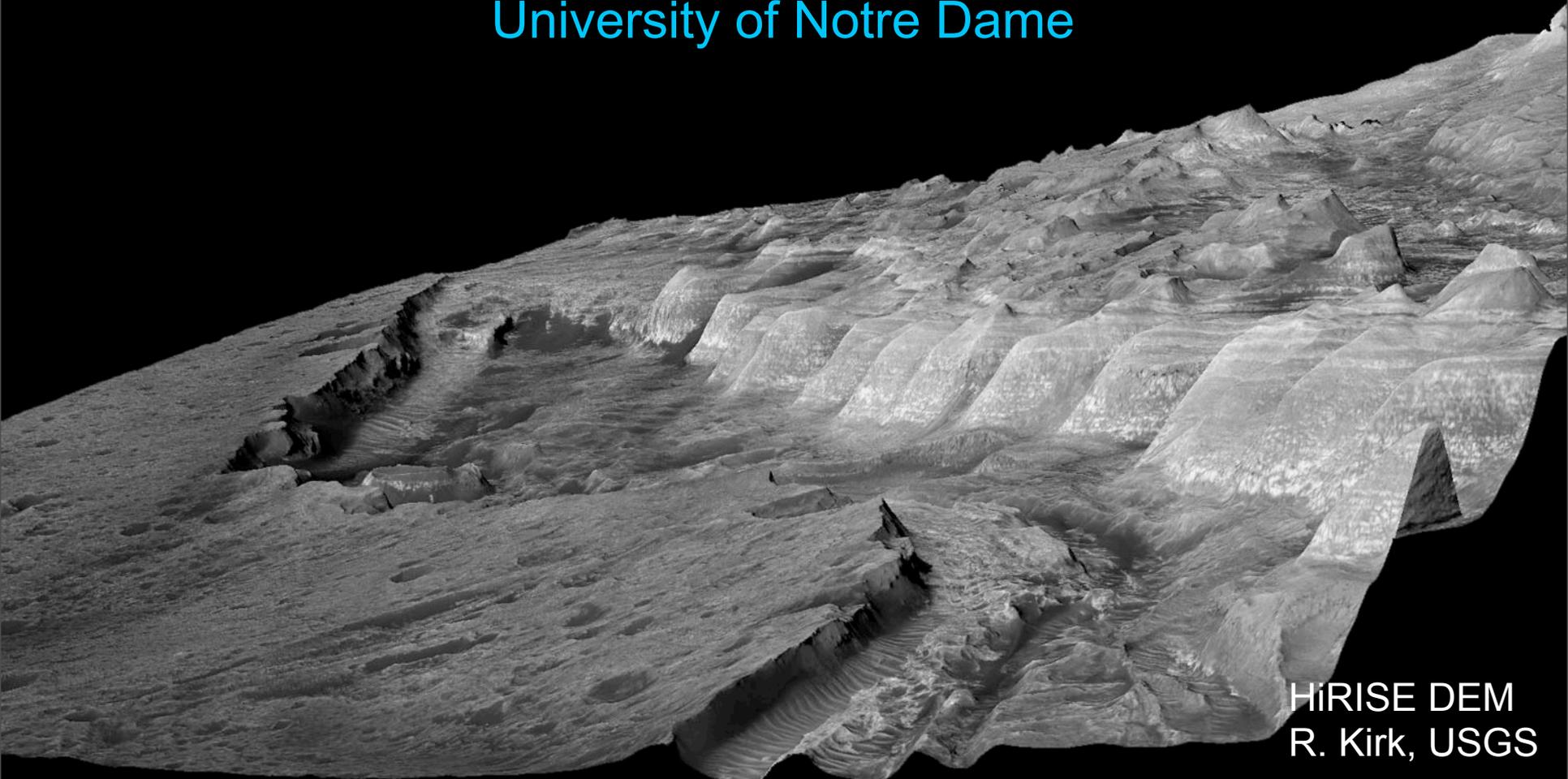


The Mineralogical & Stratigraphic Relationships at Gale Crater

Ralph Milliken
University of Notre Dame

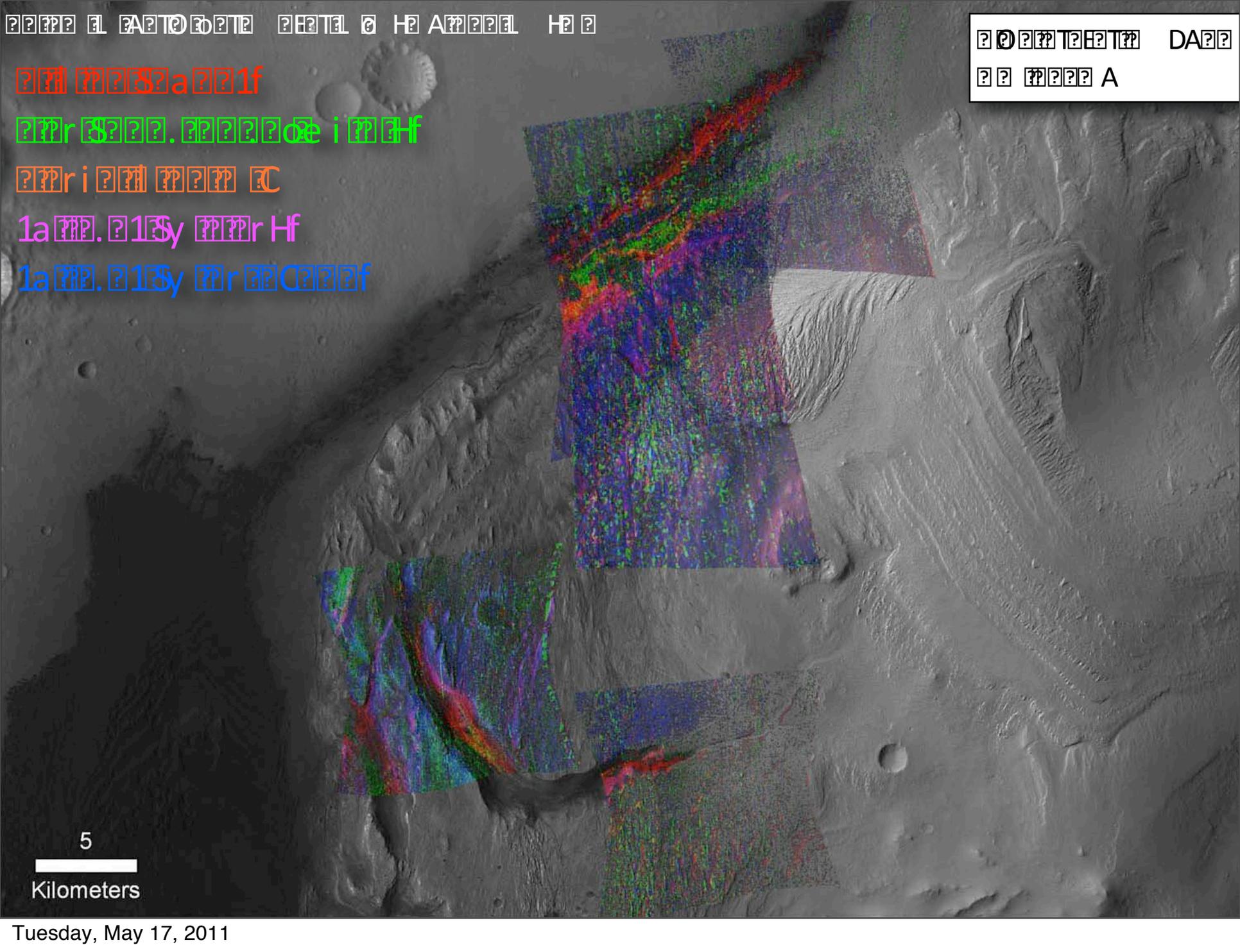


HiRISE DEM
R. Kirk, USGS

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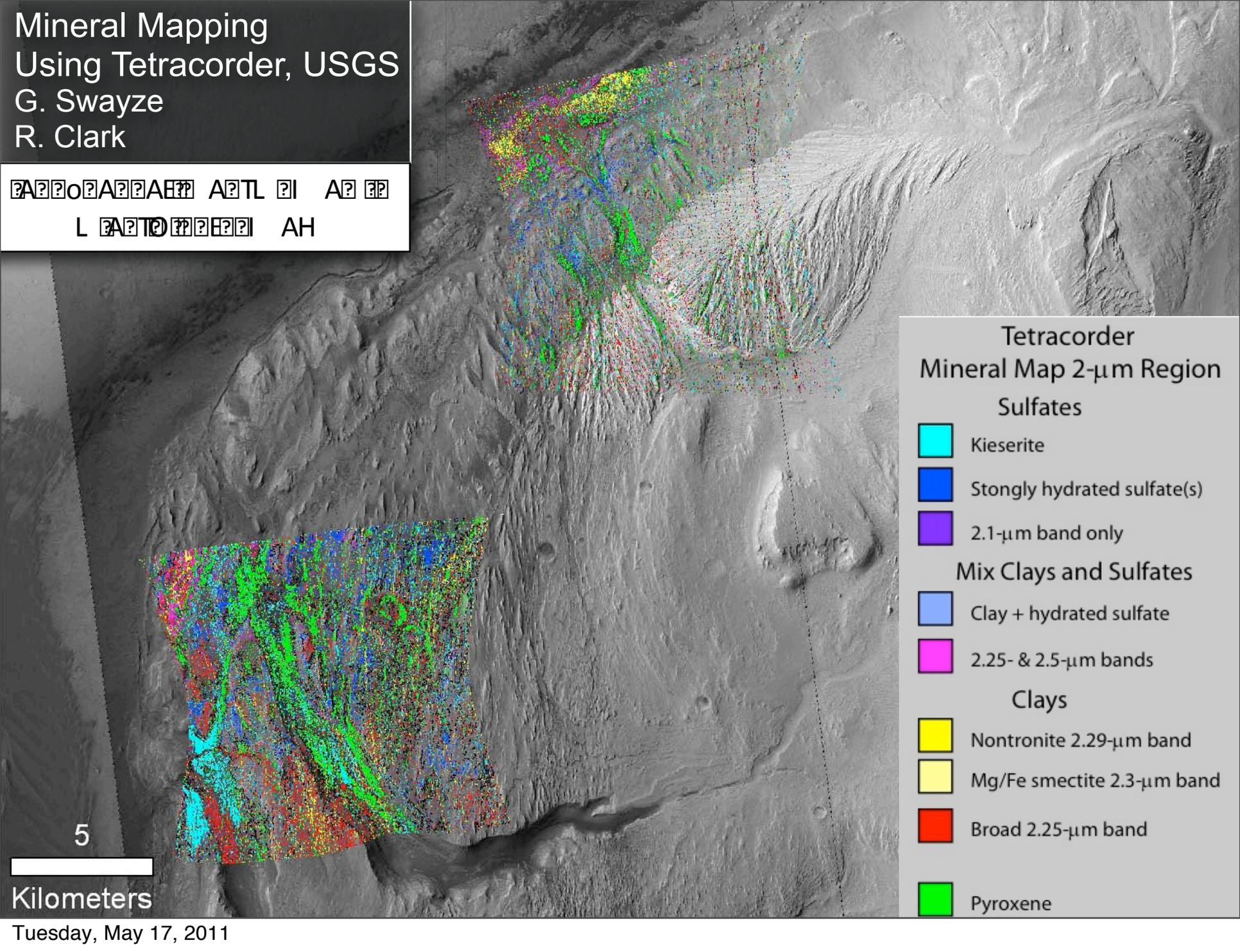


