Deltaic deposits in Magong Crater, Xanthe Terra

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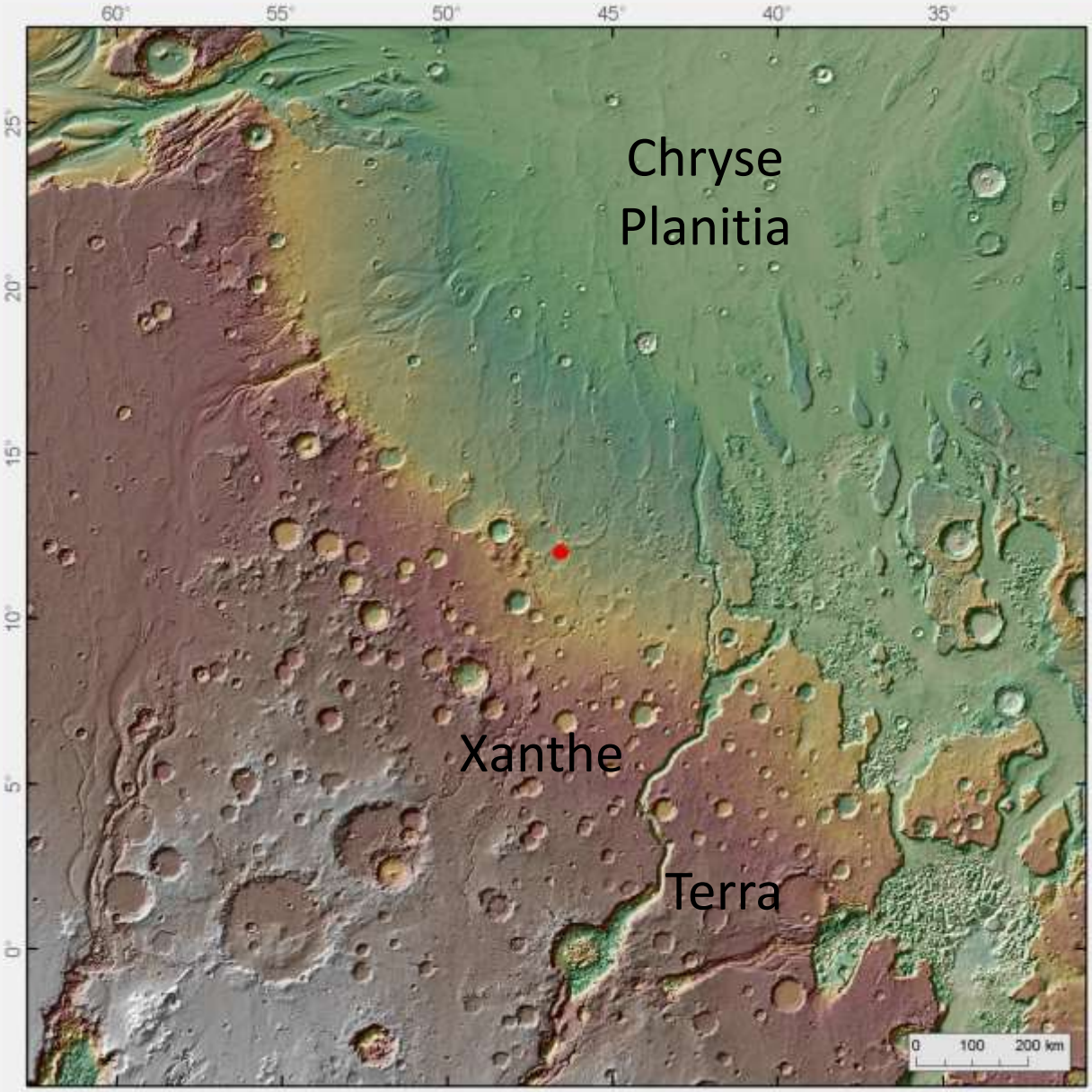
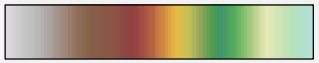
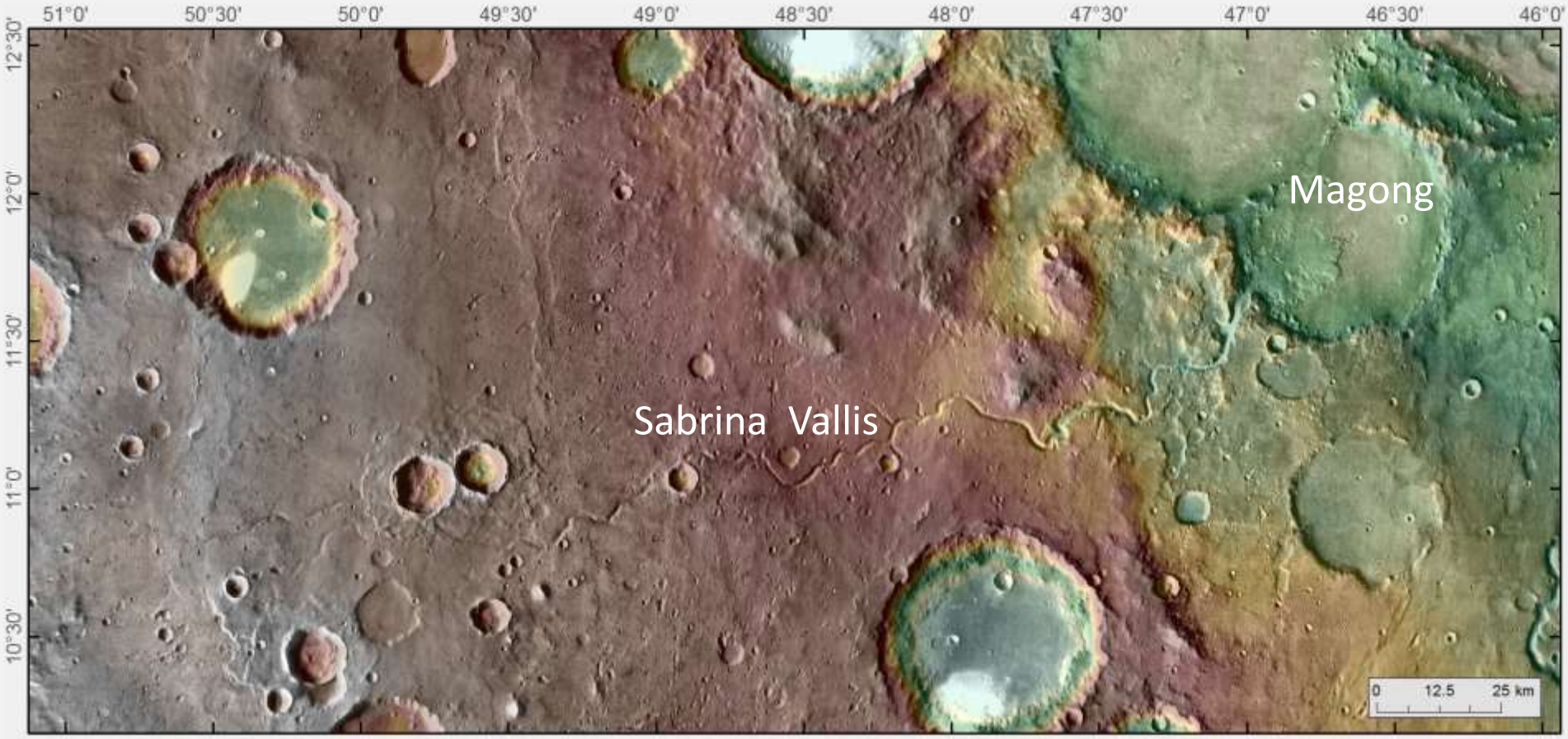
PSI Planetary Science Institute
DLR Deutsches Zentrum für Luft- und Raumfahrt
LPG
KØBENHAVNS UNIVERSITET

