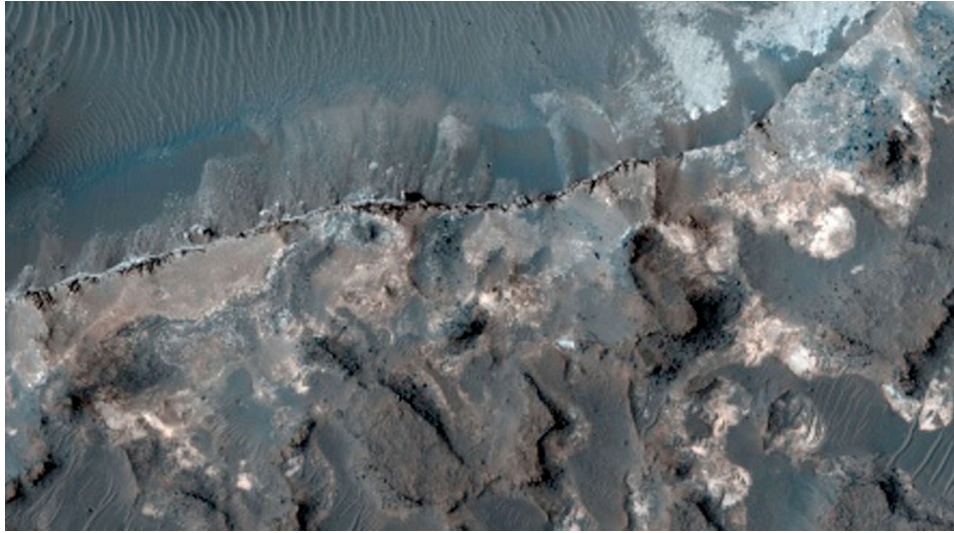


Meters

## Layered Deposits with Fe/Mg Smectites







HiRISE color products highlight diversity in composition within layered deposits.

Units with Fe/Mg smectites are light brown in these false color images.





# Ritchey Crater is an Excellent Site for MSL Science Goals

The crater acts as a closed sedimentary basin...

- thick sequence of sedimentary deposits
- sequence records different depositional processes
- presence of fine-grained materials (clays)
- there are likely mudstones within this sequence

Evidence for lots of water (amount and duration)...

- fluvial features along crater wall and rim
- alluvial/fluvial deposits
- significant amount of sediment transported and deposited
- likely that some material precipitated out of the water  
(interbedded sulfate, chlorides, other evaporites?)

Potential to find clays formed under different environmental conditions...

- clays formed in Noachian excavated by impact
- clays formed by impact-induced hydrothermal alteration
- clays formed in low-temperature fluvial/lacustrine setting



# Ritchey Crater is an Excellent Site for MSL Science Goals

## Diversity in mineralogy and depositional processes

- clays, hydrated glass, mafic minerals, etc.
- smectites may be the key to initiation and preservation of life/organics
- sediments deposited in an aqueous environment (**habitability**)

*Stratigraphy*, morphology, and central peak allow for unraveling the geologic history and evaluating the potential for habitability

- different facies can be used to determine the depositional environment(s)
- central peak will allow us to understand impact processes and how they alter pre-existing compositions...impact-induced hydrothermal alteration?

***Clays are present within the landing ellipse!***

***This will allow immediate access to materials important for addressing key science goals of MSL and evaluating the potential for habitability***