5
Kilometers

Mineral Mapping Using Tetracorder, USGS

G. Swayze
R. Clark

AP?o?A?A?? A?TL ?| A? ??
L ?A?T? ??H? ? AH



Tetracorder Mineral Map 2- μ m Region Sulfates

-  Kieserite
-  Strongly hydrated sulfate(s)
-  2.1- μ m band only

Mix Clays and Sulfates

-  Clay + hydrated sulfate
-  2.25- & 2.5- μ m bands

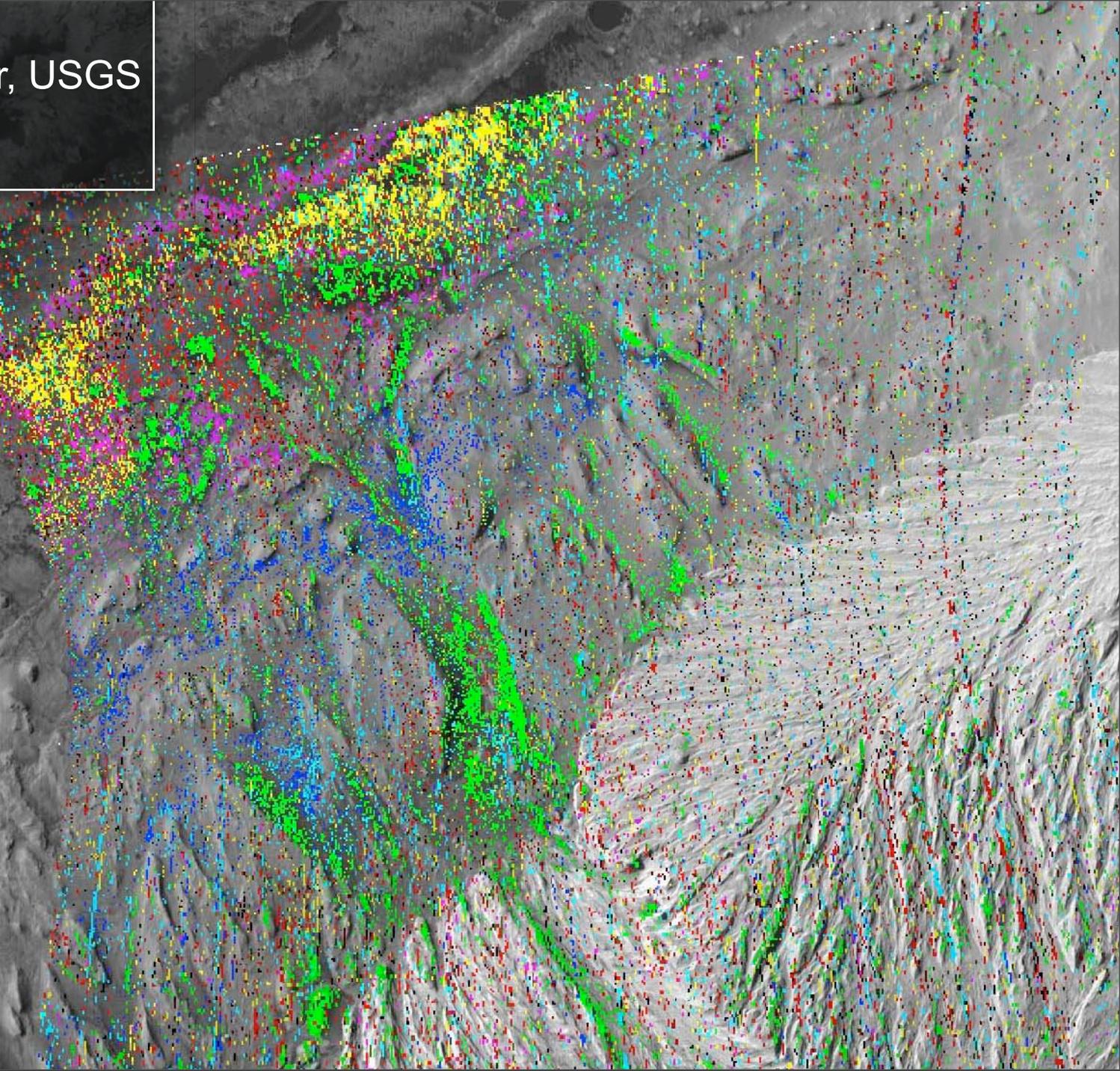
Clays

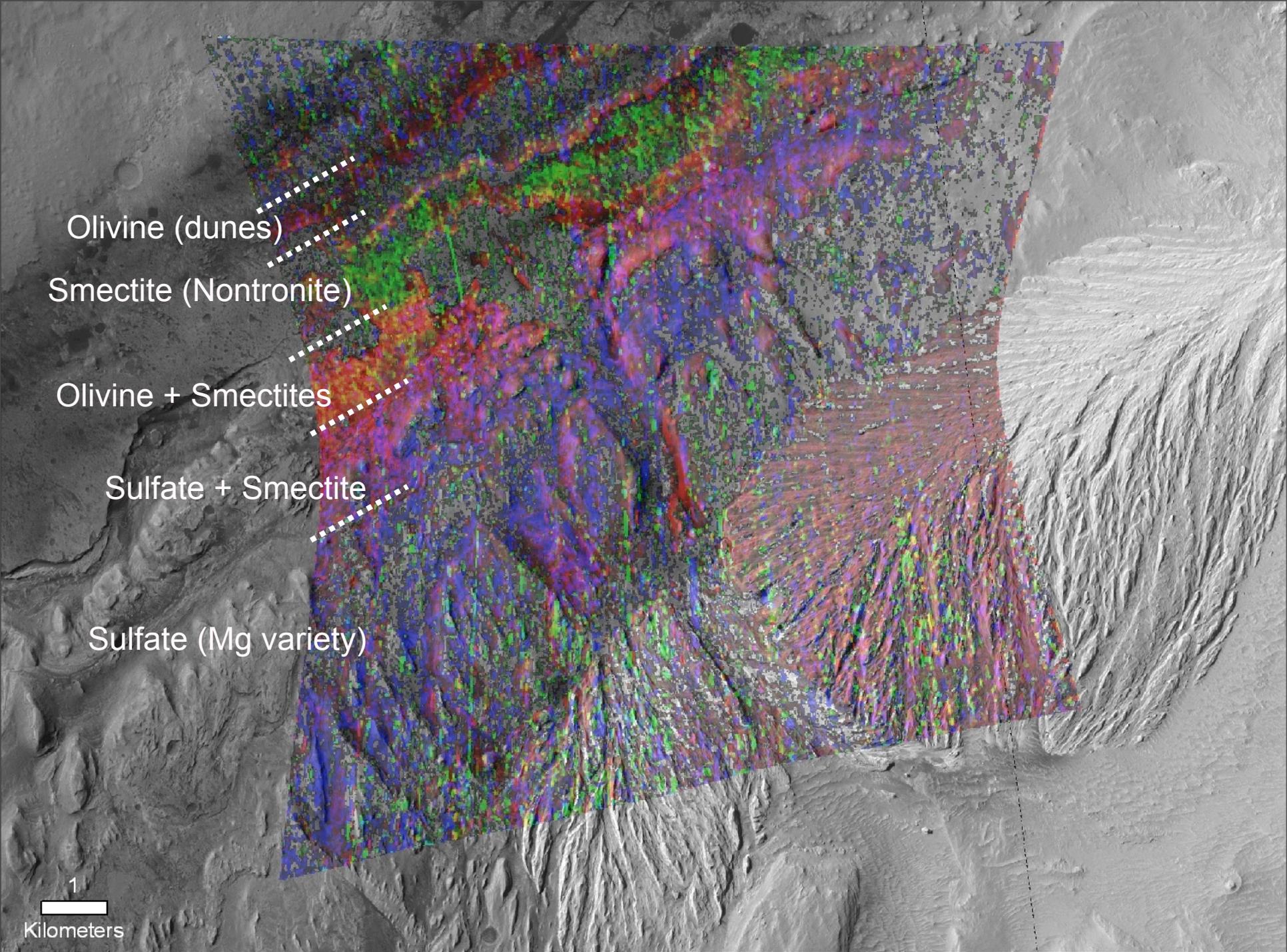
-  Nontronite 2.29- μ m band
-  Mg/Fe smectite 2.3- μ m band
-  Broad 2.25- μ m band
-  Pyroxene