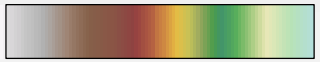




4980 m -5490

MOLA DTM/hillshade





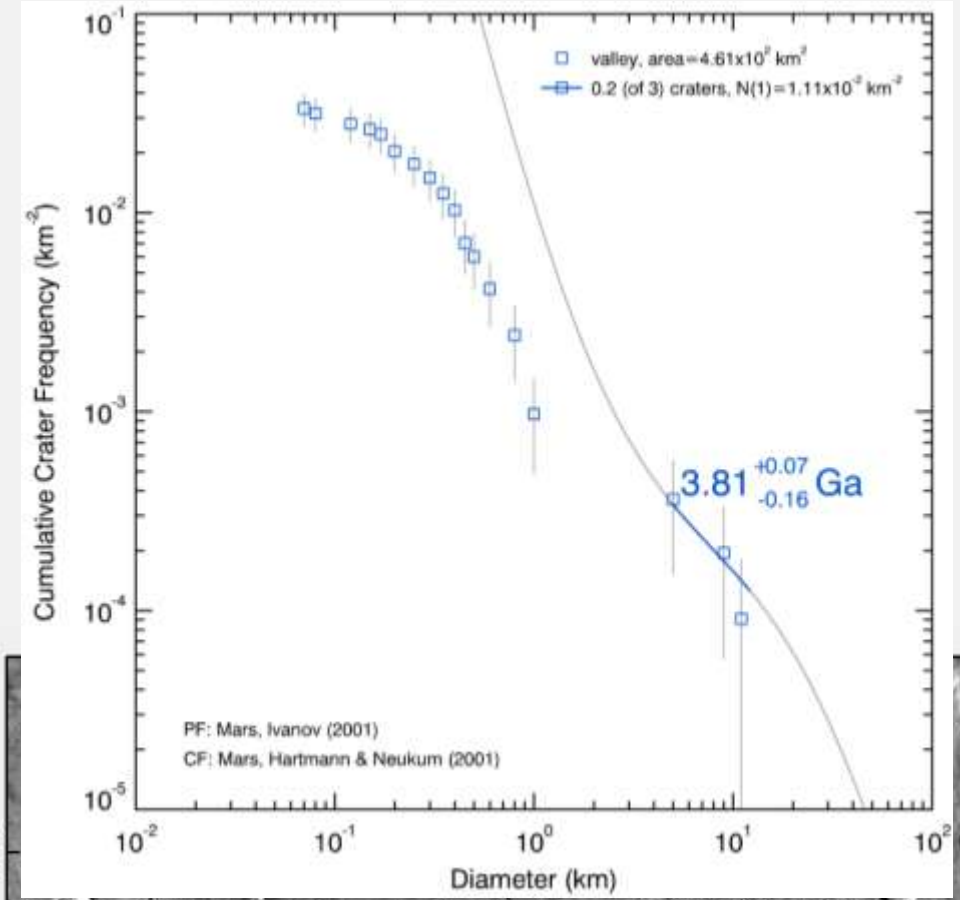
MOLA DTM over THEMIS IRday

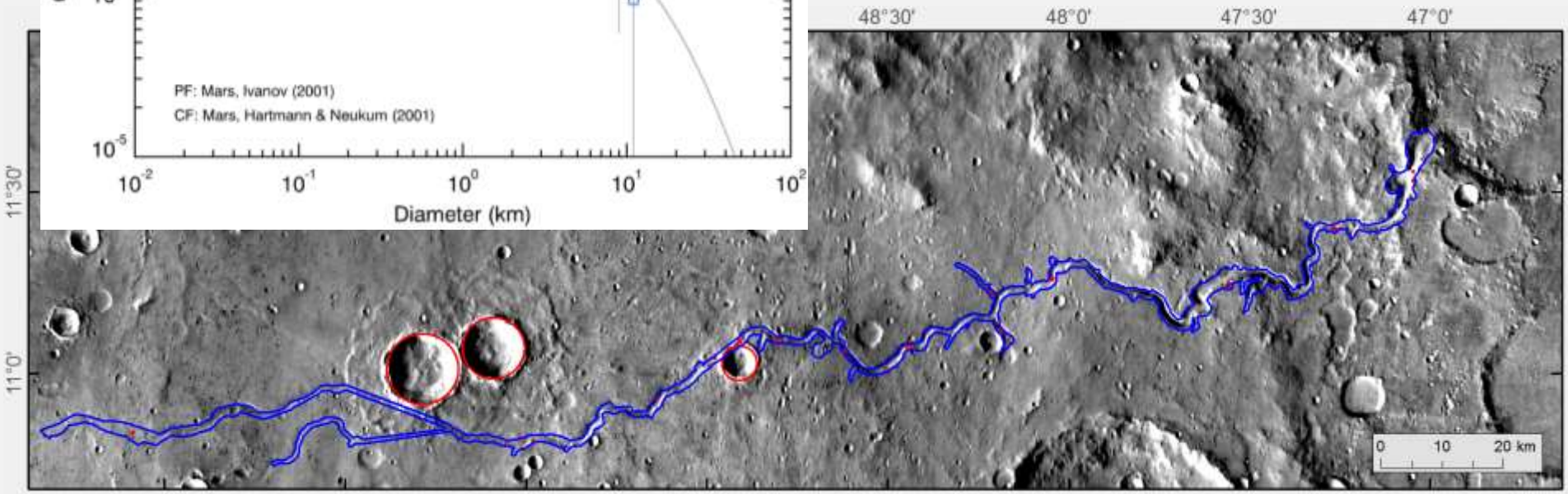
Age of Sabrina Vallis

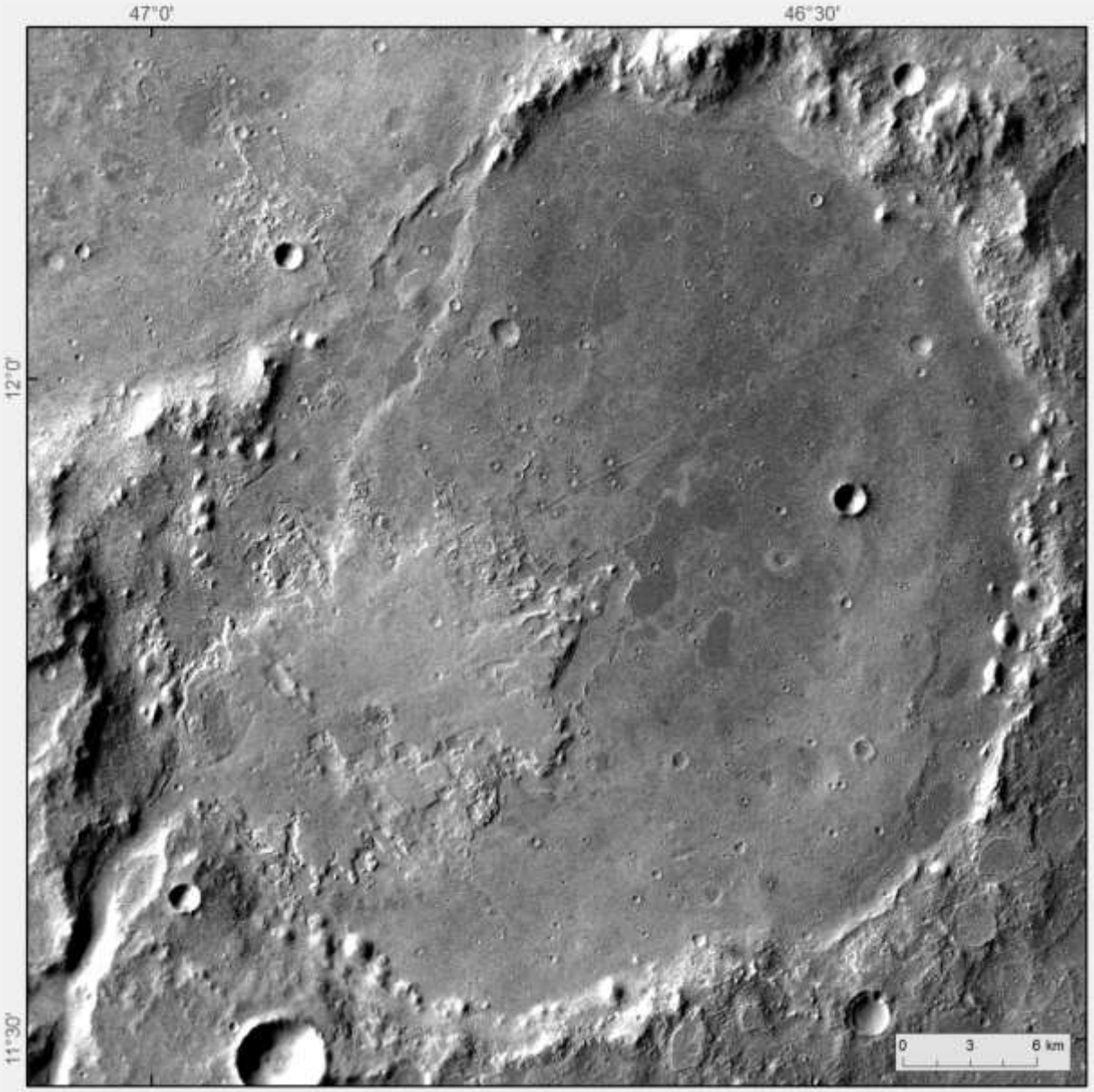
Late Noachian Epoch
3.71-3.83 Ga

Middle Noachian Epoch
3.83-3.94 Ga

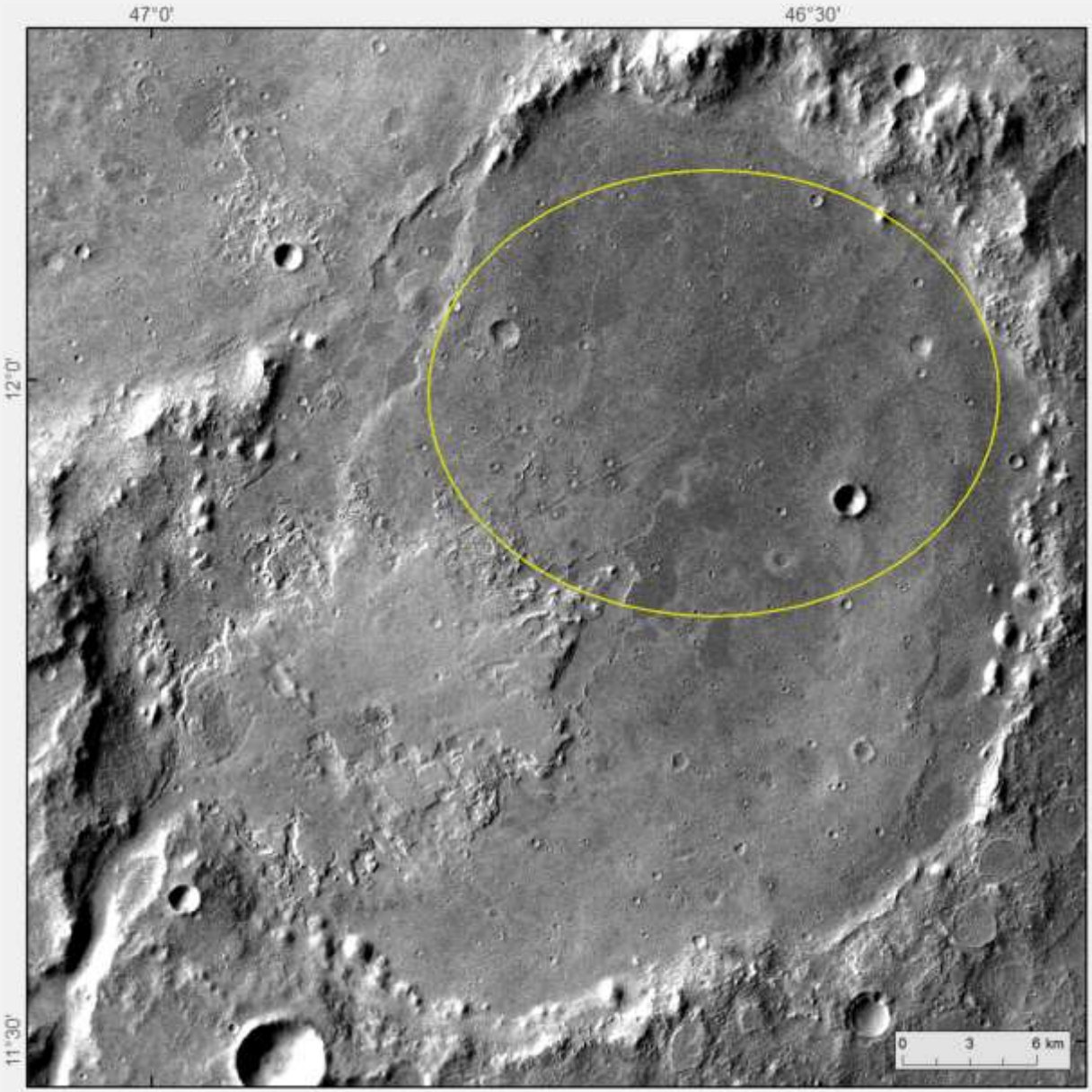
Buffered crater counting (Kneissl et al., 2015)