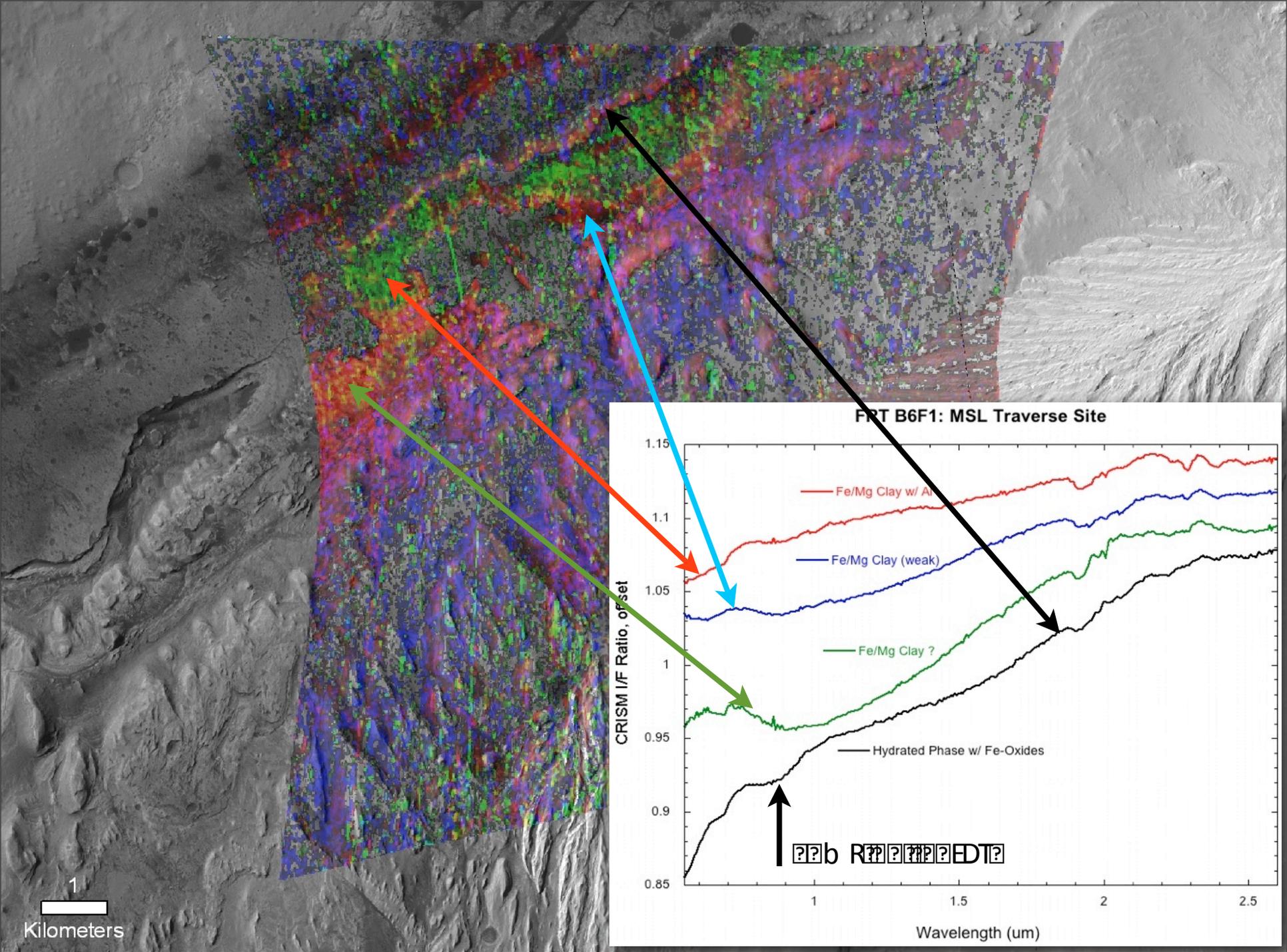
5
Kilometers

Mineral Mapping Using Tetracorder, USGS

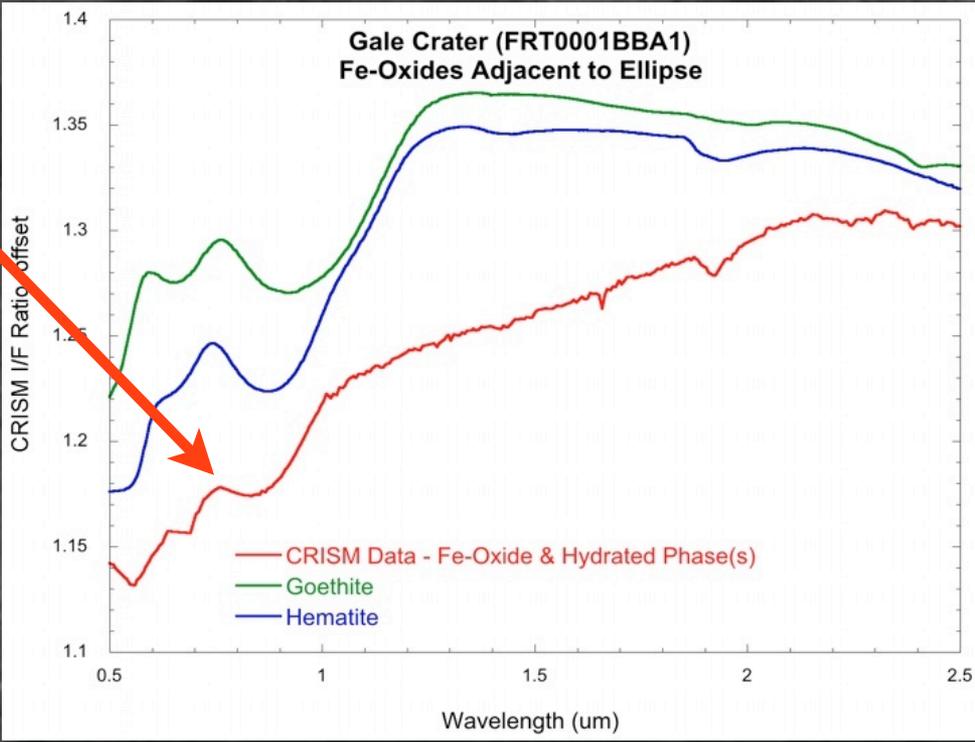
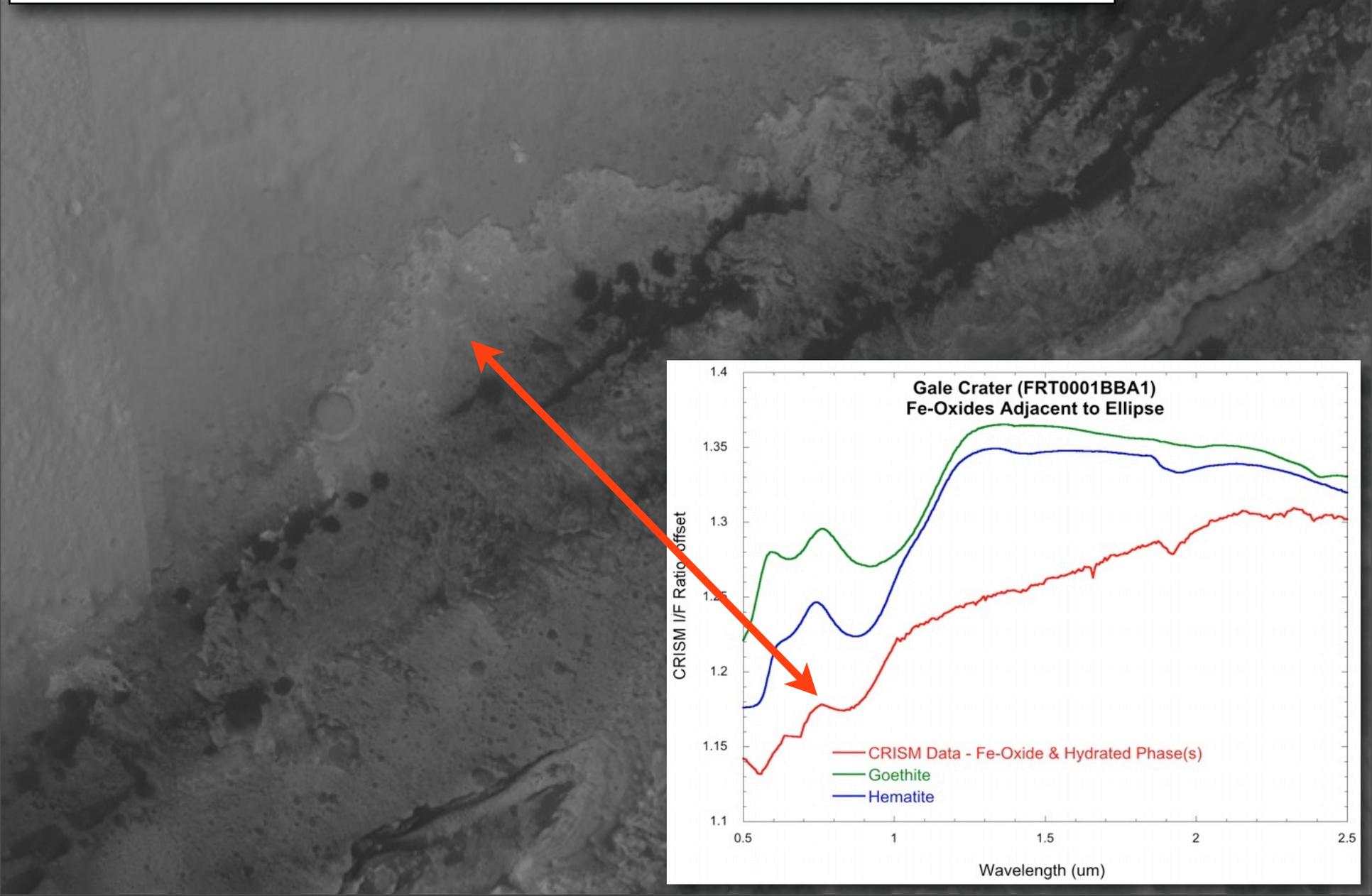
G. Swayze
R. Clark