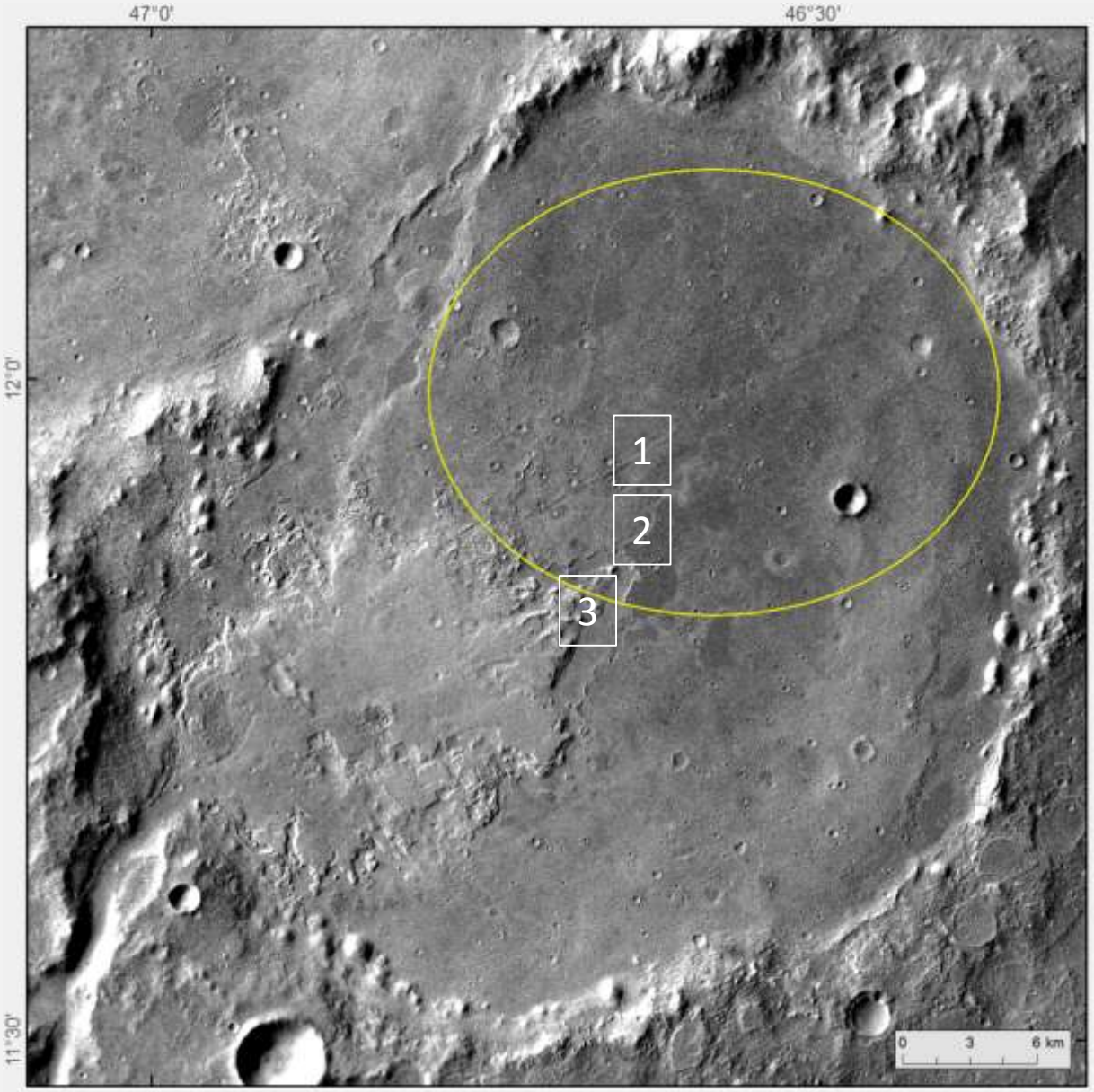


HRSC orbit
h0894_0000



20 km × 25 km landing ellipse

HRSC orbit
h0894_0000



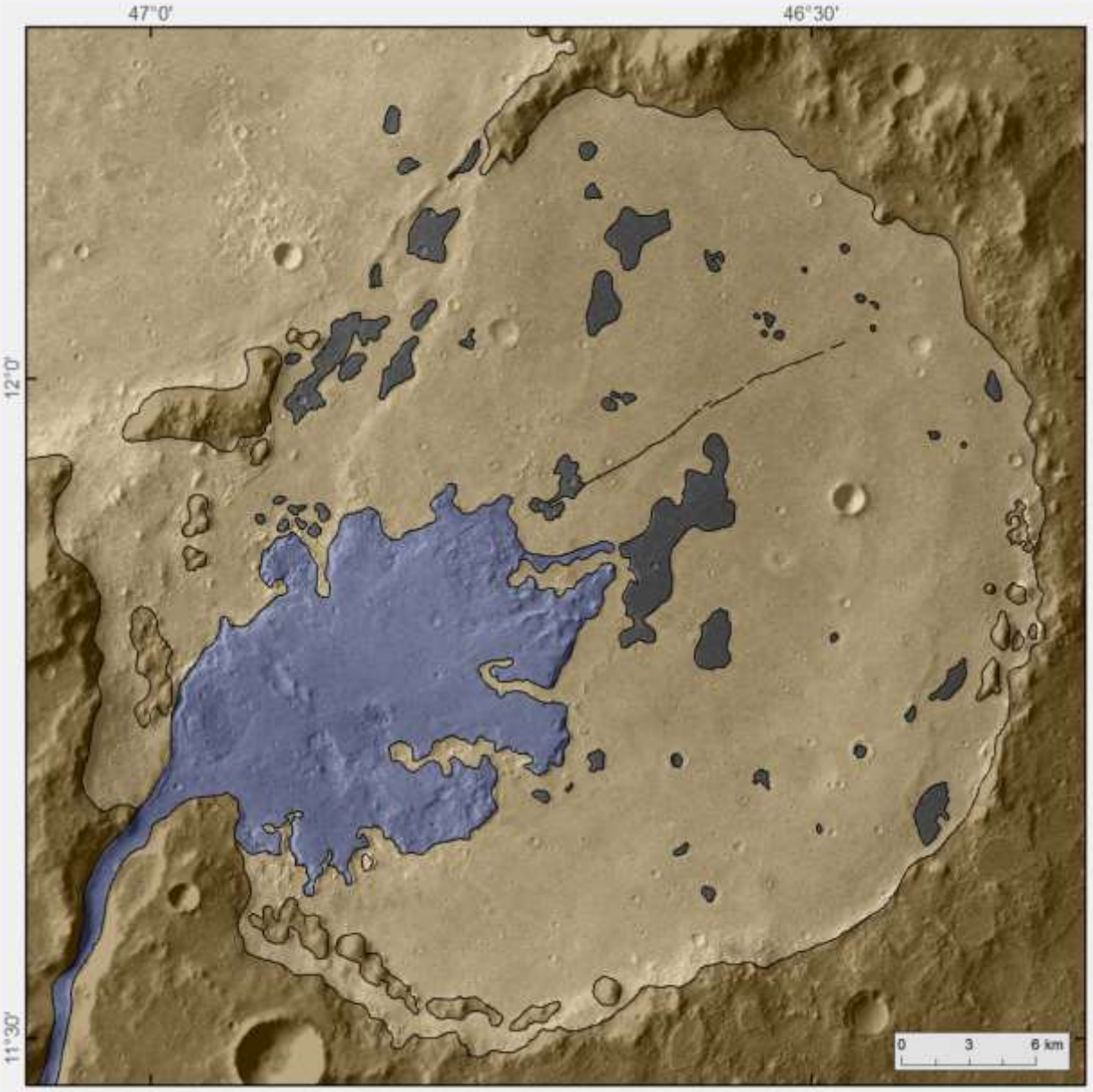
Regions of Interest

(1) Ridge/floor material

(2) Dark deposit

(3) Delta

HRSC orbit
h0894_0000



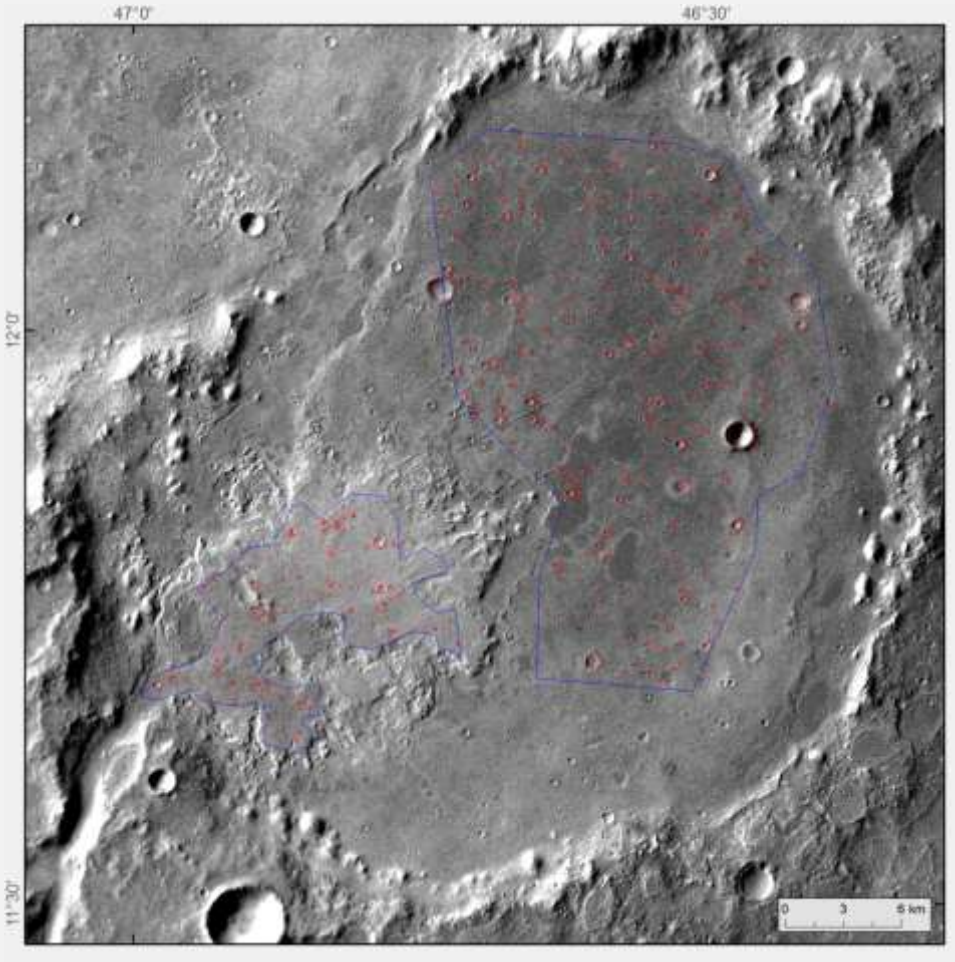
Delta

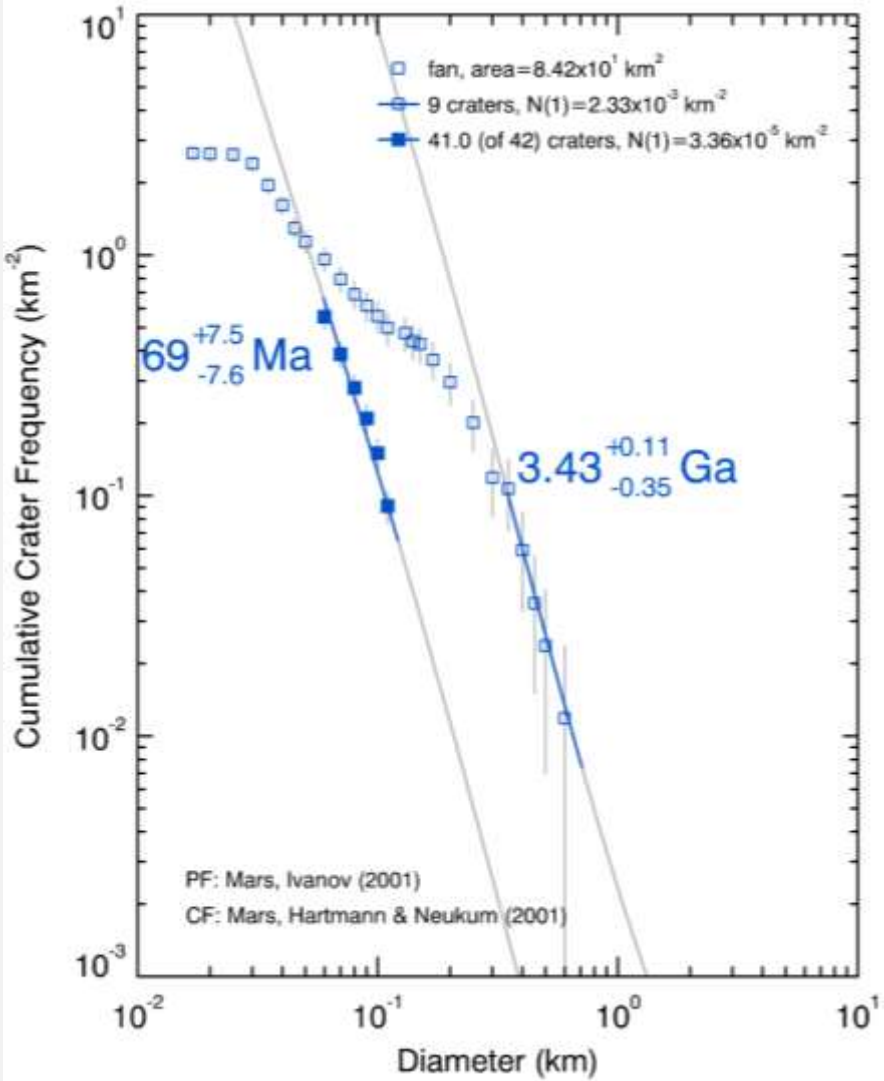
Dark deposit

Crater floor material

Highland material

Ridge

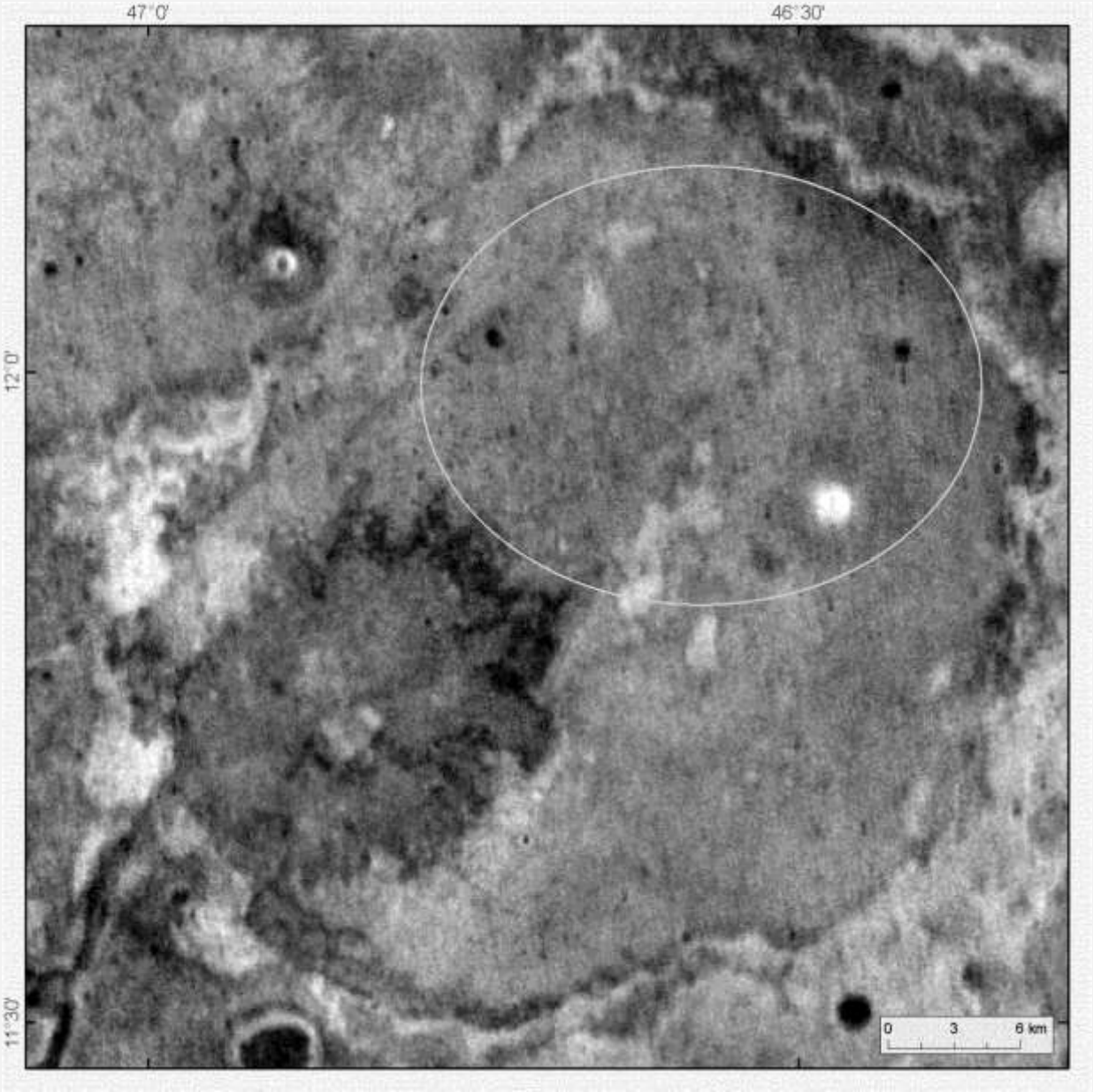




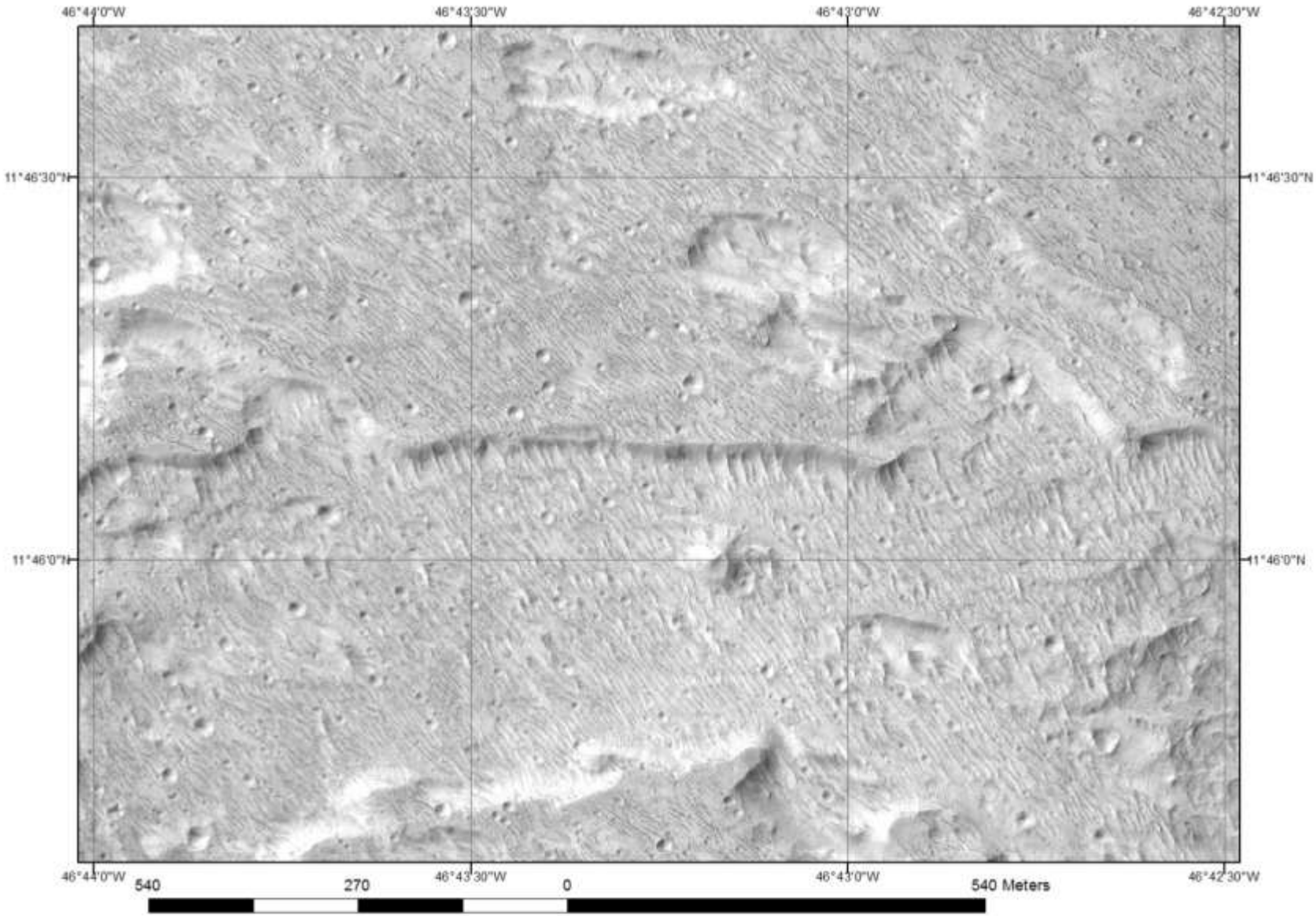
HRSC orbit
h0894_0000

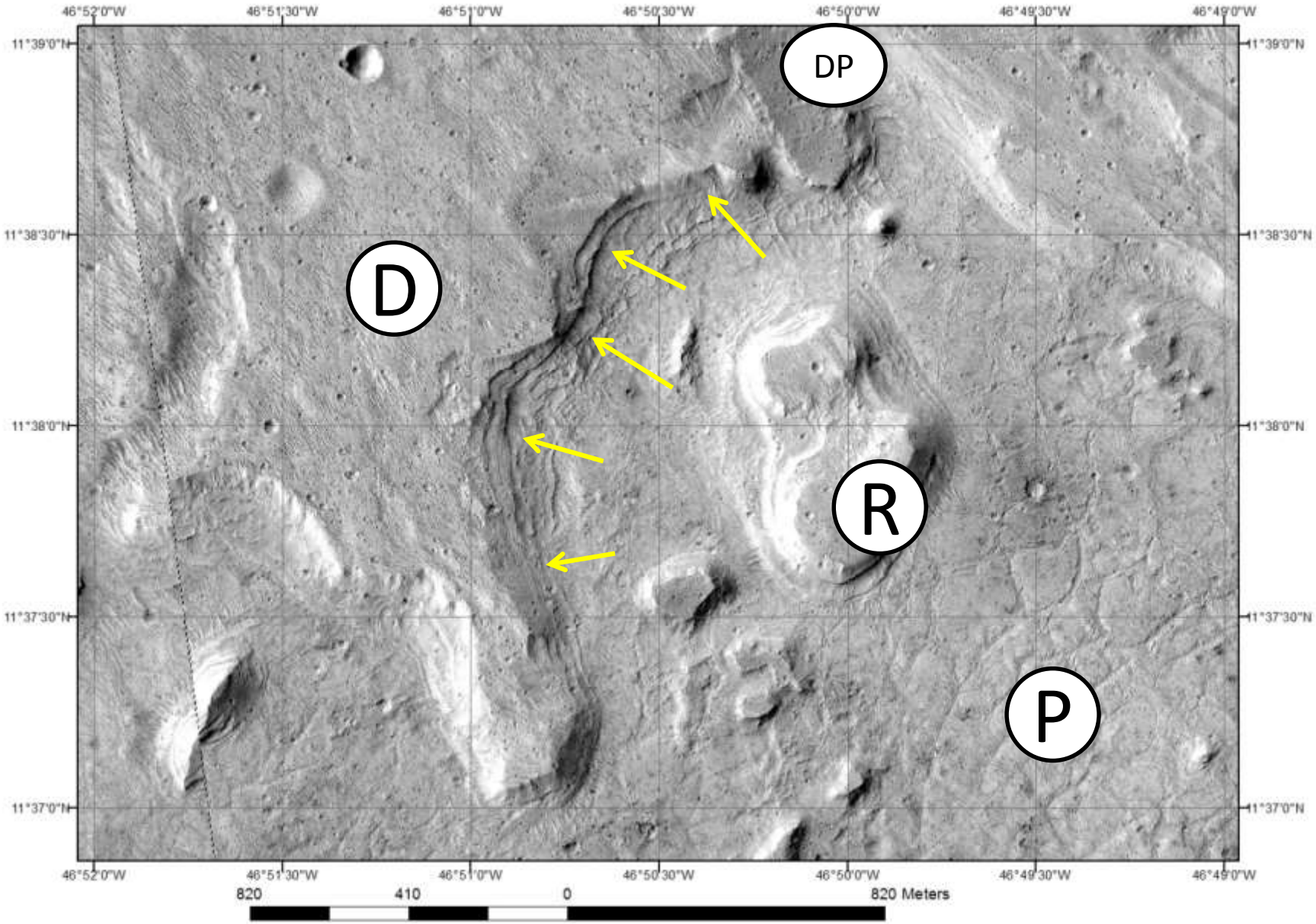
Age of Delta

Hauber et al. (2013)



THEMIS IRnight


46°44'0"W
46°43'30"W
46°43'0"W
46°42'30"W
11°46'30"N
11°46'0"N
540
270
0
540 Meters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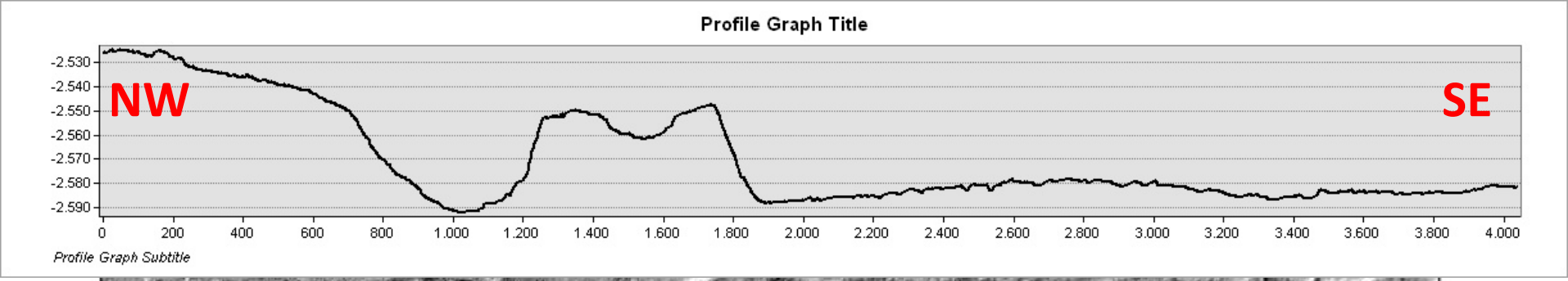
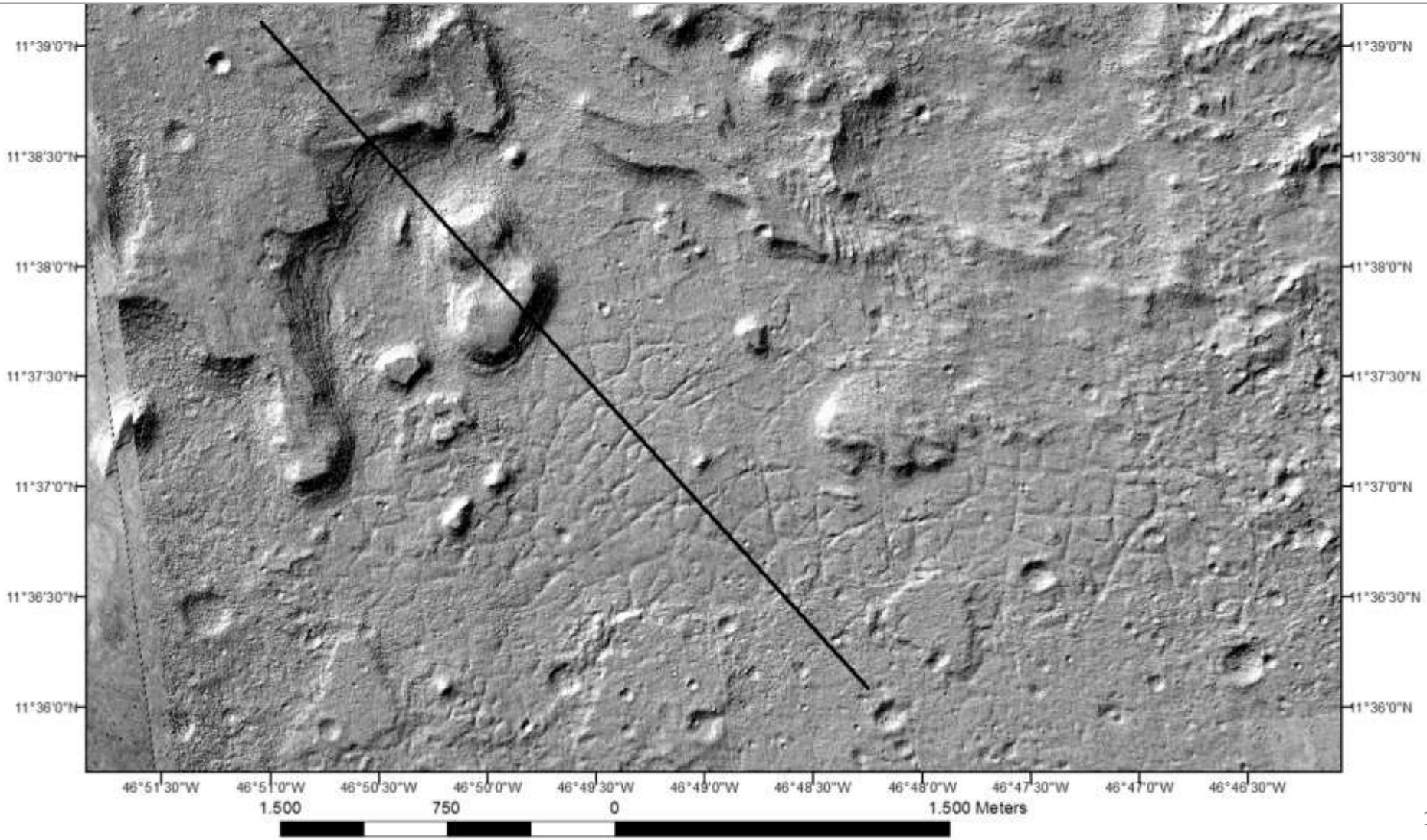
46°51'30"W
46°51'0"W
46°50'30"W
46°50'0"W
46°49'30"W
46°49'0"W
11°39'0"N
11°38'30"N
11°38'0"N
11°37'30"N
11°37'0"N
DP
D
R
P
820
410
0
820 Meters