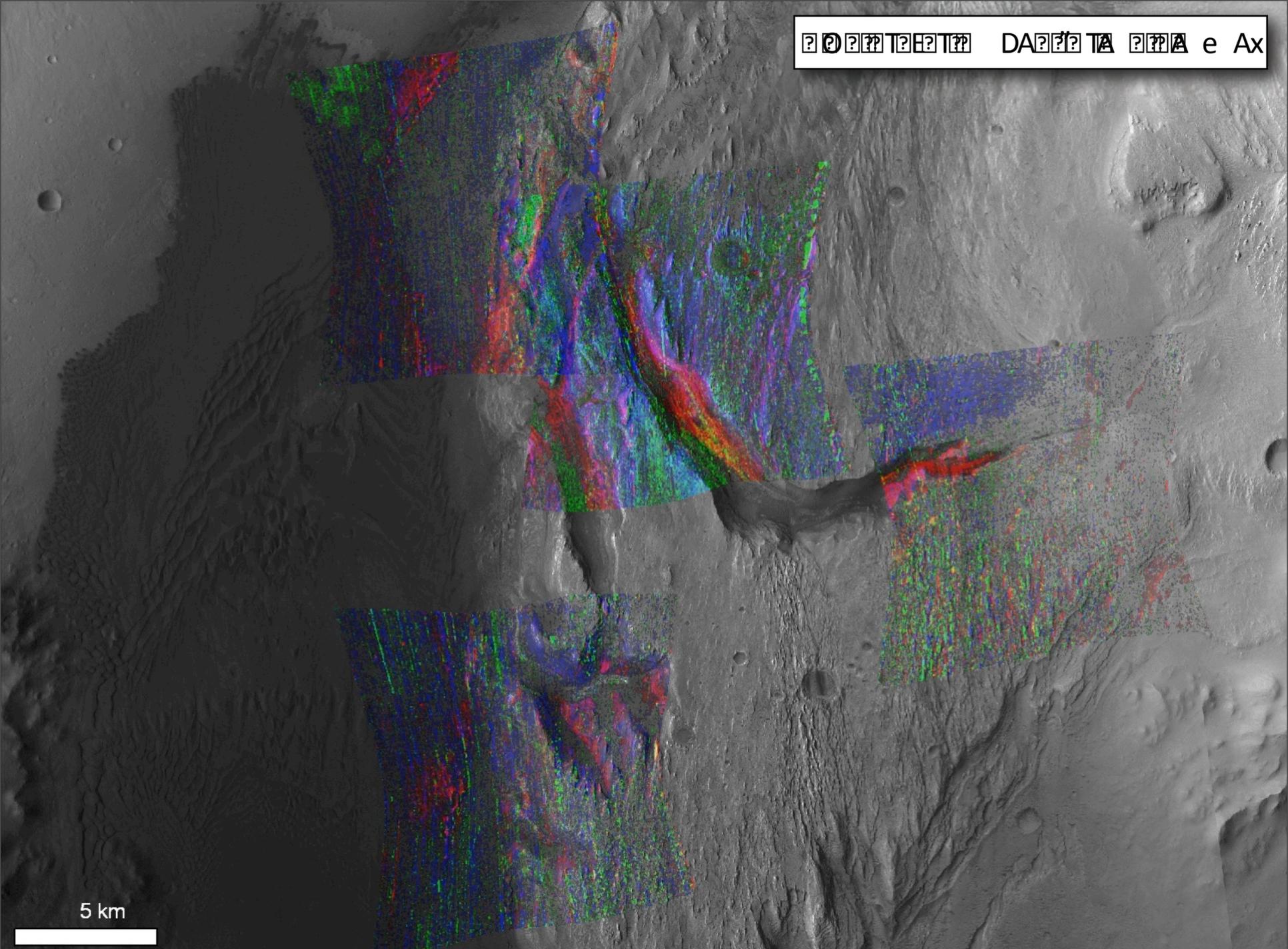






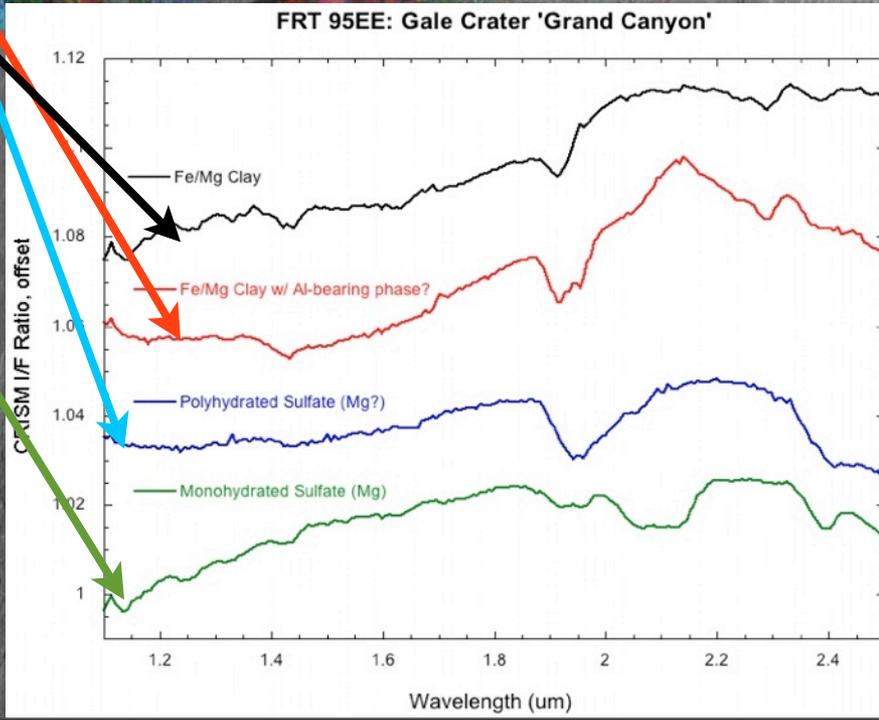
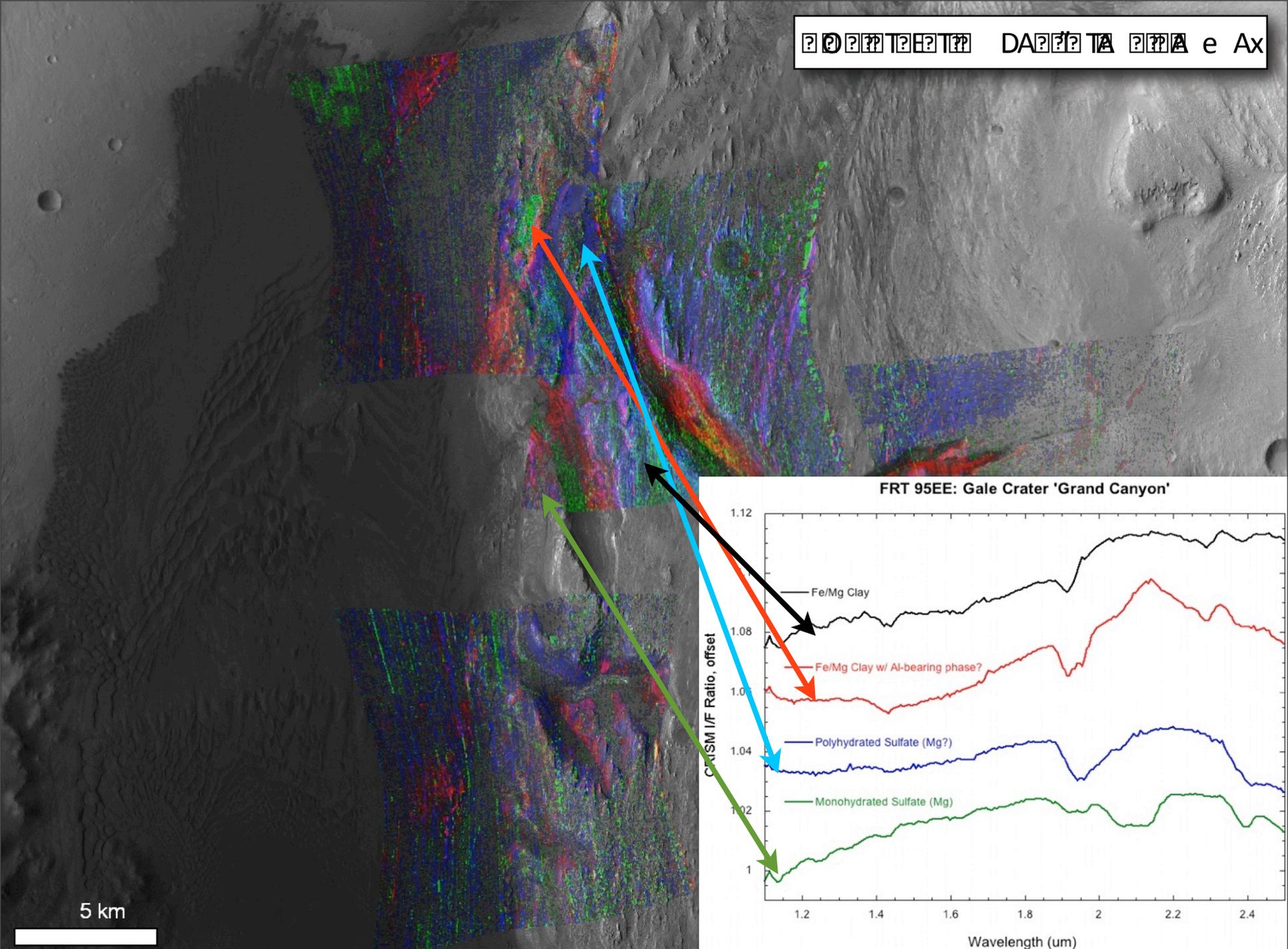
CRISM data from Mars Reconnaissance Orbiter (MRO) showing the presence of iron oxides and hydrated phases in Gale Crater. The data indicates the presence of goethite and hematite, which are associated with water. The CRISM instrument measures the reflectance of the surface, and the data shows a characteristic absorption feature around 0.8-1.0 micrometers, consistent with iron oxides. The presence of hydrated phases is also indicated by the data, suggesting a past aqueous environment.





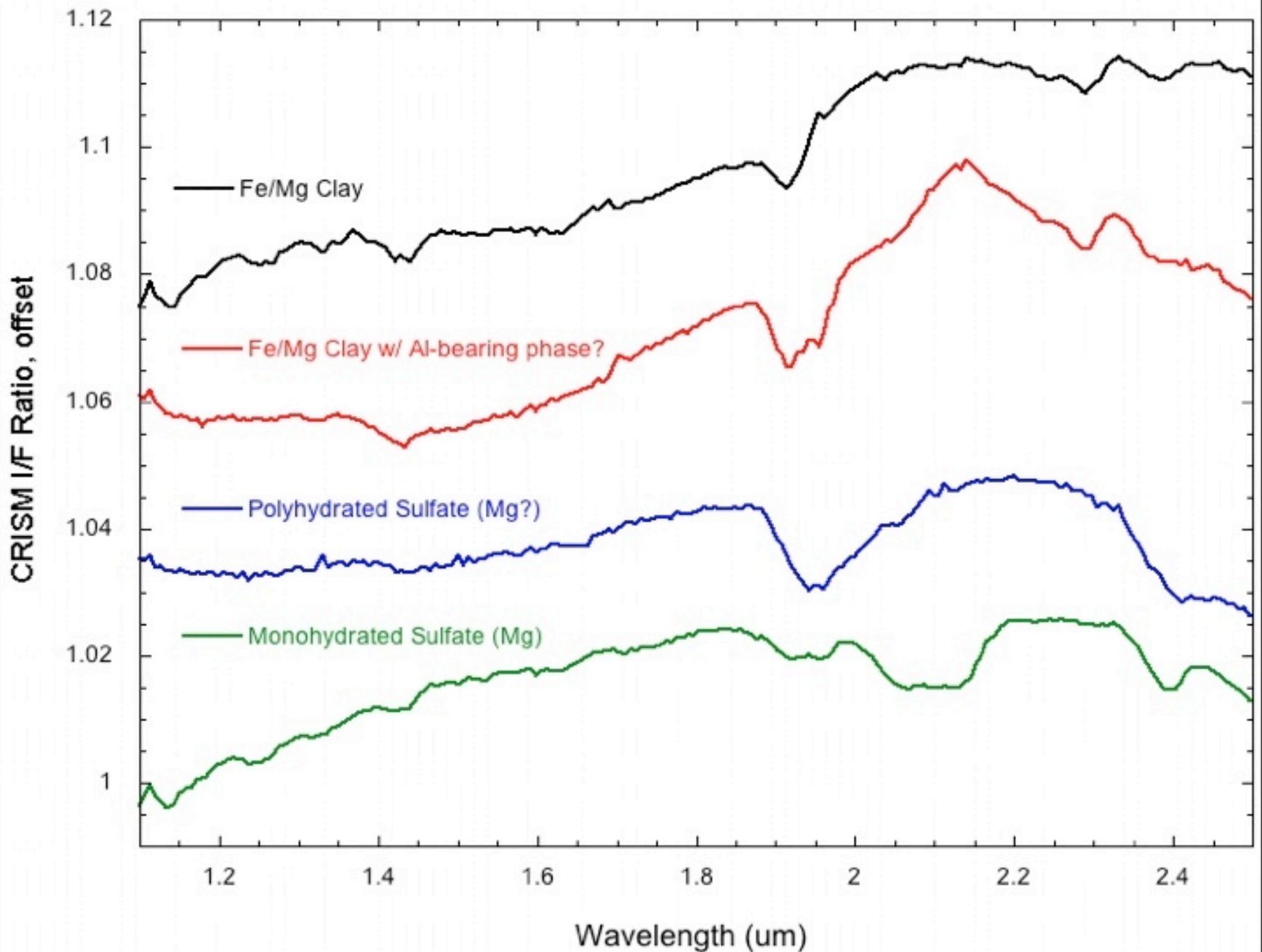
5 km

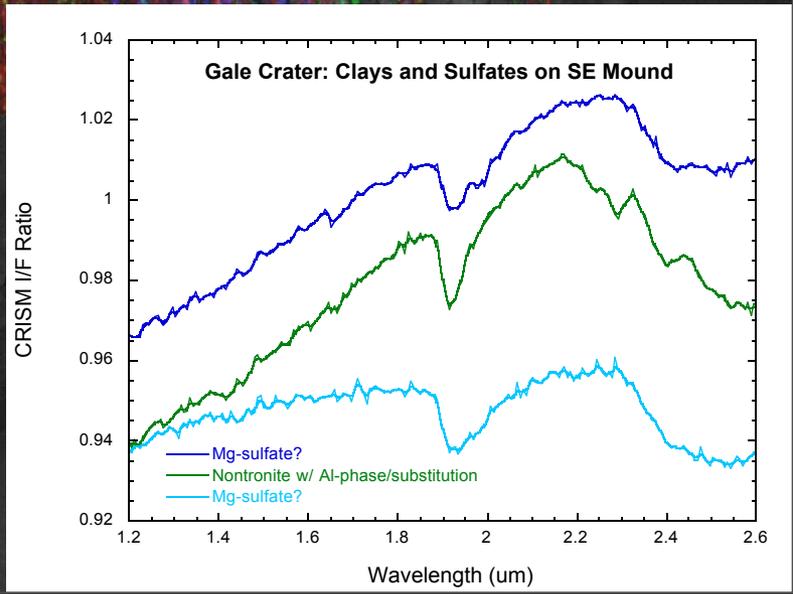
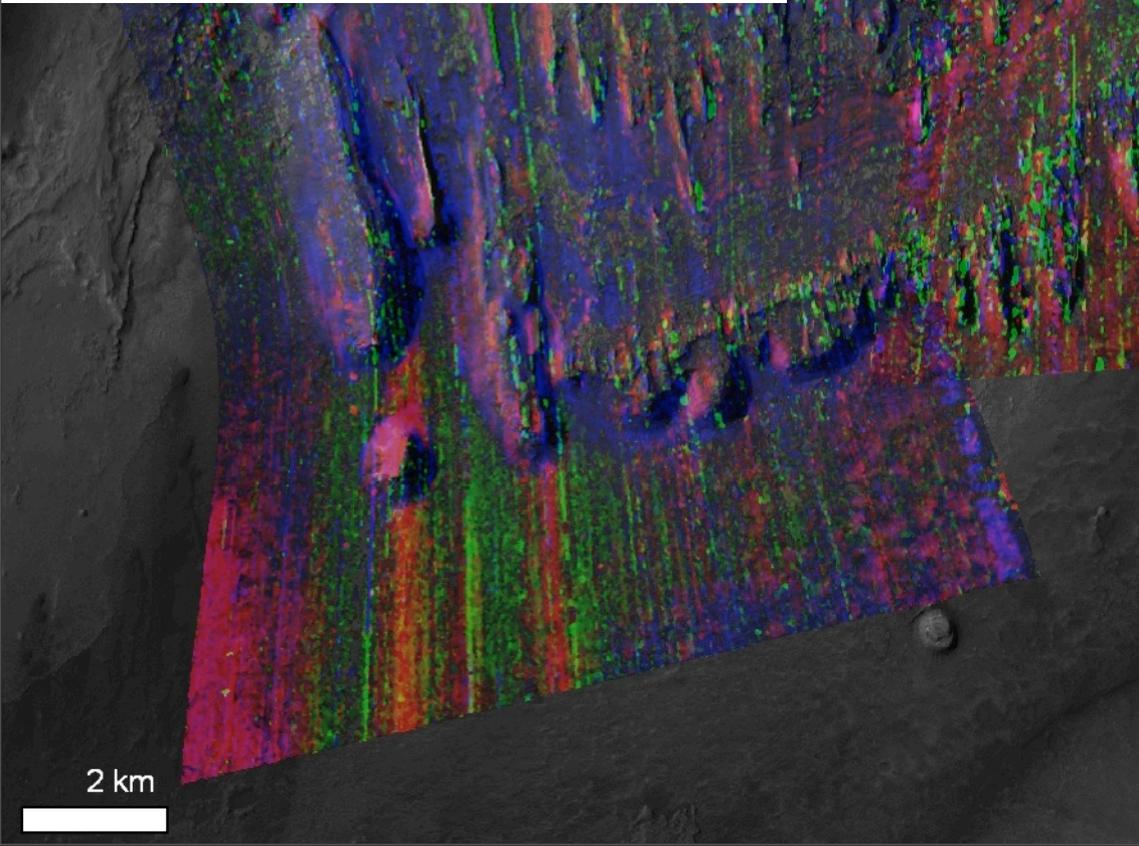
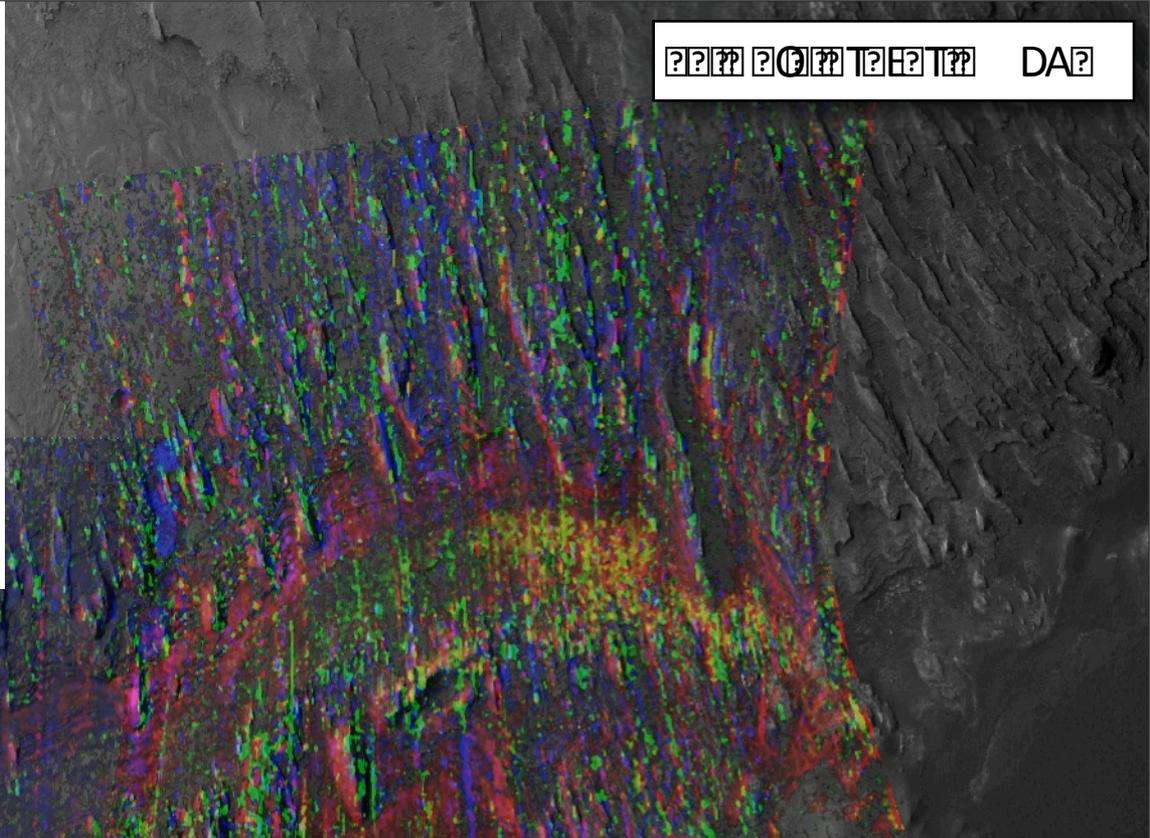
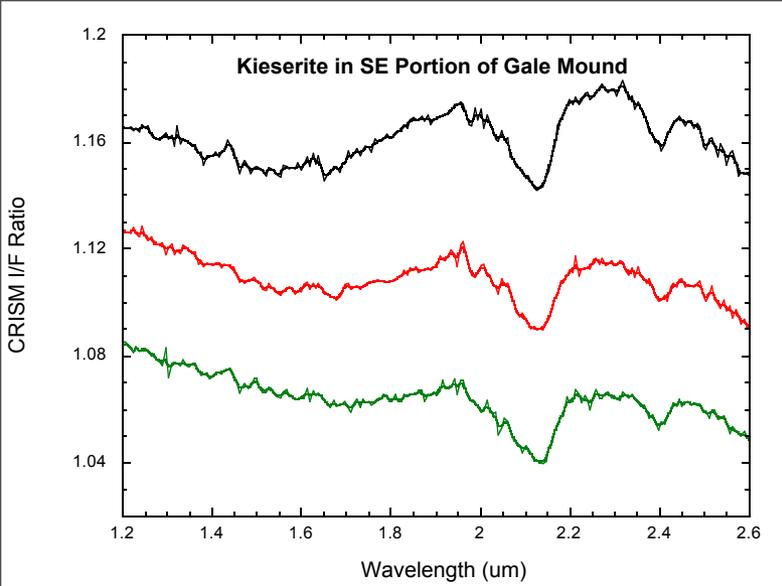




5 km

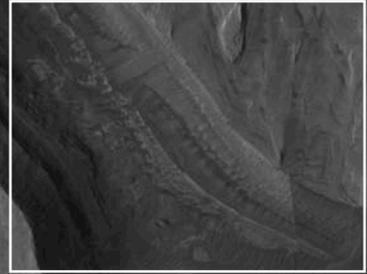
FRT 95EE: Gale Crater 'Grand Canyon'



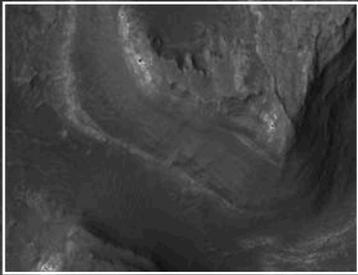


Units can be correlated
between canyons

1



2



2



Kilometers

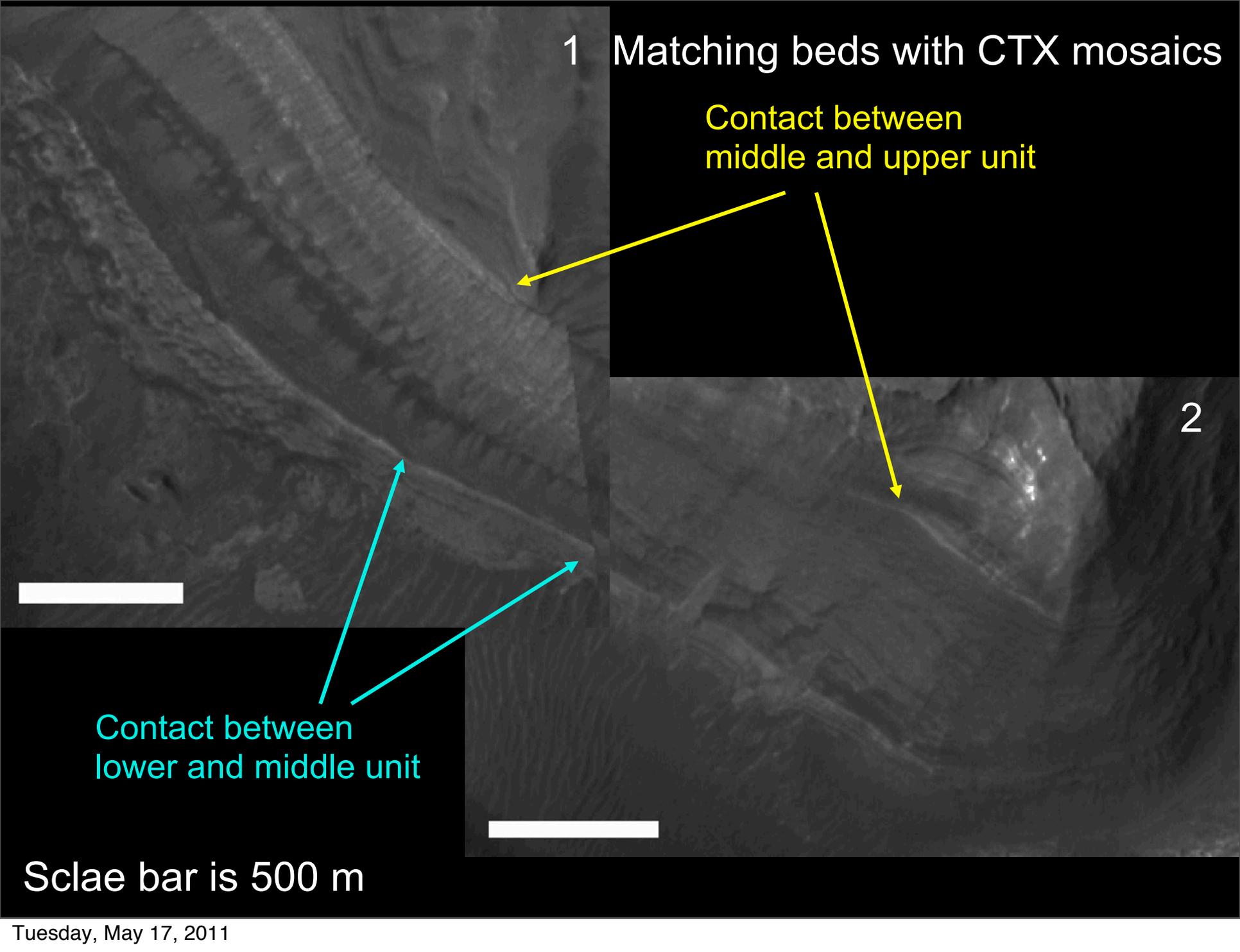
1 Matching beds with CTX mosaics

Contact between
middle and upper unit

2

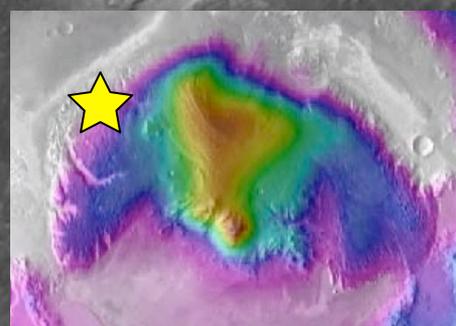
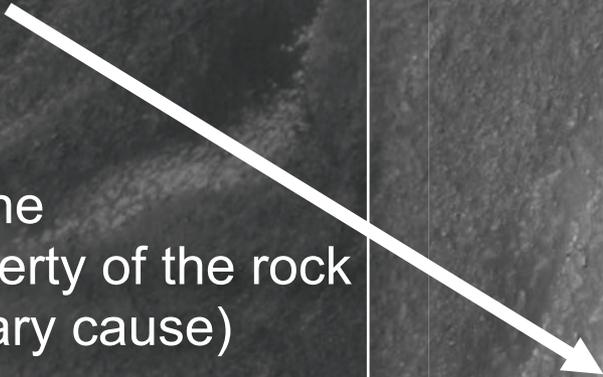
Contact between
lower and middle unit

Sclae bar is 500 m



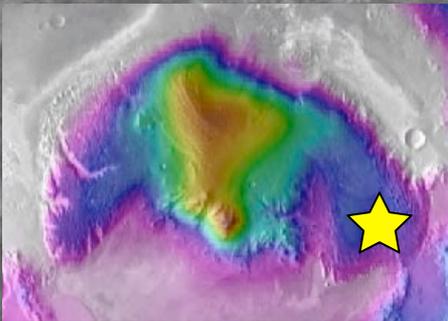
Distinctive 'Marker Bed'

- dark & smooth
- may be dark from debris or the tone may be an inherent property of the rock (images suggest latter is primary cause)
- can be traced over long distances



50
Meters

Marker bed is also present in the SE section of the mound; mineralogy of SE section is similar to what is observed in NW section.