Profile Graph Title
NW
SE
-2.530
-2.540
-2.550
-2.560
-2.570
-2.580
-2.590
0
200
400
600
800
1.000
1.200
1.400
1.600
1.800
2.000
2.200
2.400
2.600
2.800
3.000
3.200
3.400
3.600
3.800
4.000
Profile Graph Subtitle


11°39'0"N
11°38'30"N
11°38'0"N
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11°37'0"N
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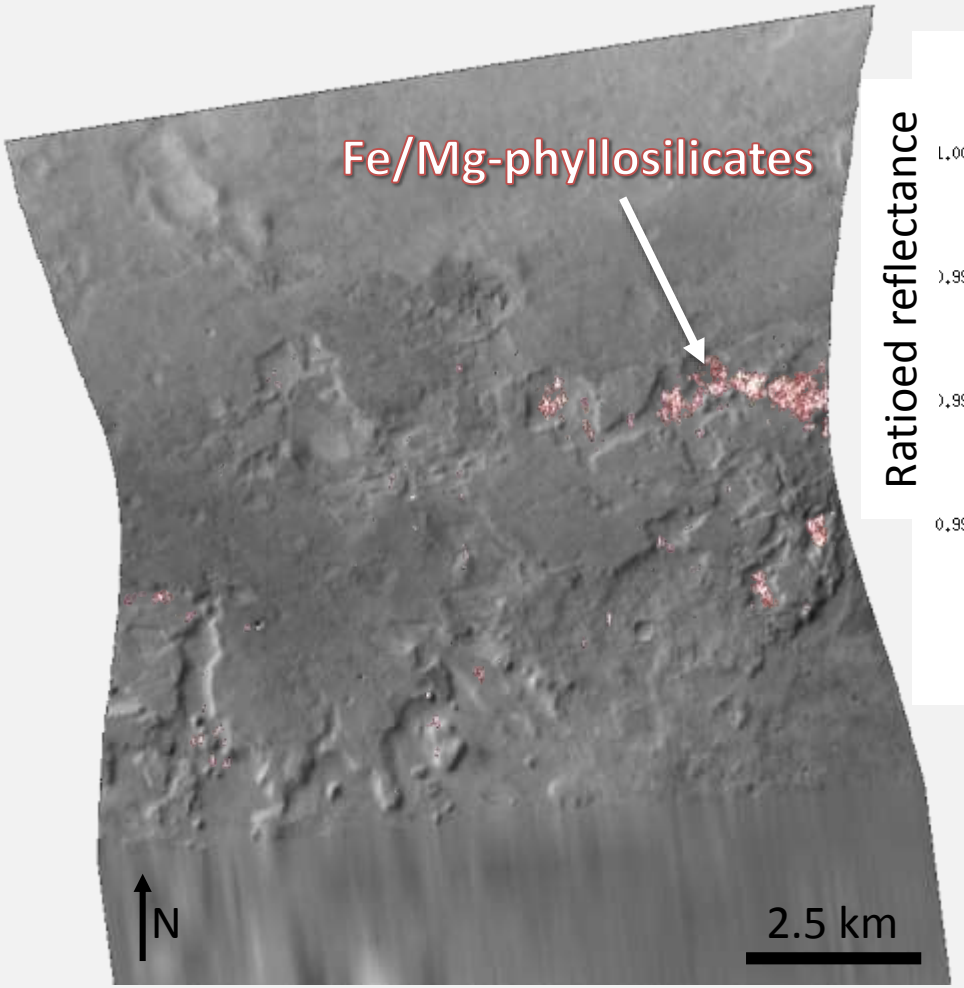
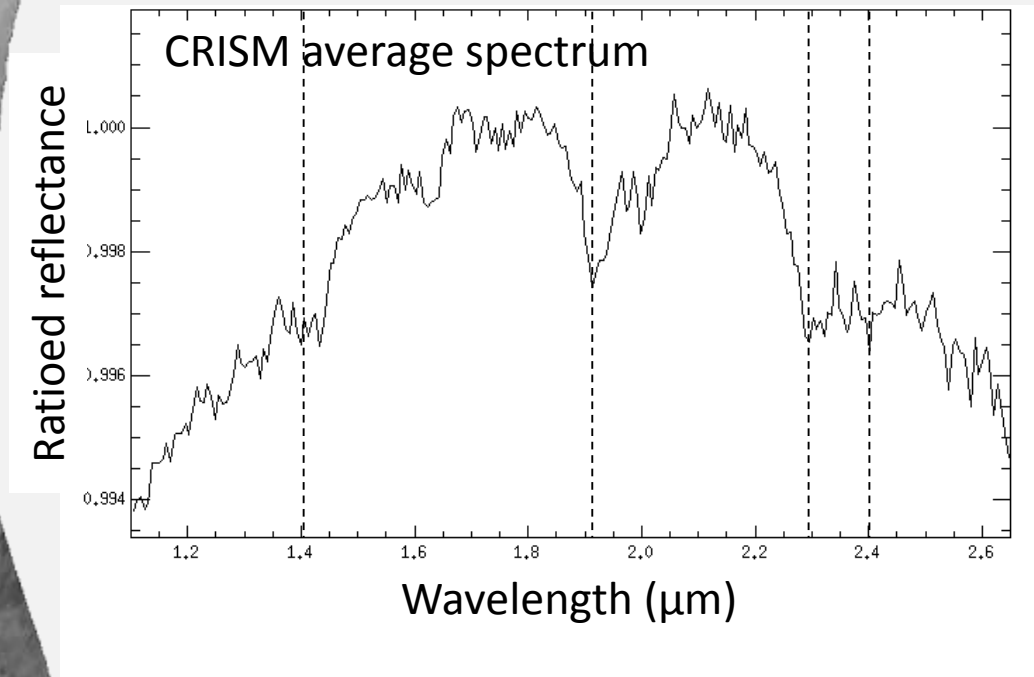
46°51'30"W
46°51'0"W
46°50'30"W
46°50'0"W
46°49'30"W
46°49'0"W
46°48'30"W
46°48'0"W
46°47'30"W
46°47'0"W
46°46'30"W
1.500
750
0
1.500 Meters