Results of Tracing Beds Using HiRISE, CTX, & MOC

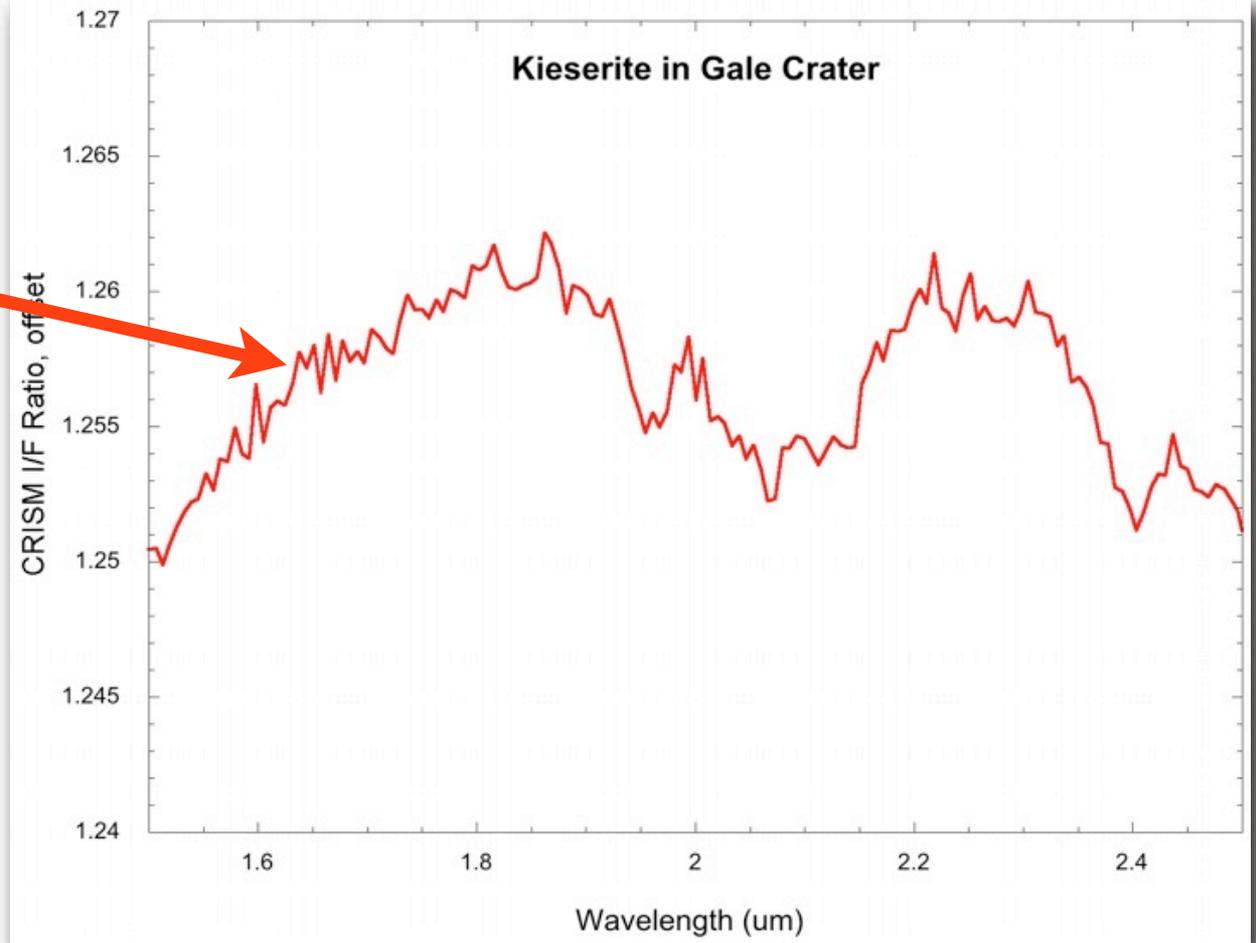
— Contact between darker middle beds and brighter upper beds

— Contact between bright lower beds & darker middle beds

Beds exposed in large canyon are the same beds exposed on the north of the mound.
(near the MSL landing ellipse)

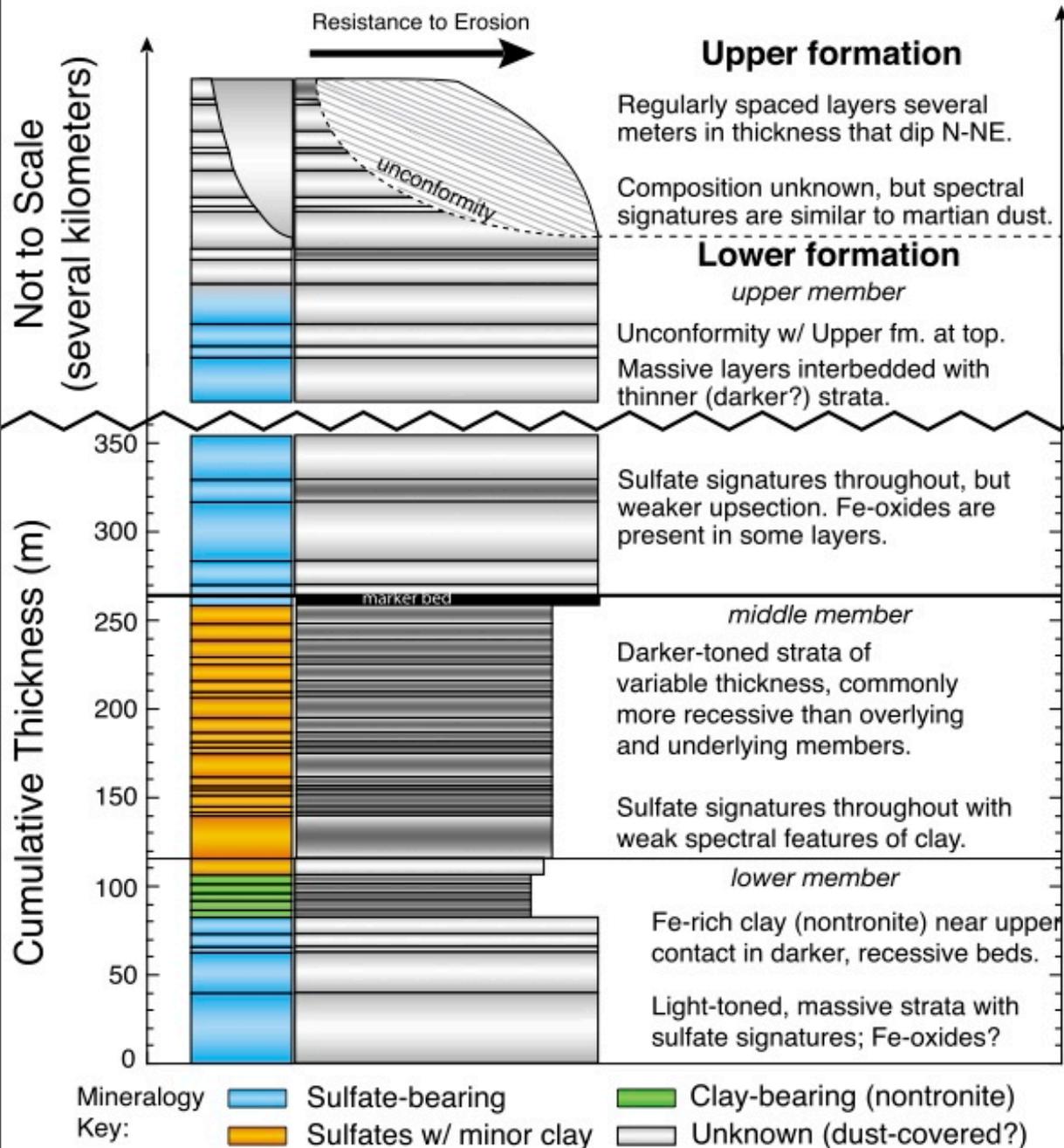
5

Kilometers



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Mineralogy Morphology Interpretations/Comments



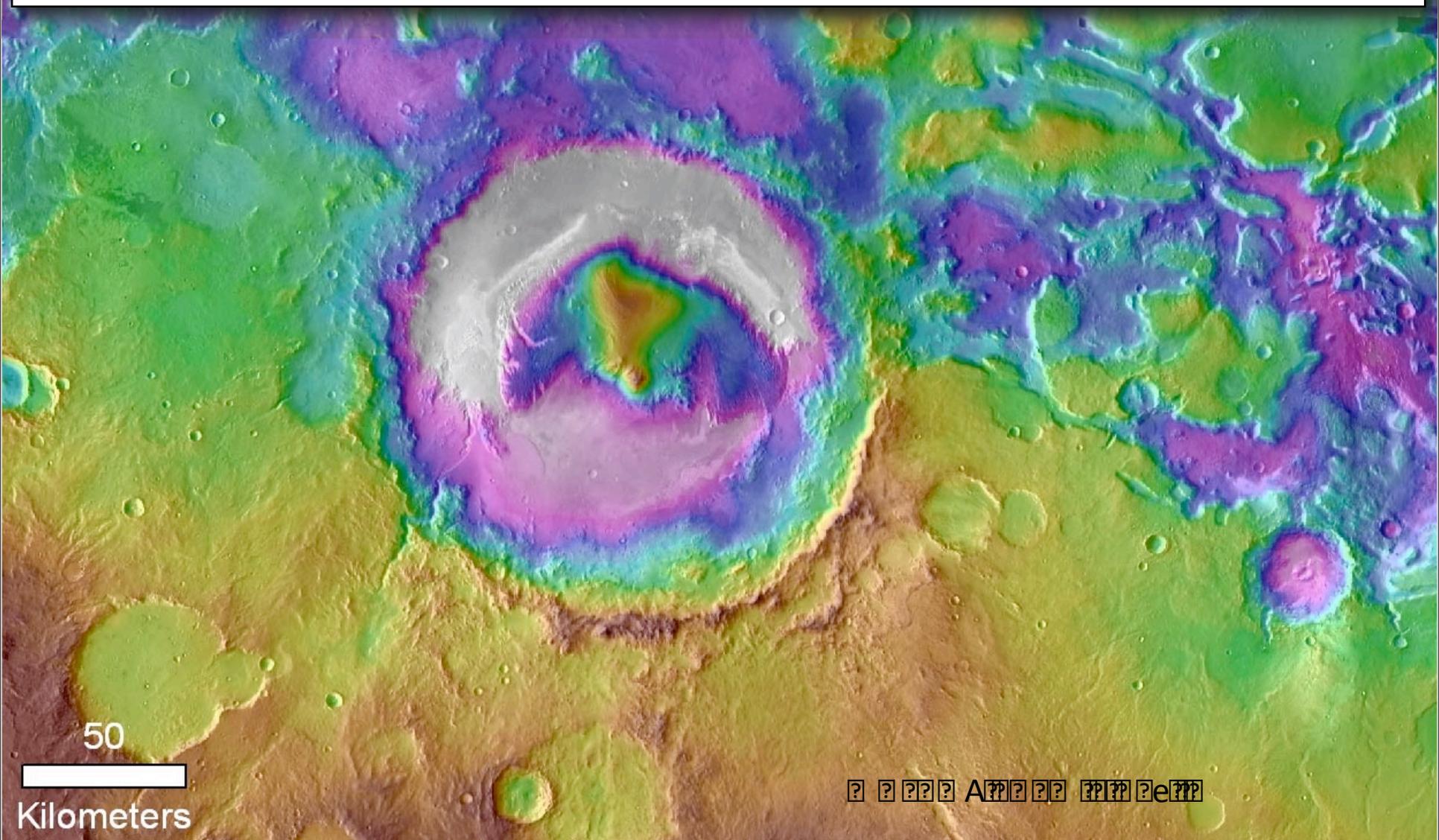
Curiosity would be able to examine clear variations in mineralogy possibly linked to environmental changes.

- Lowermost strata exhibit sulfate signatures, sometimes with crystalline Fe-oxides (hematite).
- Clays are in thin, recessive beds located just below the lower/middle unit contact.
- A darker-toned unit with kieserite overlies the clays; some strata have polyhydrated sulfates and Fe-oxides; other strata may contain leached smectites.