Weak signature of Fe/Mg-phyllosilicates

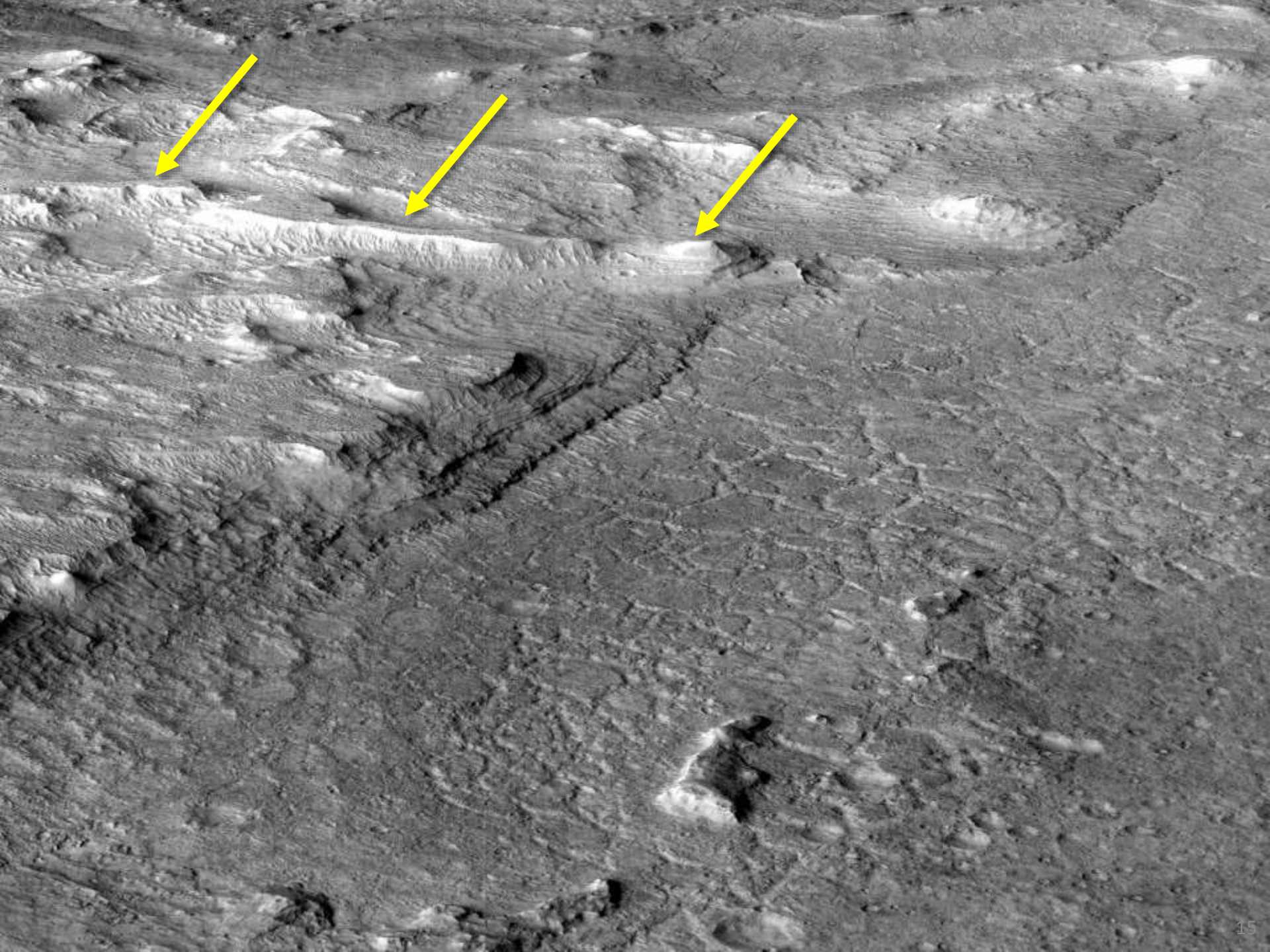


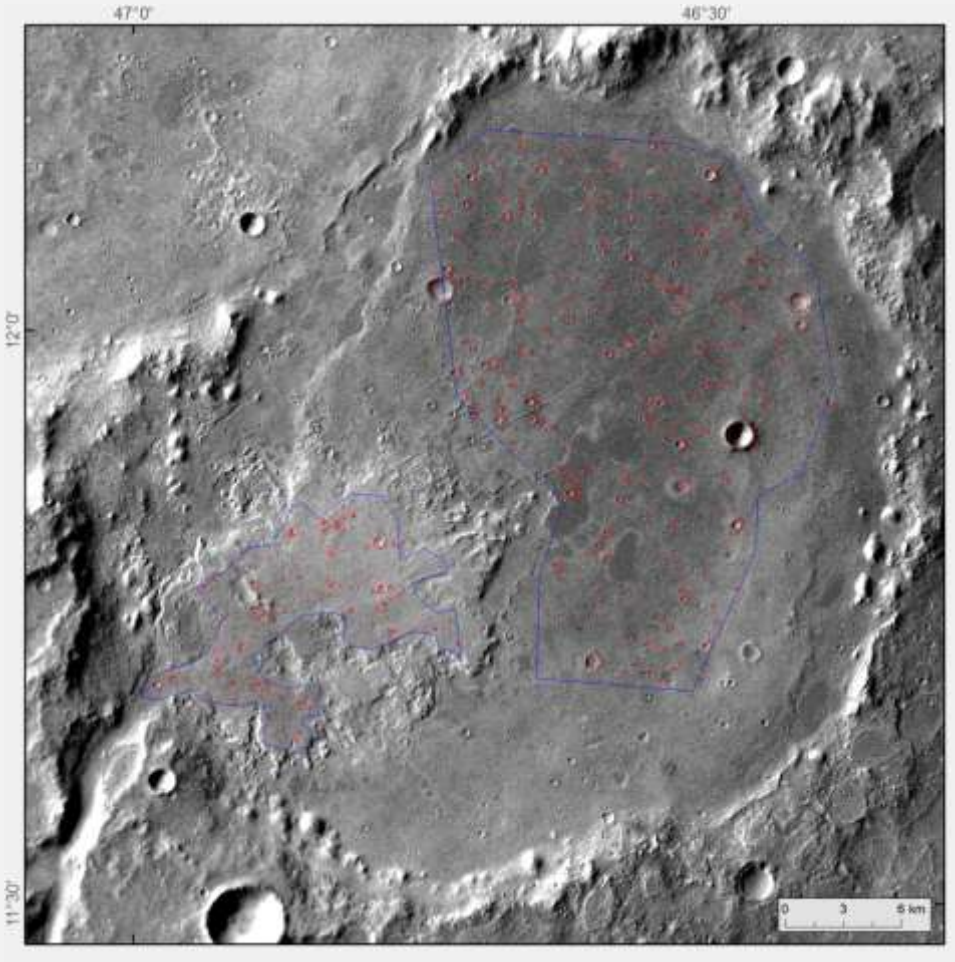
CRISM FRT 24155

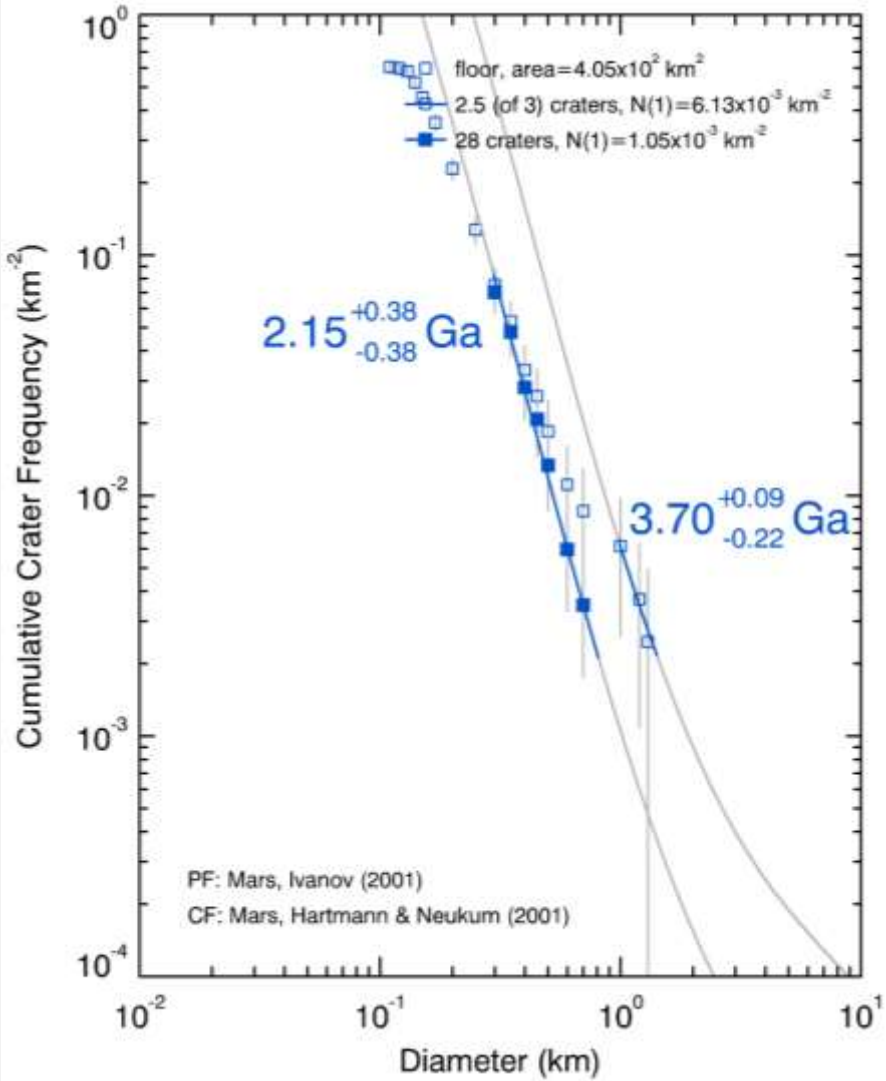


Possible Fe/Mg-phyllosilicates include nontronite, vermiculite, and saponite

Data provided by John Carter

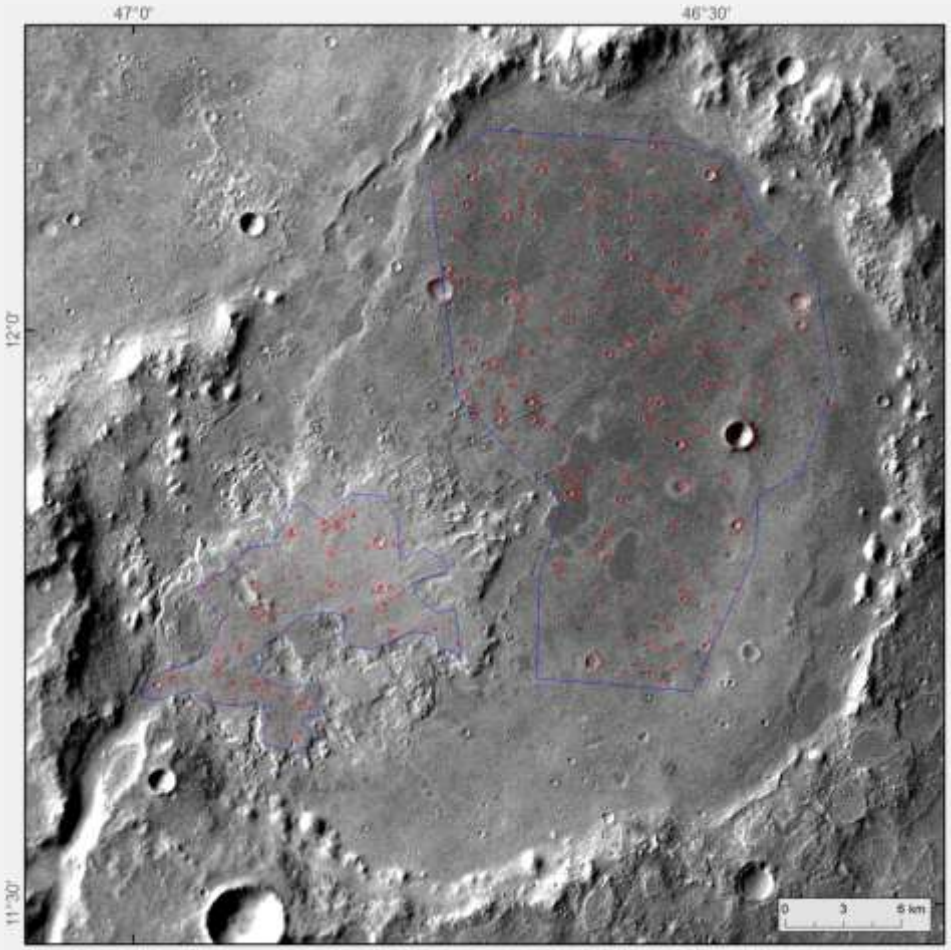


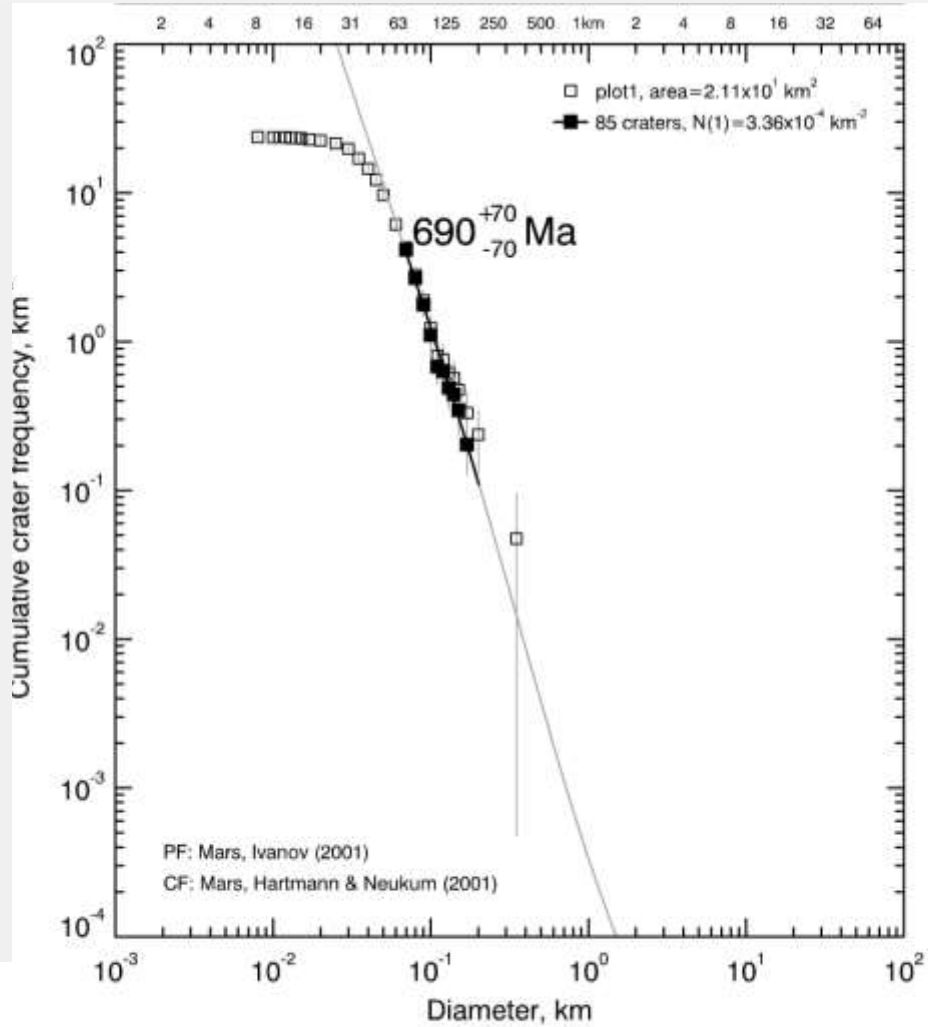




HRSC orbit
h0894_0000

Age of Crater floor

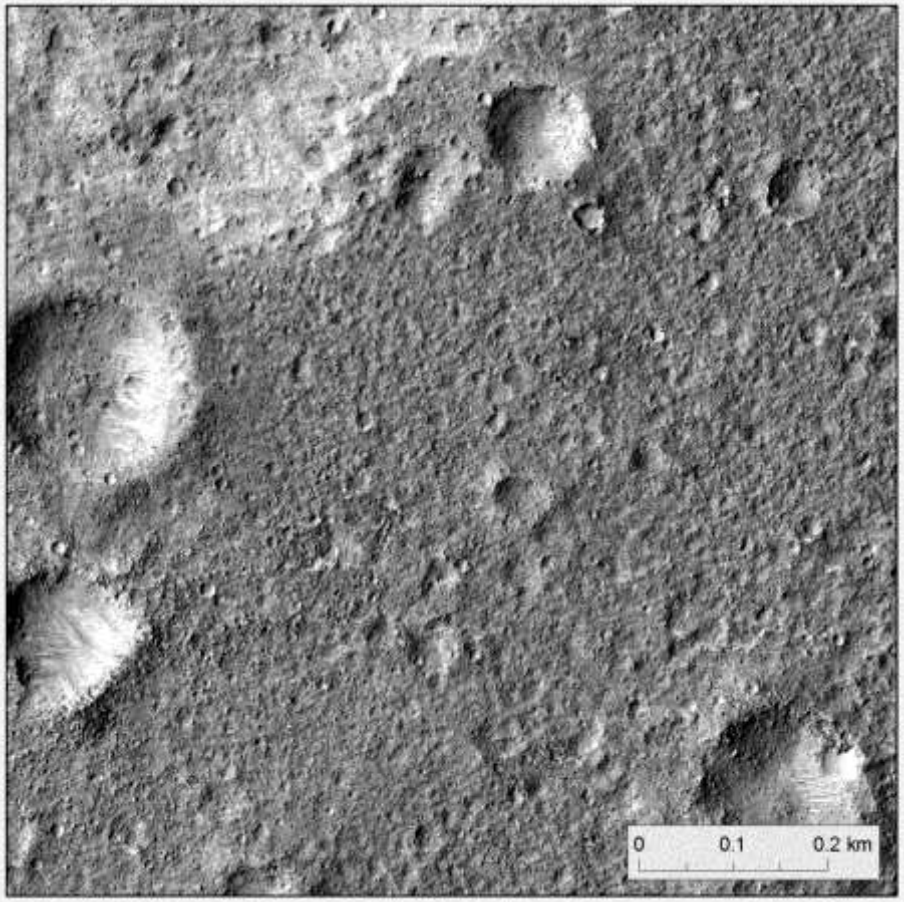




HRSC orbit
h0894_0000

Age of Dark deposit-young

Dark deposit



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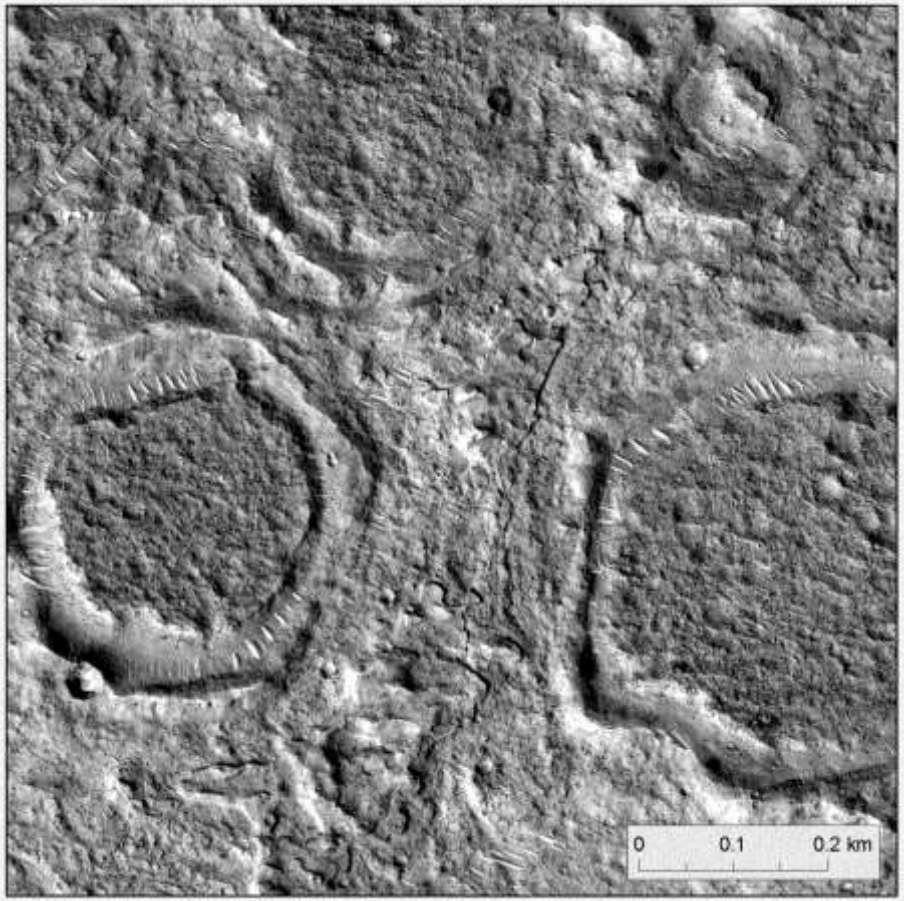

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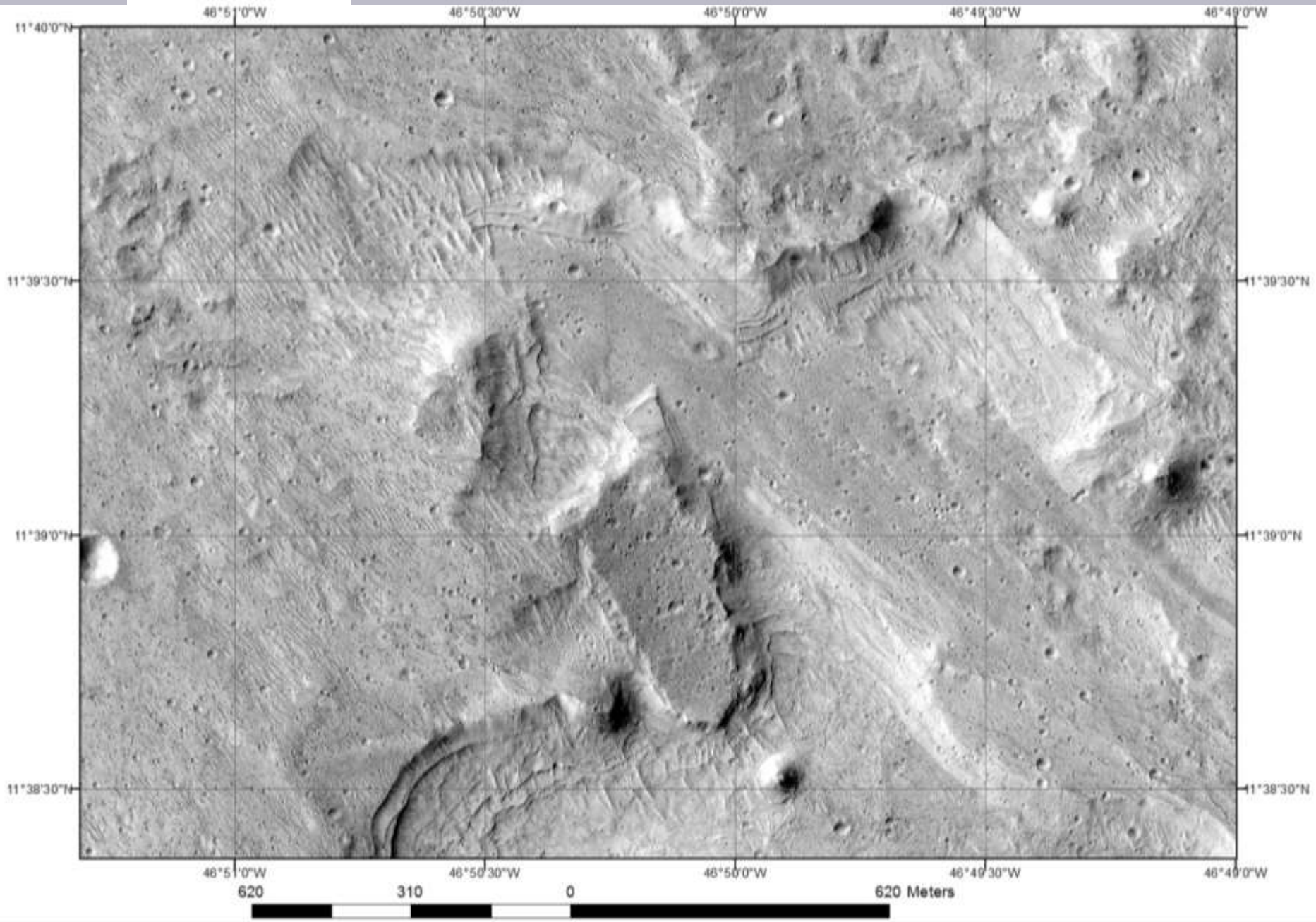
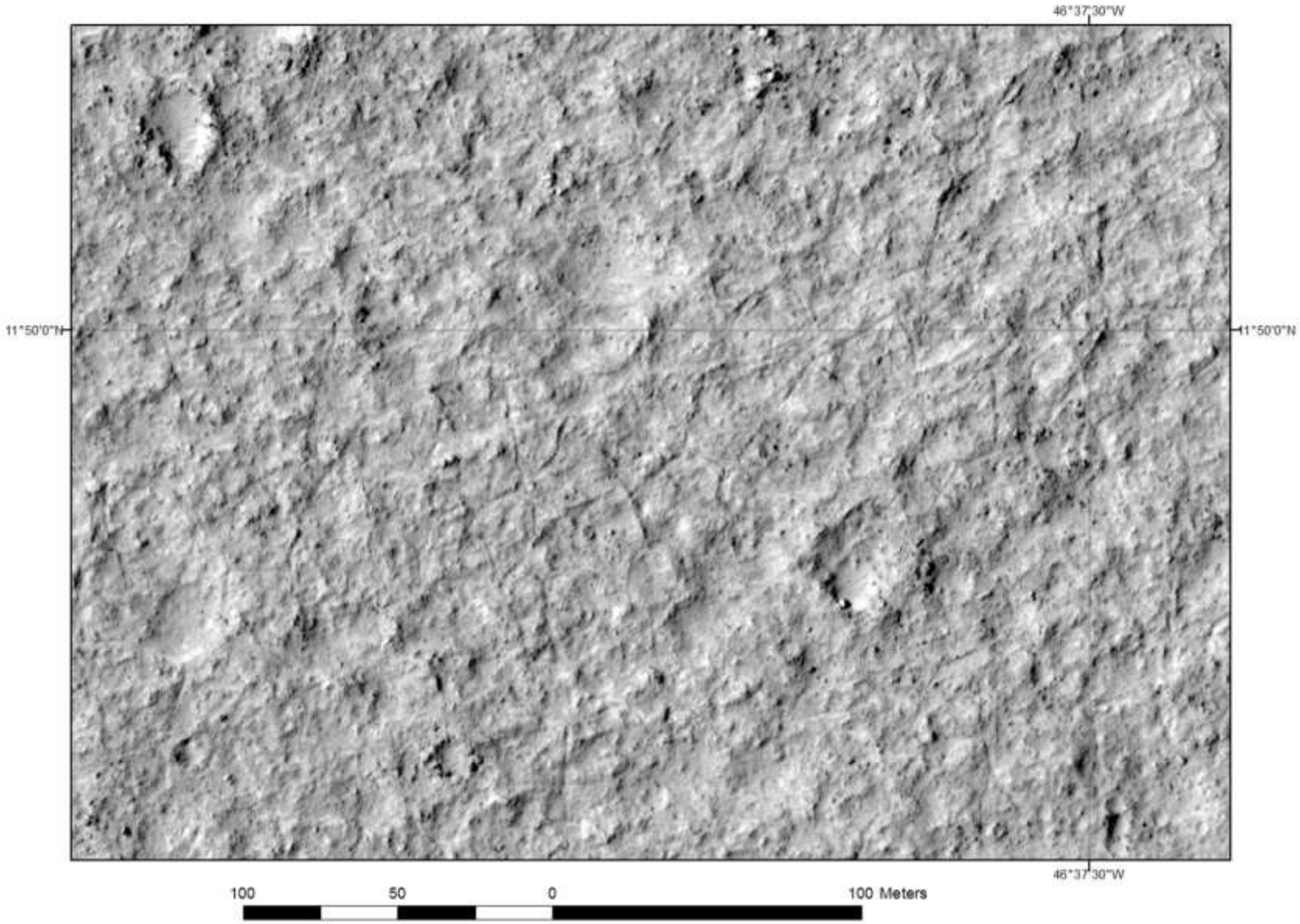

46°51'0"W
46°50'30"W
46°50'0"W
46°49'30"W
46°49'0"W
11°40'0"N
11°39'30"N
11°39'0"N
11°38'30"N
620
310
0
620 Meters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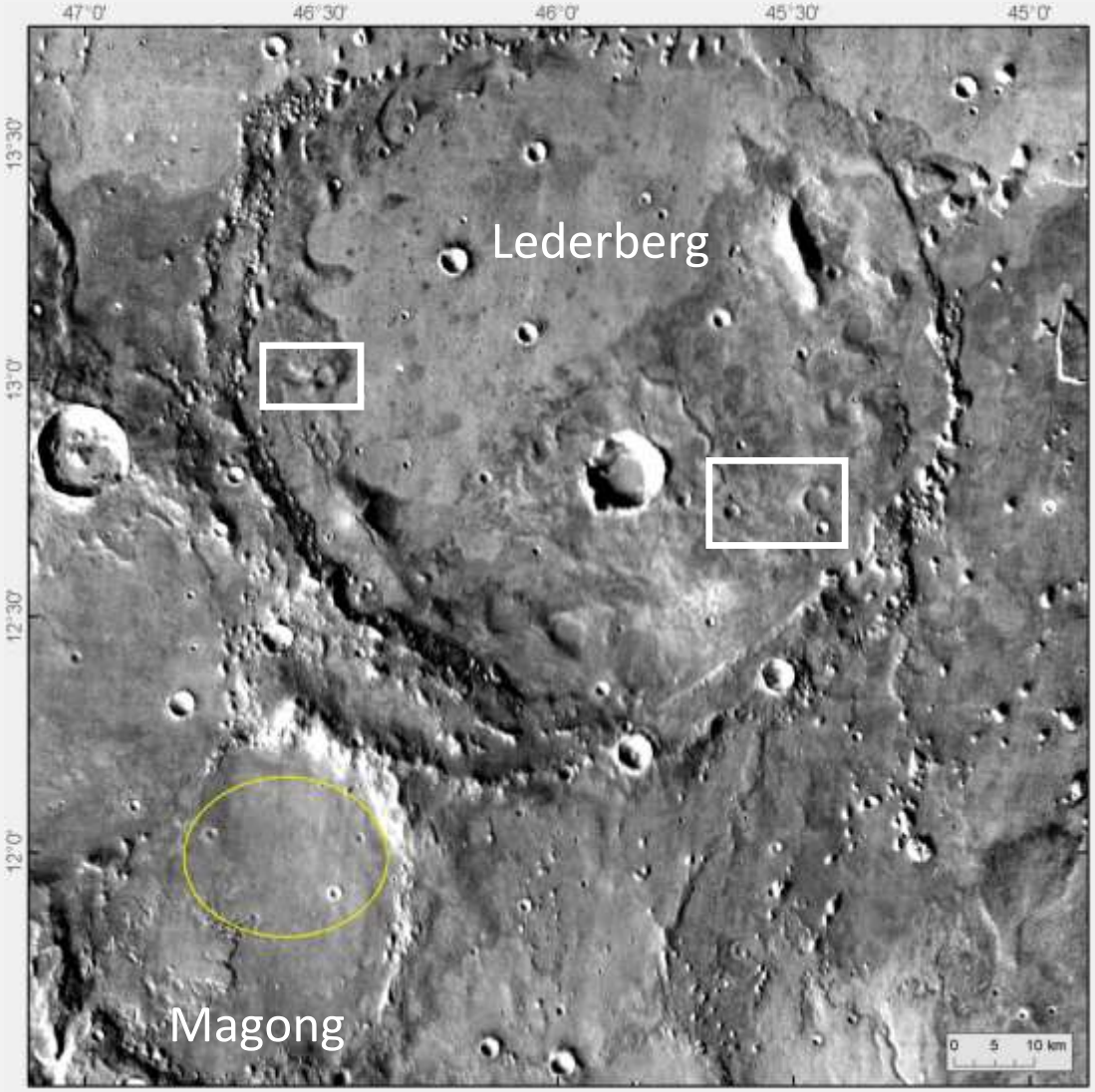
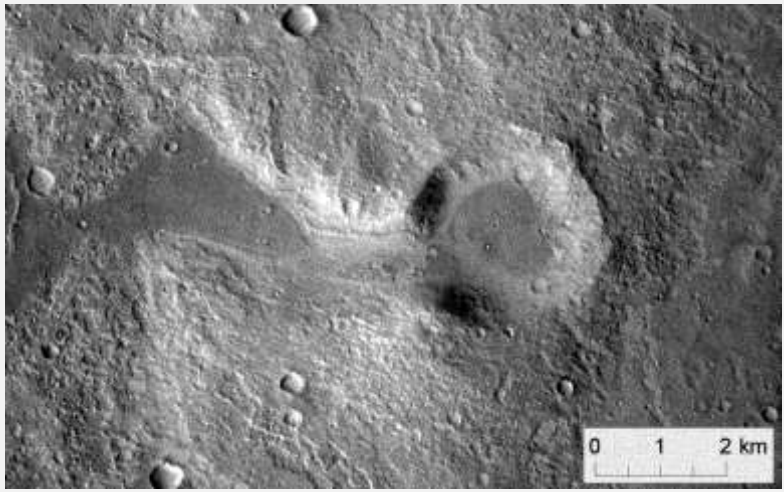
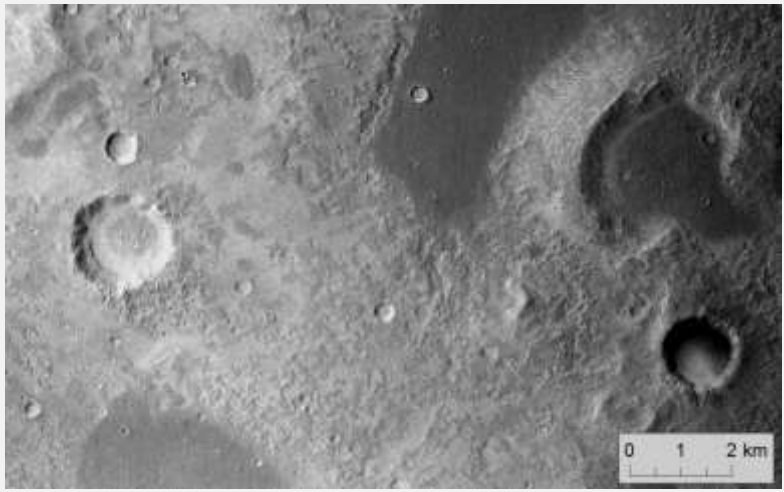
11°50'0"N
11°50'0"N
46°37'30"W
100
50
0
100 Meters



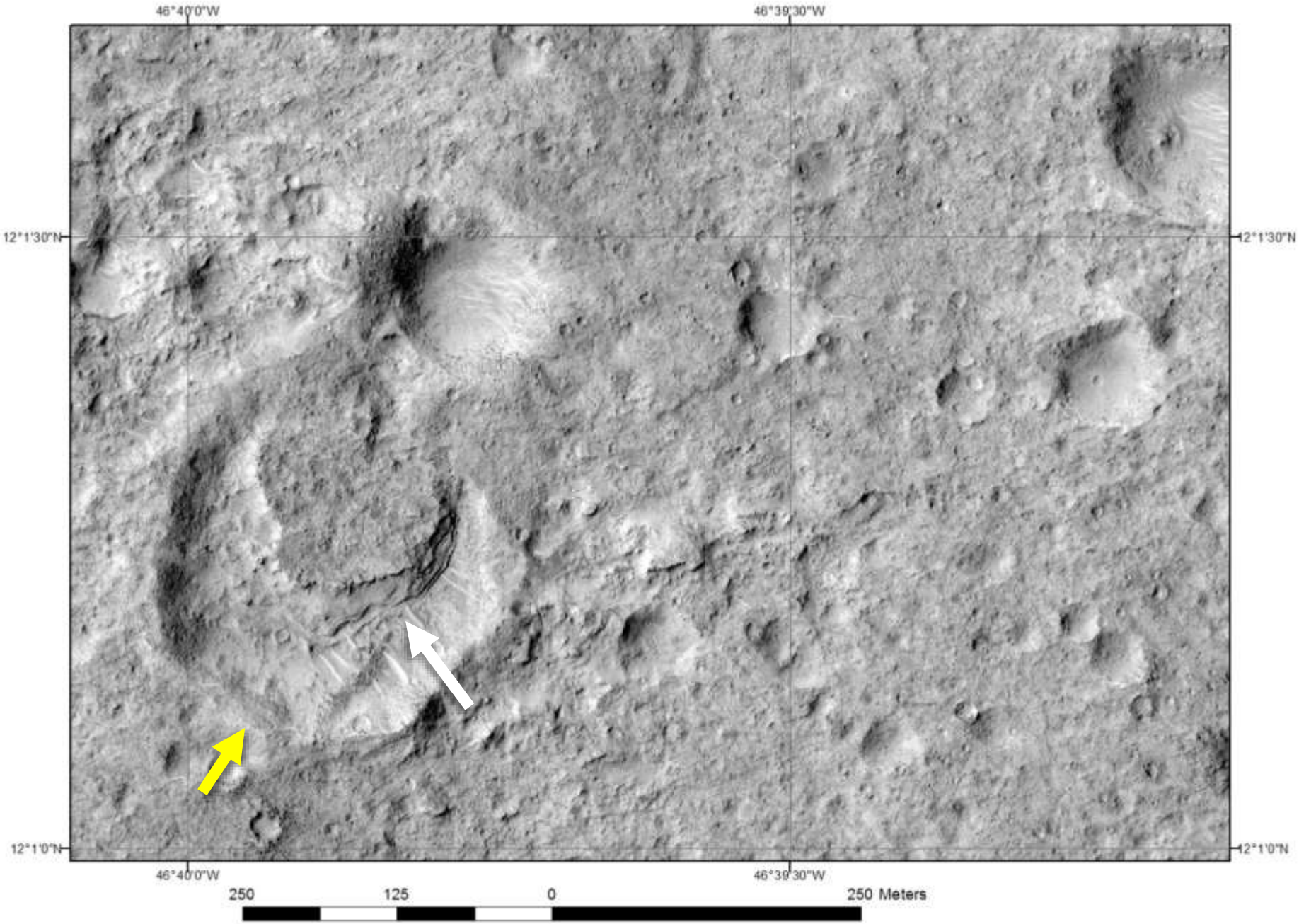
THEMIS IRday





CTX P05_003130_1937, P17_007534_1916

Brož and Hauber (2013)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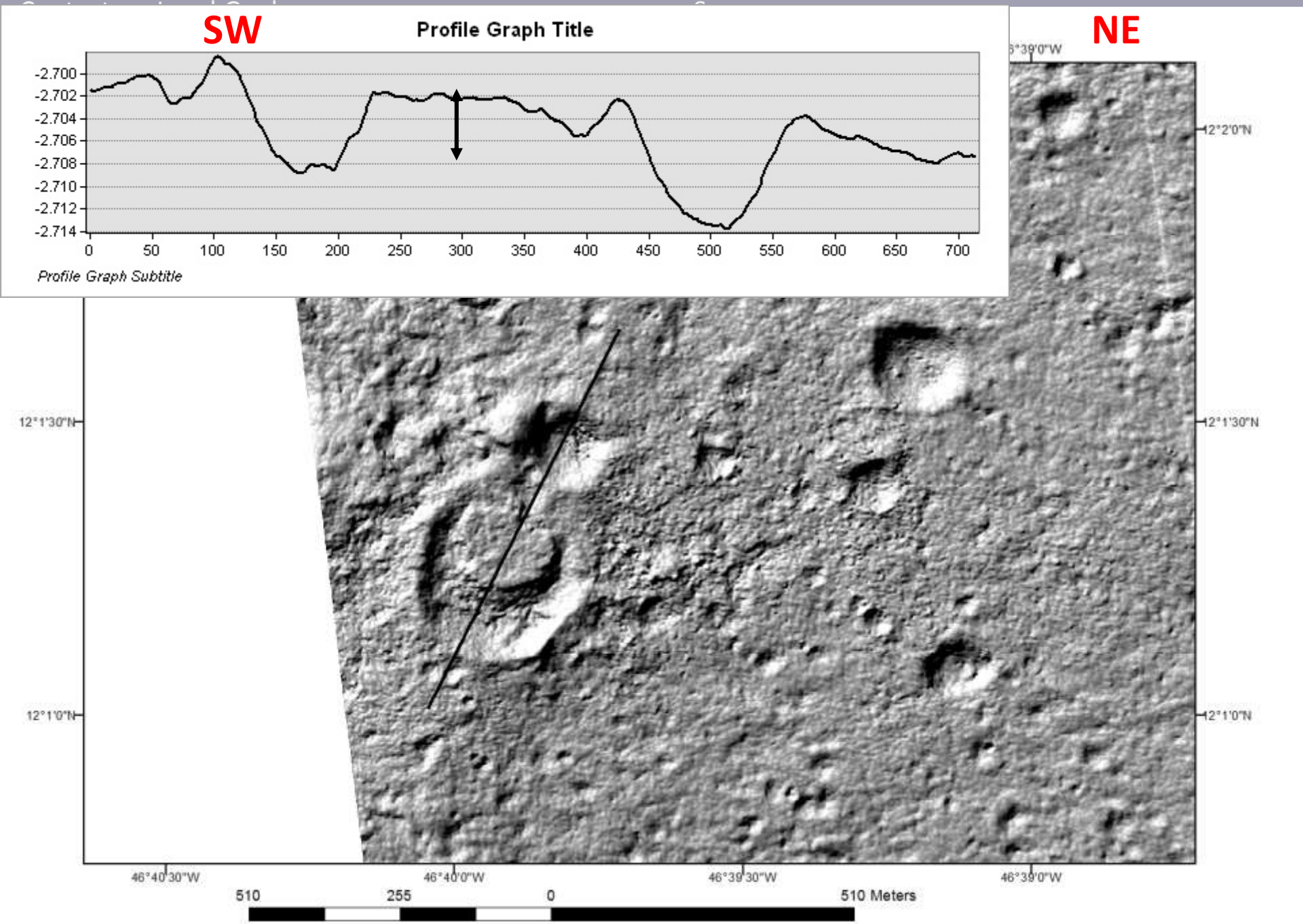
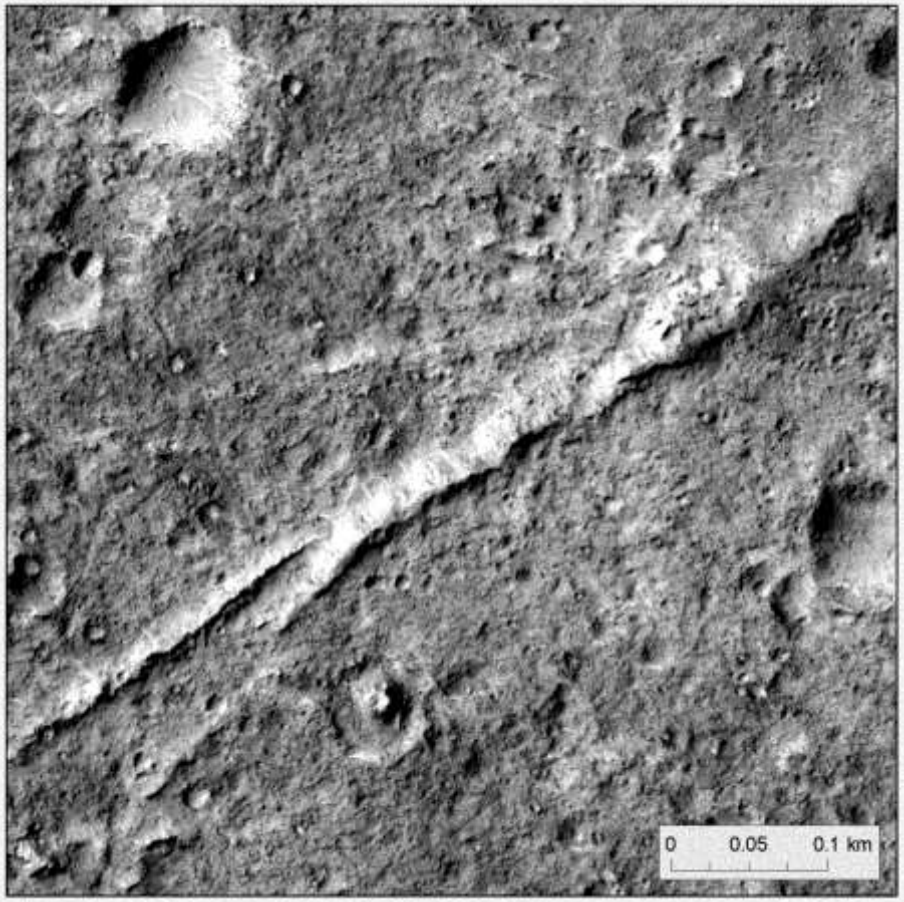
46°39'30"W
12°1'30"N
12°1'30"N
12°1'0"N
12°1'0"N
46°40'0"W
46°39'30"W
250
125
0
250 Meters