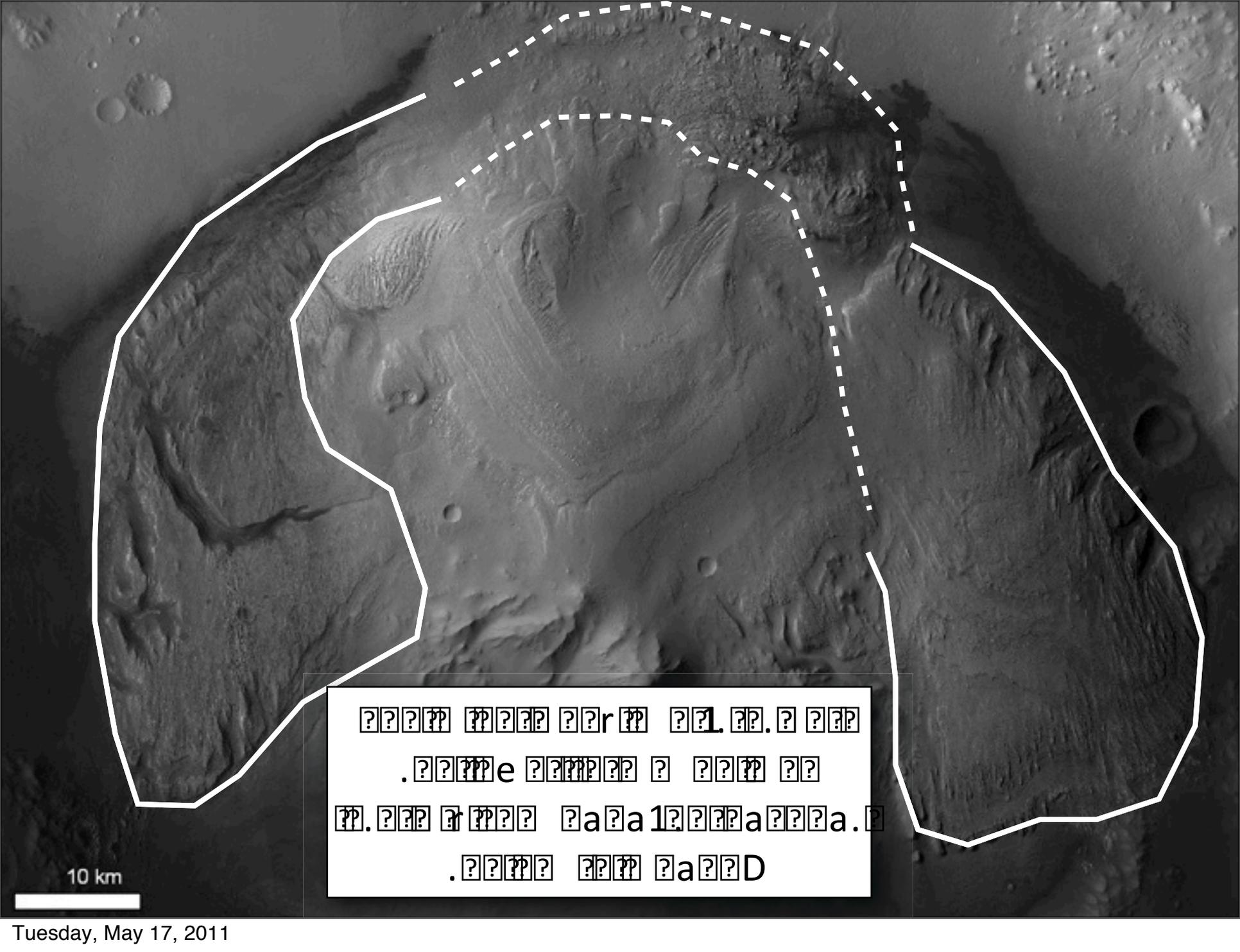
Mineralogic changes are clearly linked to stratigraphic changes.

h 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

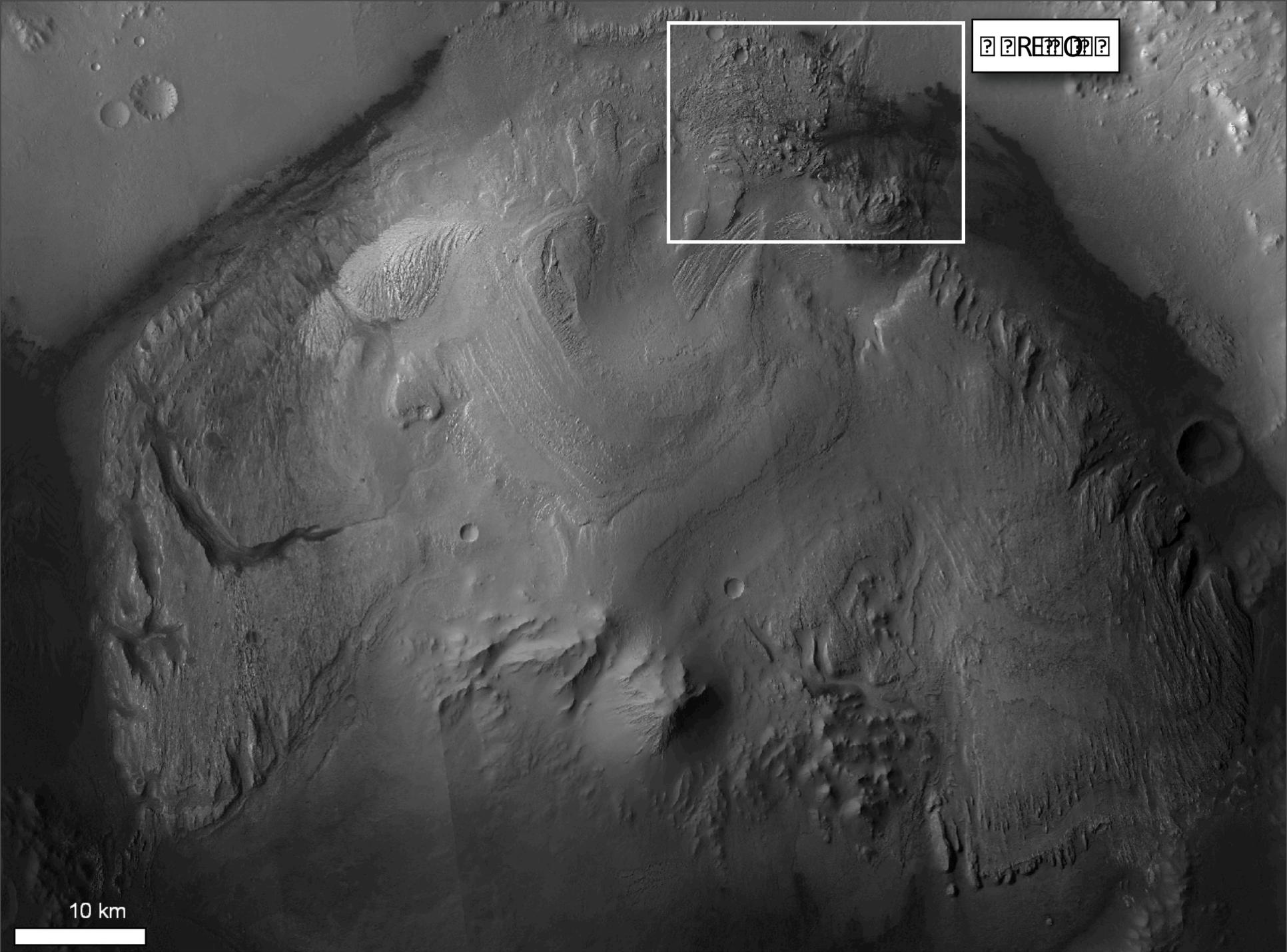


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99



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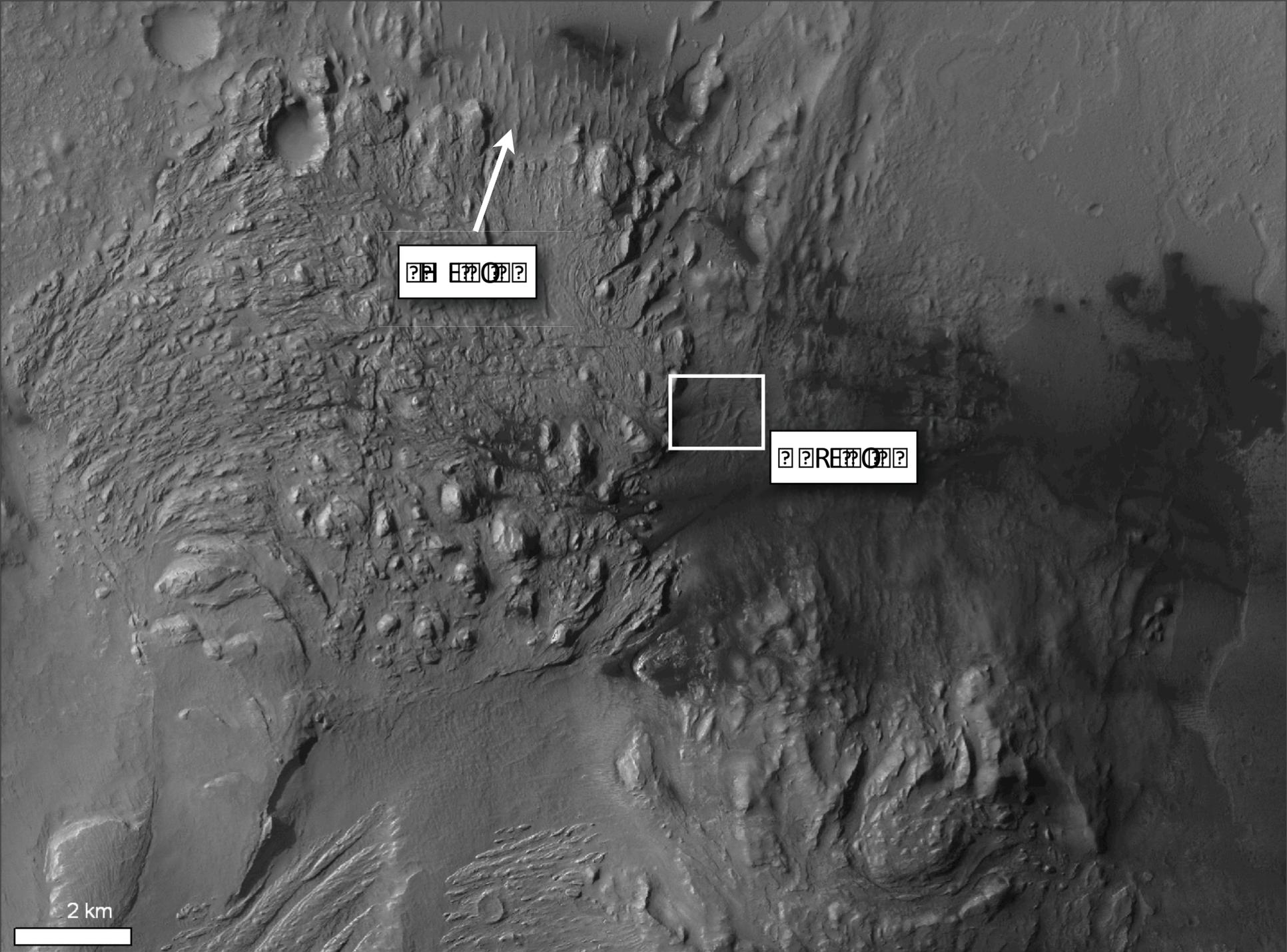
10 km



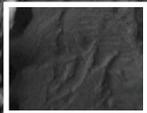
REFLECT

10 km

Tuesday, May 17, 2011



?? H??O??