SW
NE
Profile Graph Title
-2.700
-2.702
-2.704
-2.706
-2.708
-2.710
-2.712
-2.714
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
Profile Graph Subtitle
12°2'0"N
12°1'30"N
12°1'0"N
46°40'30"W
46°40'0"W
46°39'30"W
46°39'0"W
510
255
0
510 Meters

Ridge



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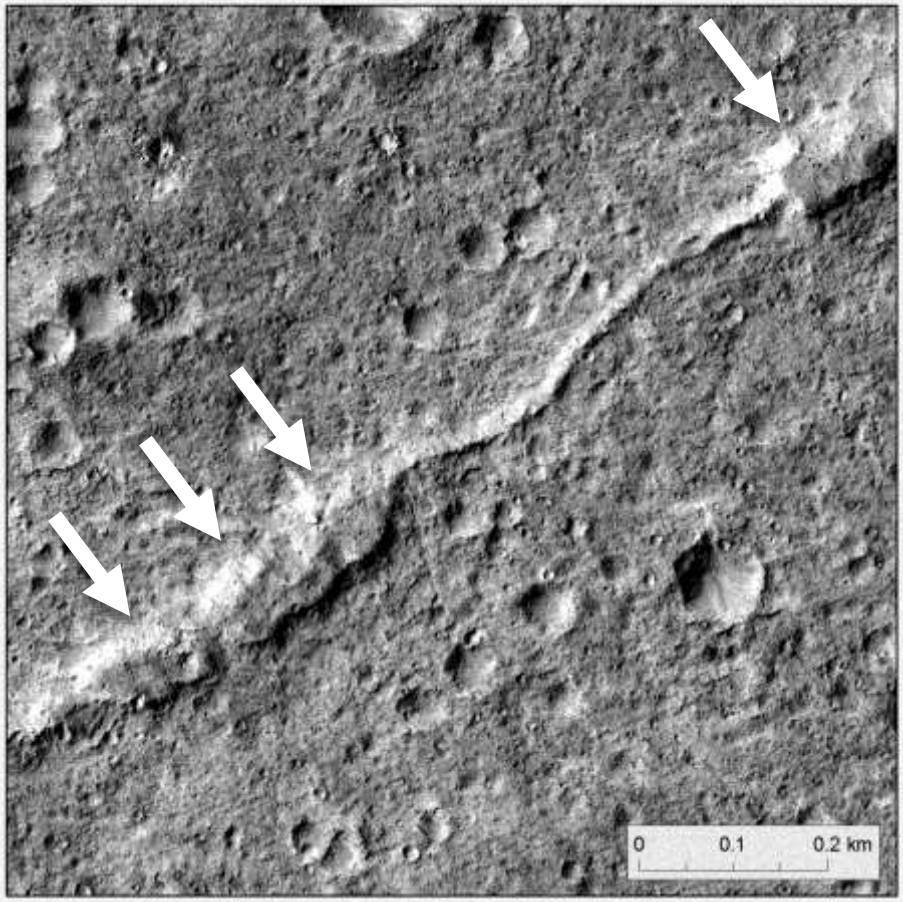

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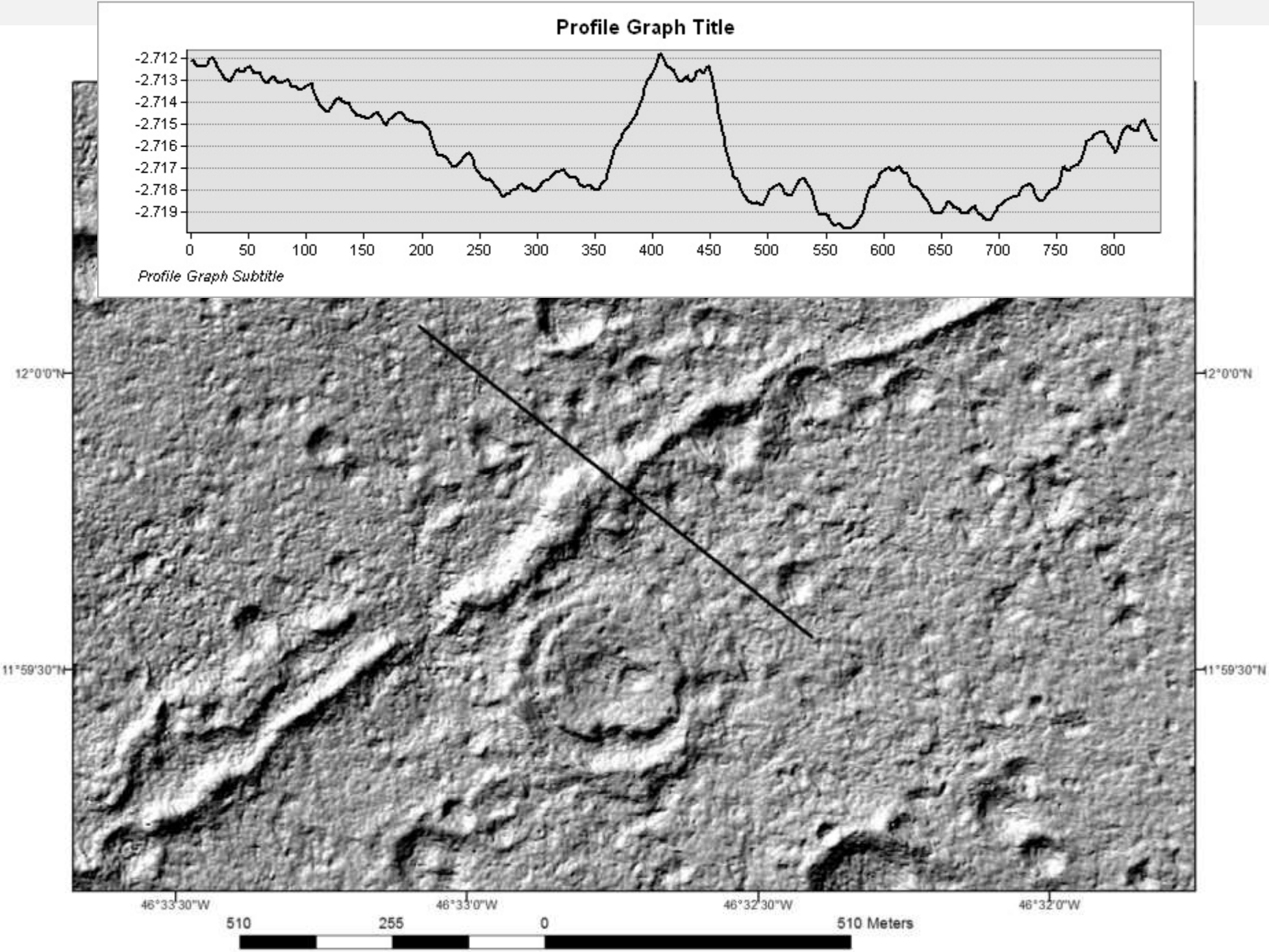
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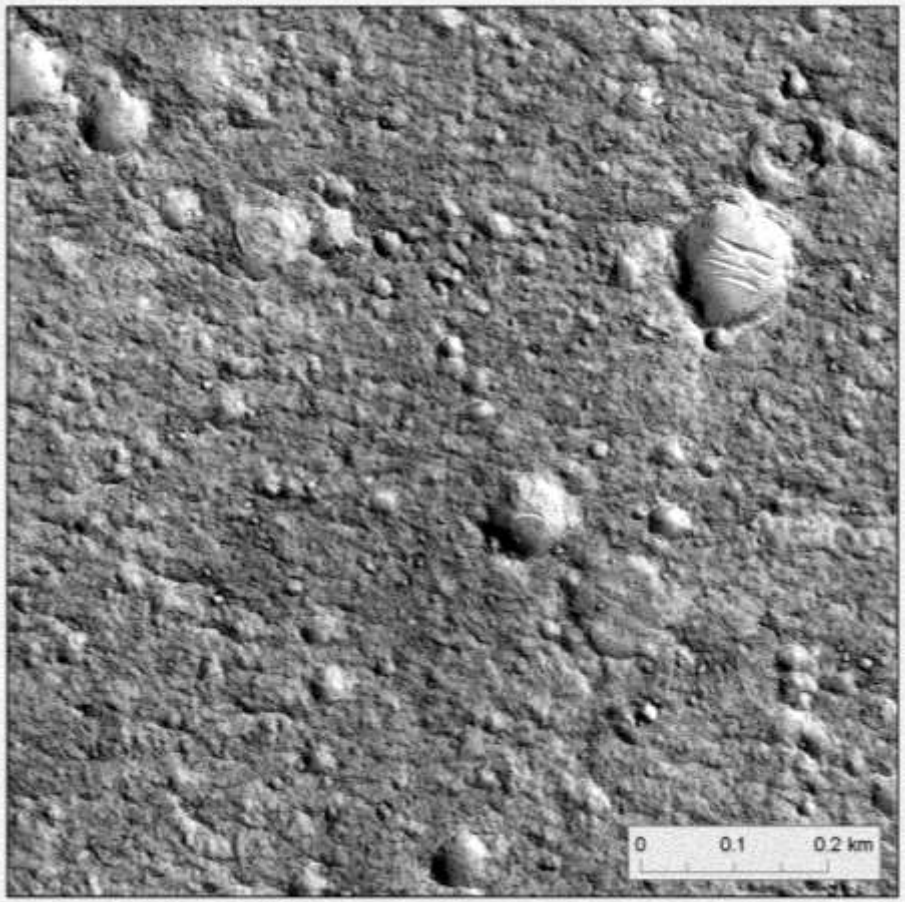
-2.712
-2.713
-2.714
-2.715
-2.716
-2.717
-2.718
-2.719
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
Profile Graph Subtitle
12°0'0"N
11°59'30"N
46°33'30"W
46°33'0"W
46°32'30"W
46°32'0"W
510
255
0
510 Meters

Crater floor material



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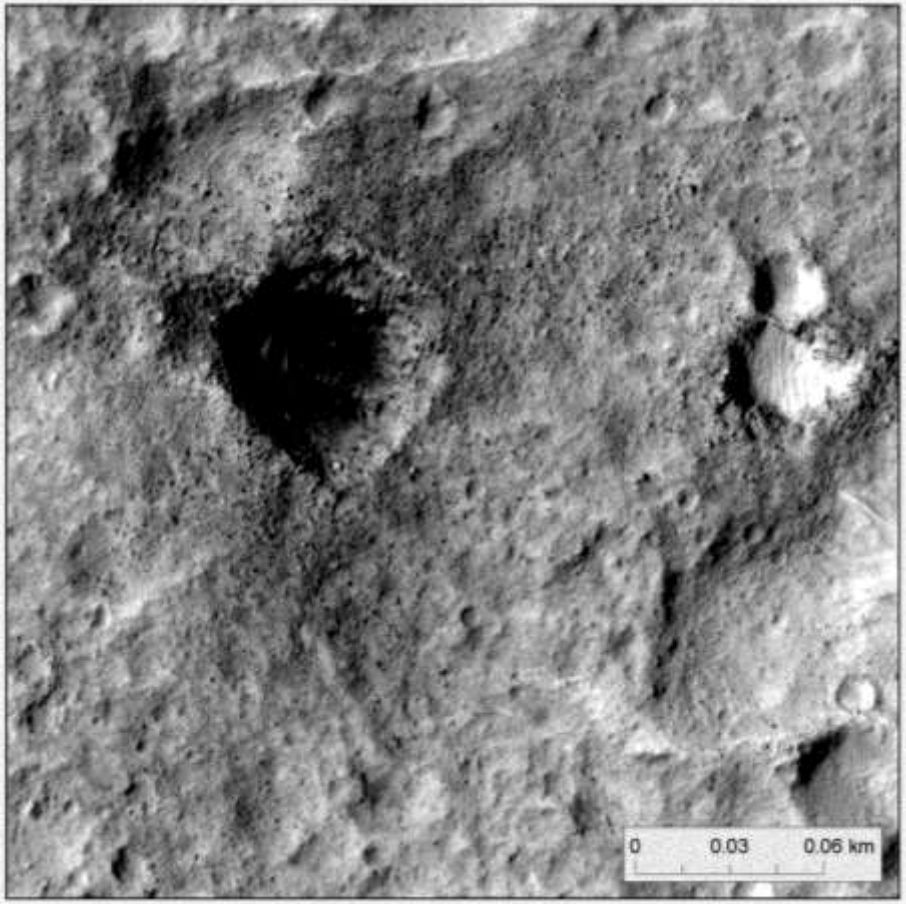