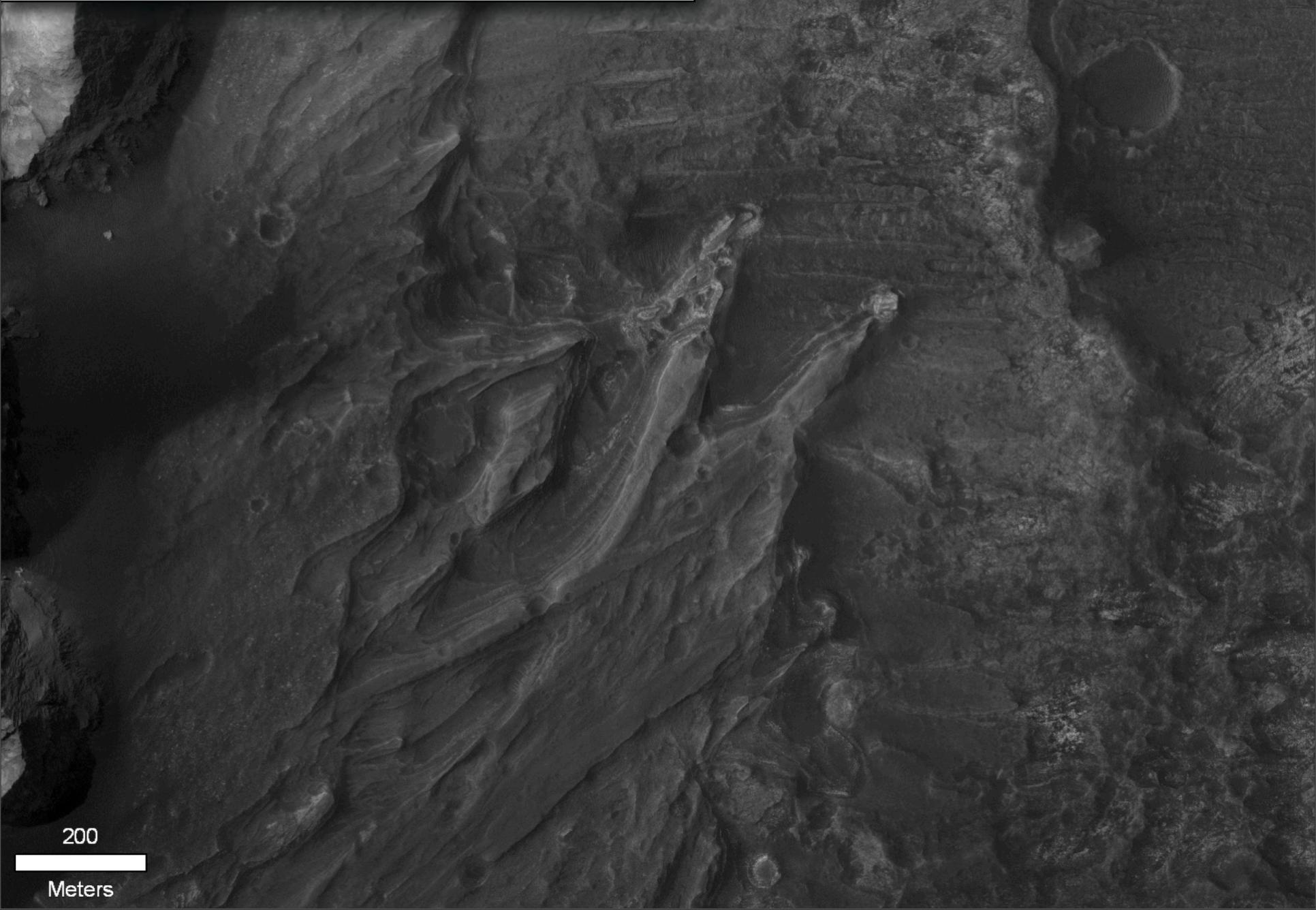


?? RE??O??

2 km



?? | ?? ?? ?? ?? ?? ?? ?? ?? ?? ?? ?? ?? ?? ?? ?? ??



200



Meters

Tuesday, May 17, 2011

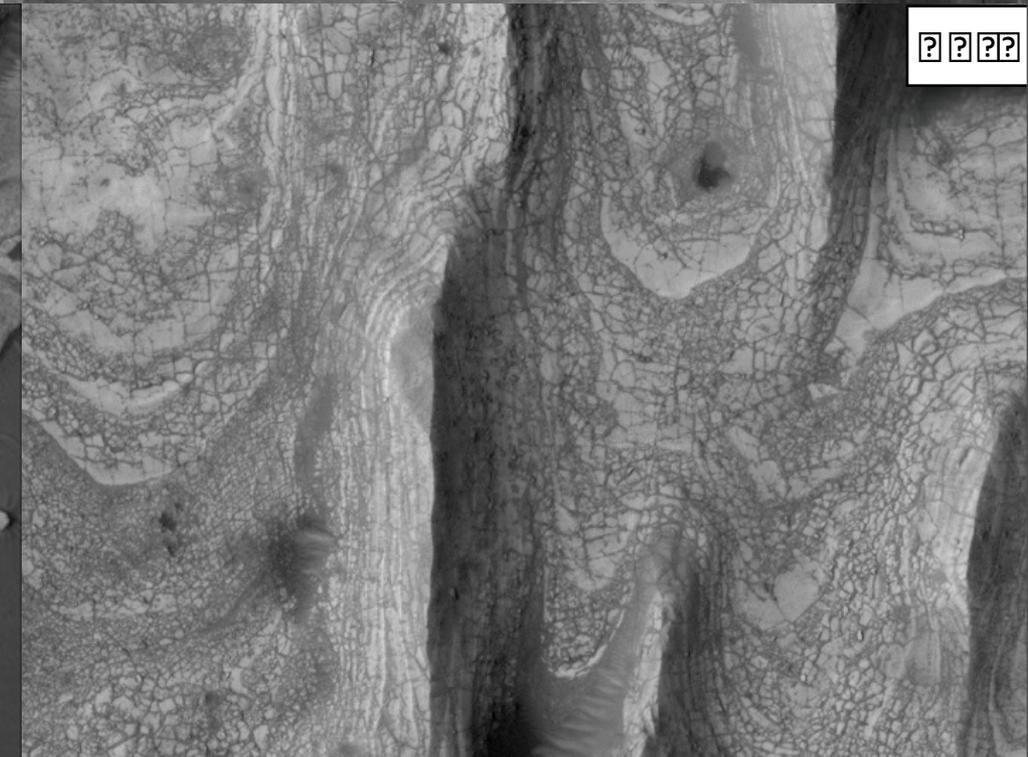
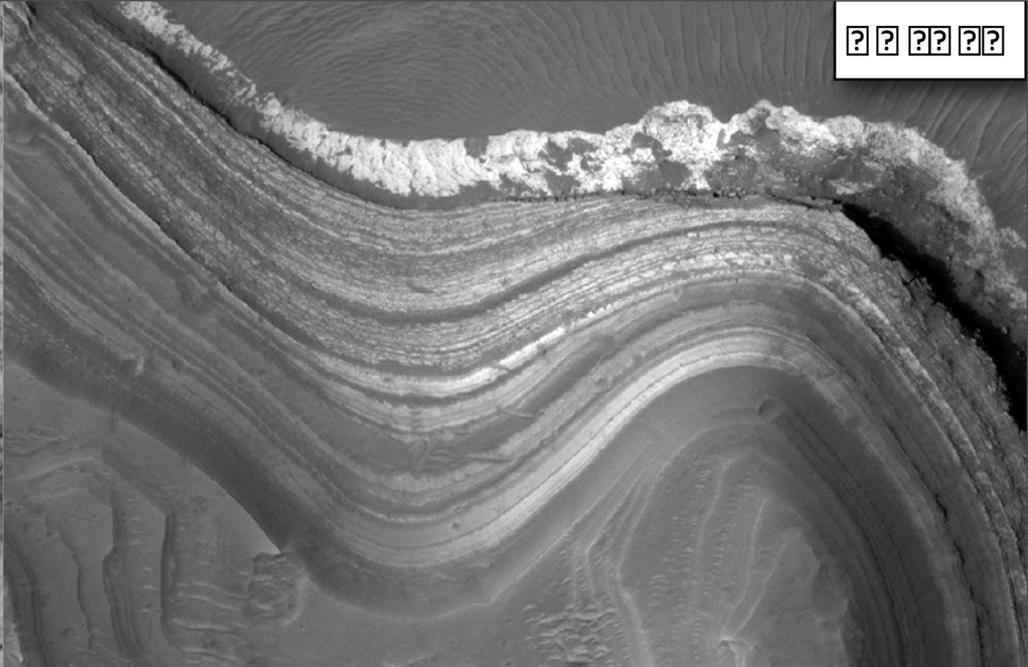
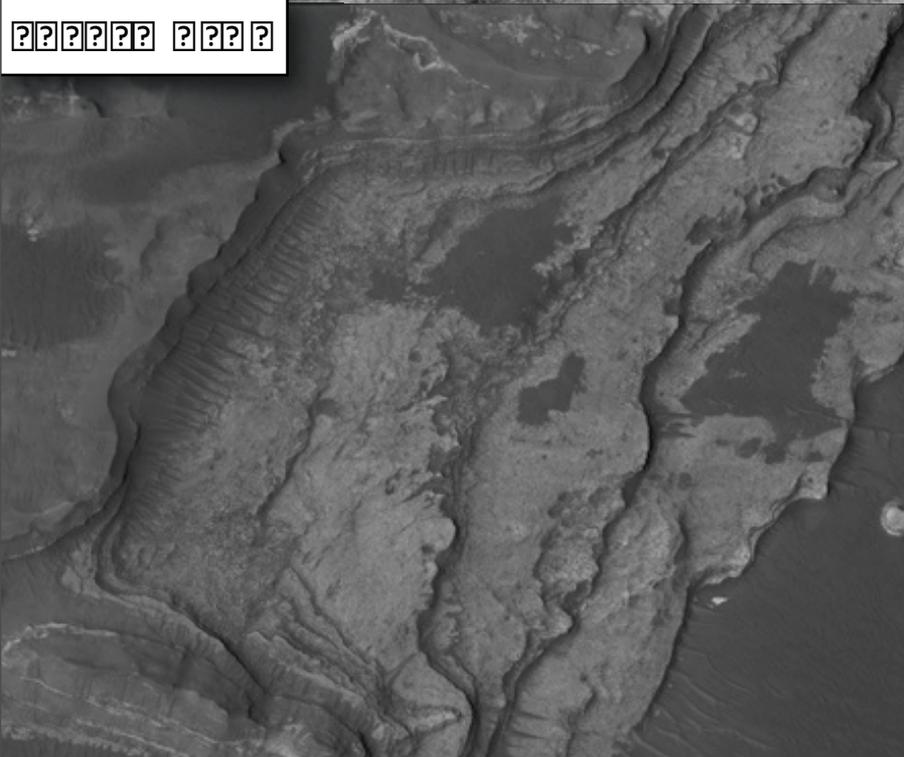
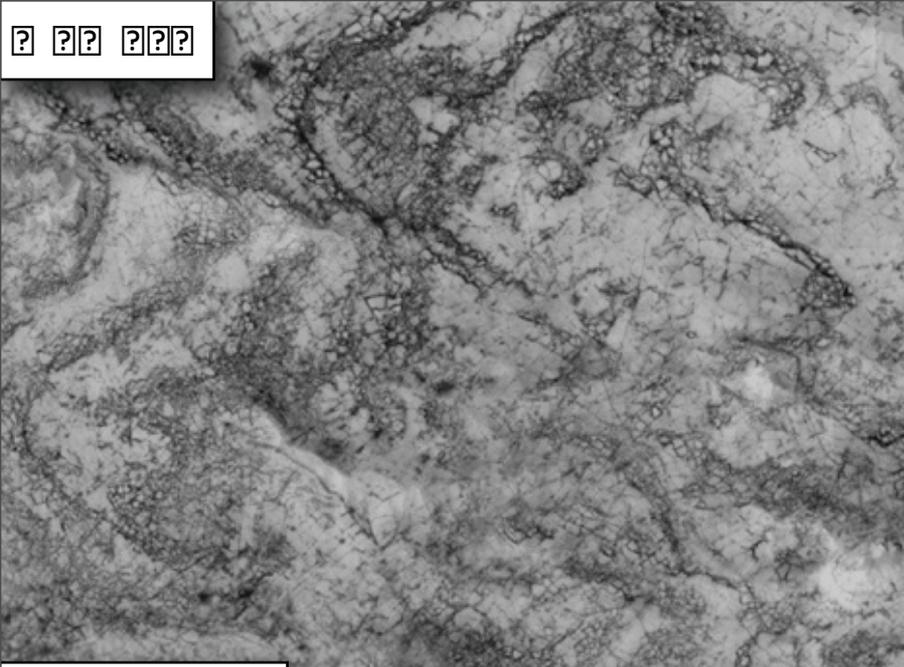


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100

Meters

Tuesday, May 17, 2011



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