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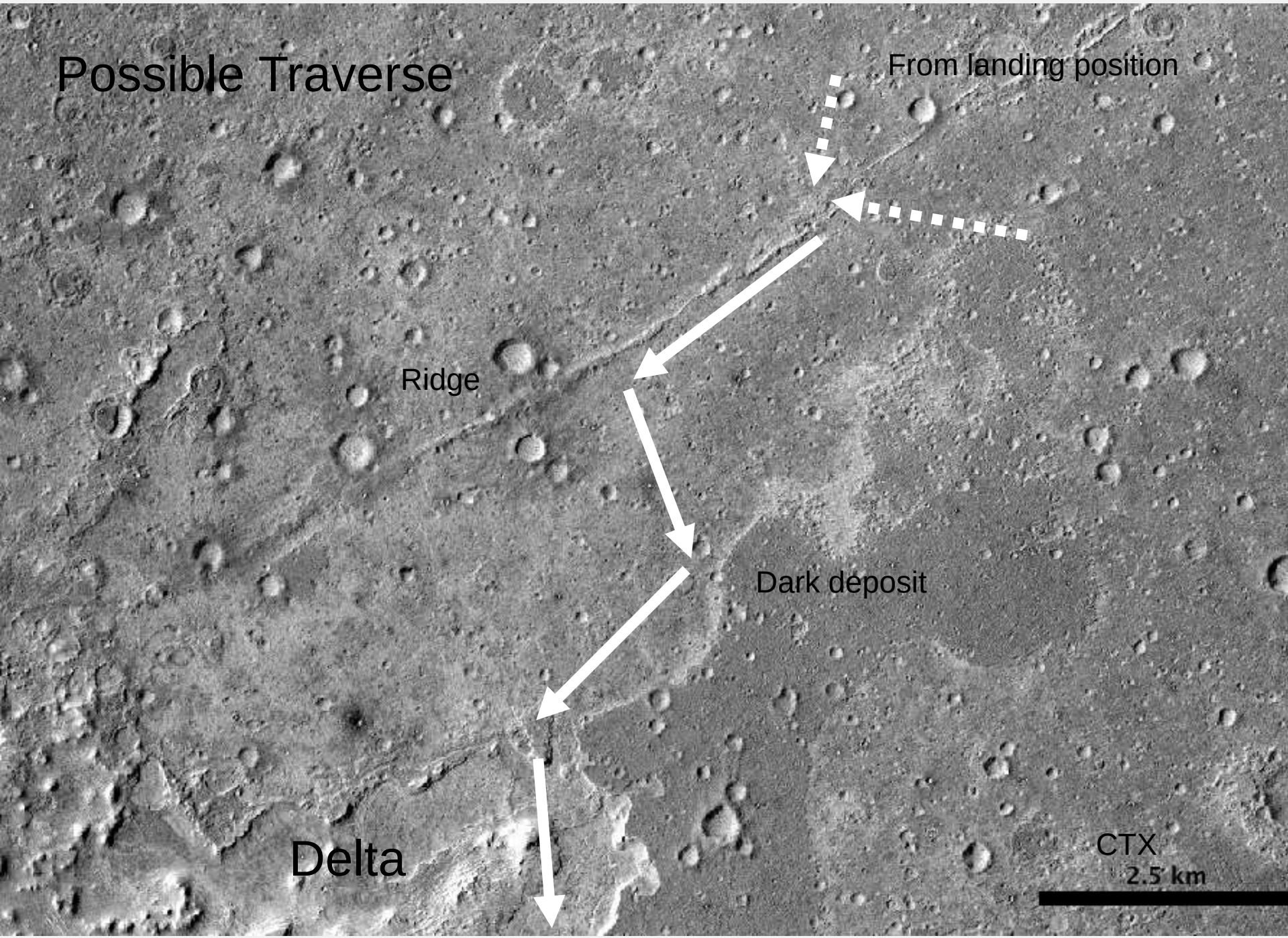
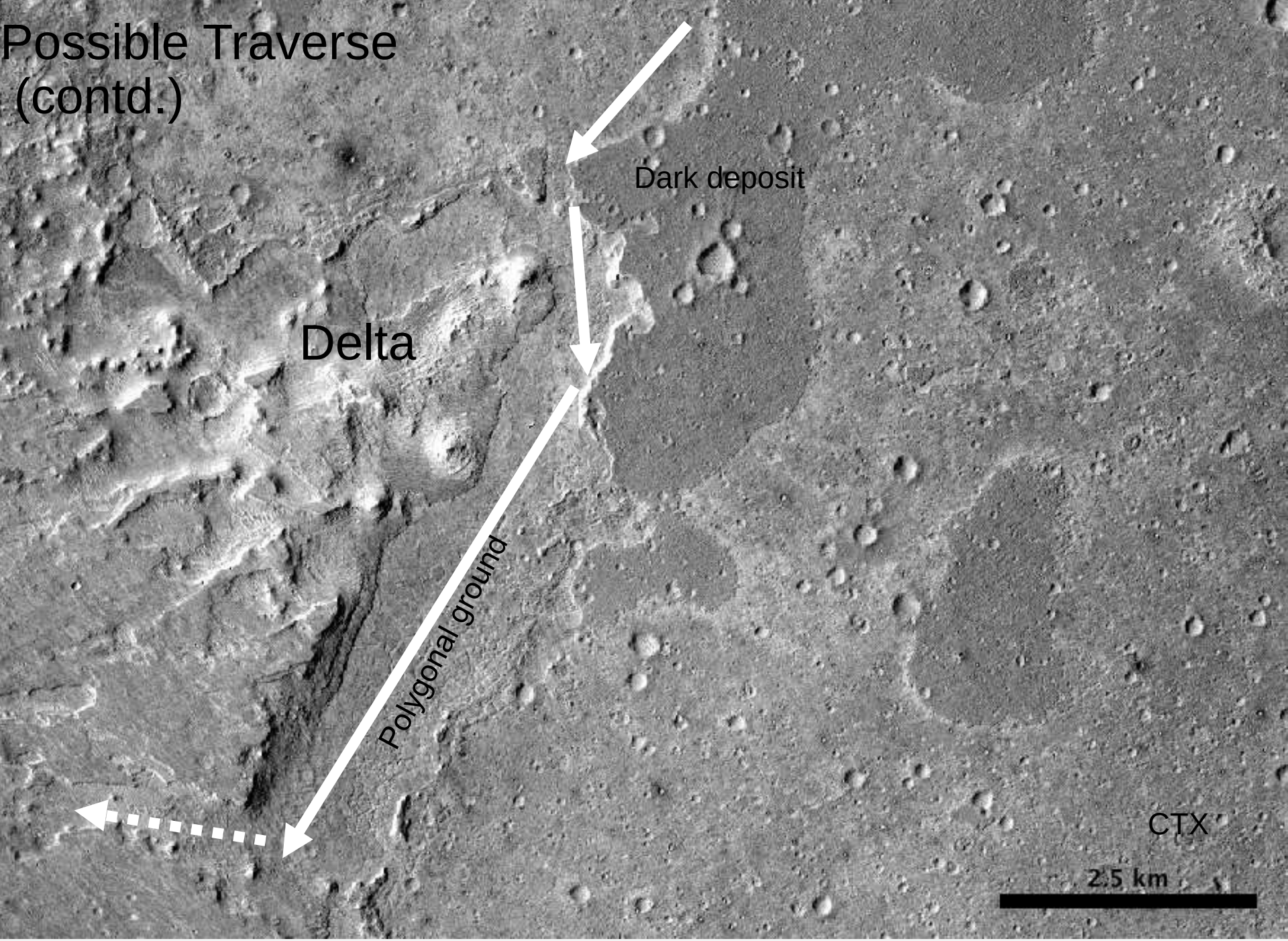

Possible Traverse
From landing position
Ridge
Dark deposit
Delta
CTX
2.5 km

Possible Traverse (contd.)



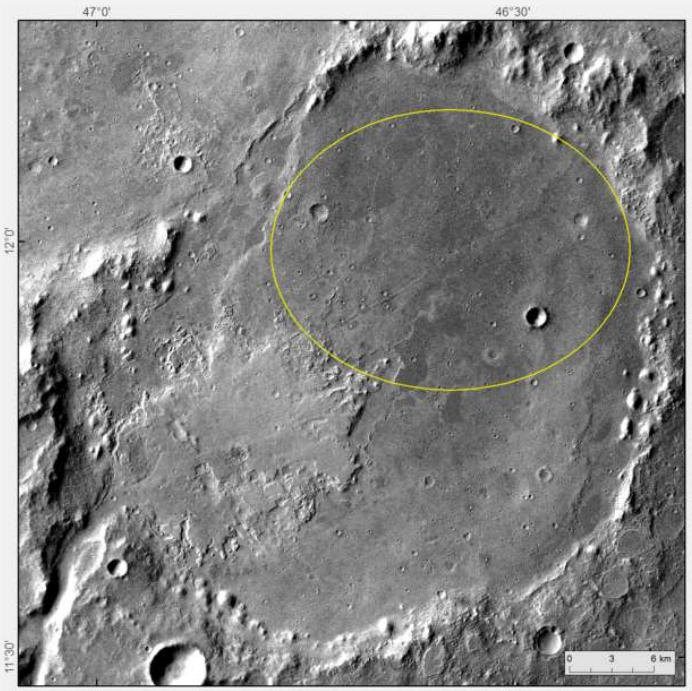
Landing Site Factor	Mars 2020 Mission and Decadal Priority Science Factors																						
	Environmental Setting for Biosignature Preservation and Taphonomy of Organics								Type 1A & 1B Samples: Aqueous Geochemical Environments indicated by Mineral Assemblages									Type 2 Samples: Igneous		Context: Martian History Sampled, Timing Constraints				
	Deltaic or Lacustrine (perennial)	Lacustrine (evaporitic)	Hydrothermal (<100°C) surface	Hydrothermal (<100°C) subsurface	Pedogenic	Fluvial/Alluvial	No diagenetic overprinting	Recent exposure	Crustal phyllosilicates	Sedimentary clays	Al clays in stratigraphy	Carbonate units	Chloride sediments	Sulfate sediments	Acid sulfate units	Silica deposits	Ferric Ox./Ferrous clays	Igneous unit (e.g. lava flow, pyroclastic, intrusive)	2nd Igneous unit	Pre- or Early-Noachian Megabreccia	Oldest stratigraphic constraint	Youngest stratigraphic constraint	Stratigrapy of units well-defined	Dateable surface, volcanic (unmodified crater SFD)
Magong (Sabrina)	○					○		○		○								~	~		MN	LA	○	~

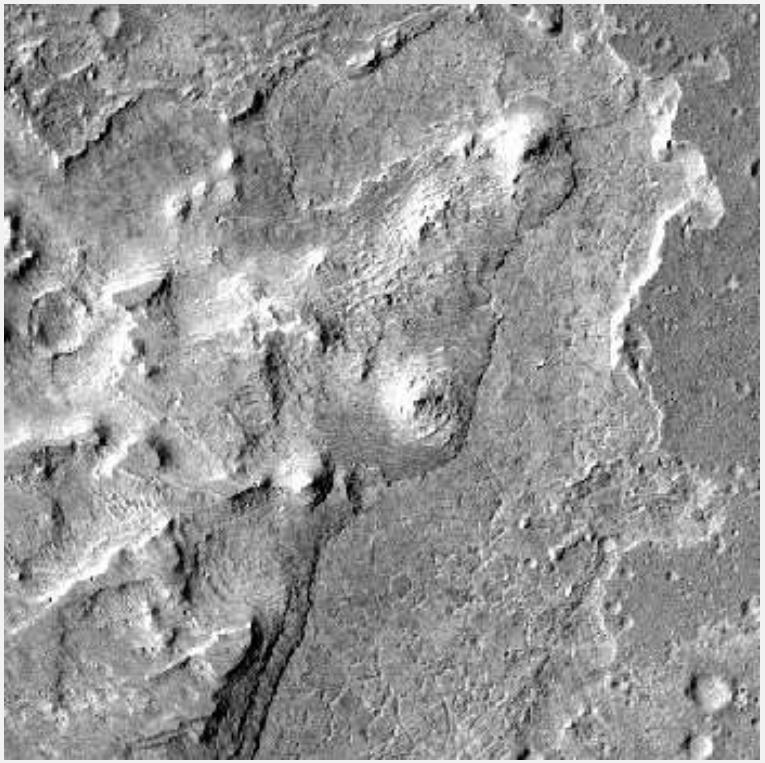
Delta deposits immediately outside ellipse

Clay detection substantially further away

Up to 3 separate igneous units.

Summary : Magong Crater (Sabrina Vallis delta)





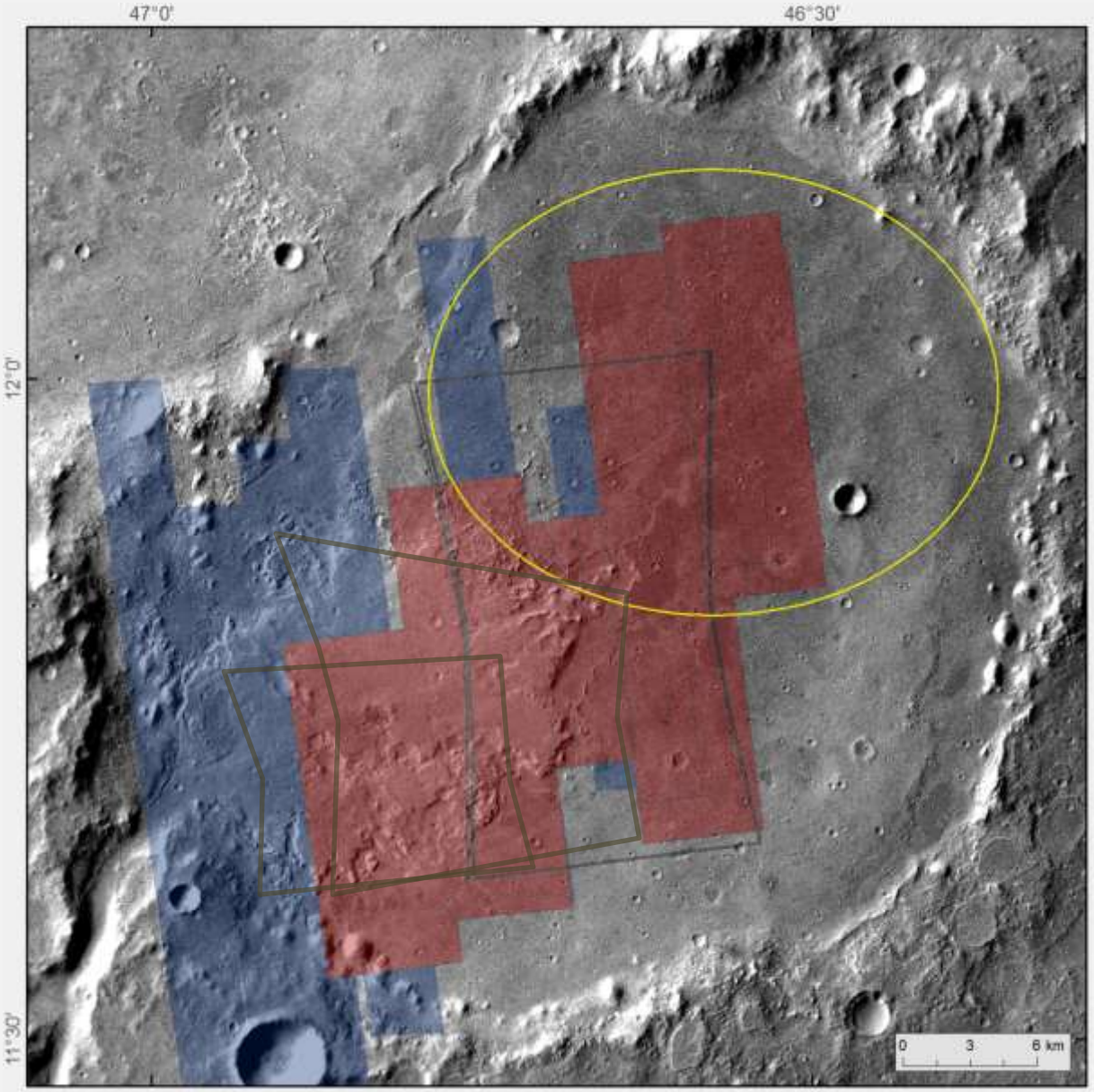
Old, heavily eroded and infilled Noachian crater

LN / EH Delta formation from ~200 km fluvial valley. Active erosion.

3 separate deposits of potentially igneous origin (Floor, Ridge, Dark deposit)

Good landing safety an traversibility

Supplementary slides



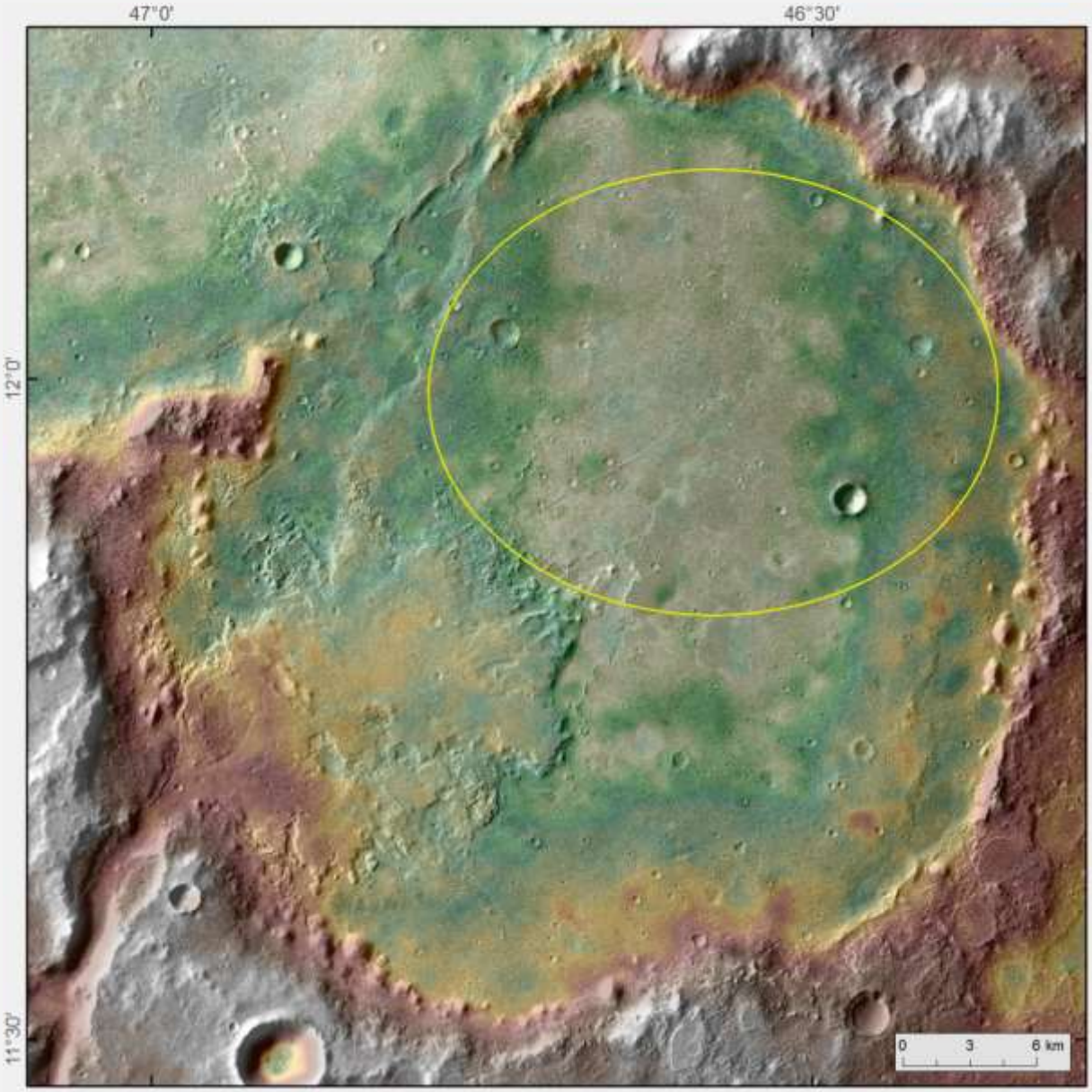
Coordinates of landing ellipse

11.990°N, 313.425°E
20 km × 25 km

Full HRSC and CTX coverage

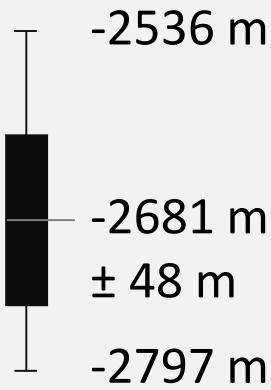
- CRISM
- HiRISE
- MOC-NA

HRSC orbit
h0894_0000

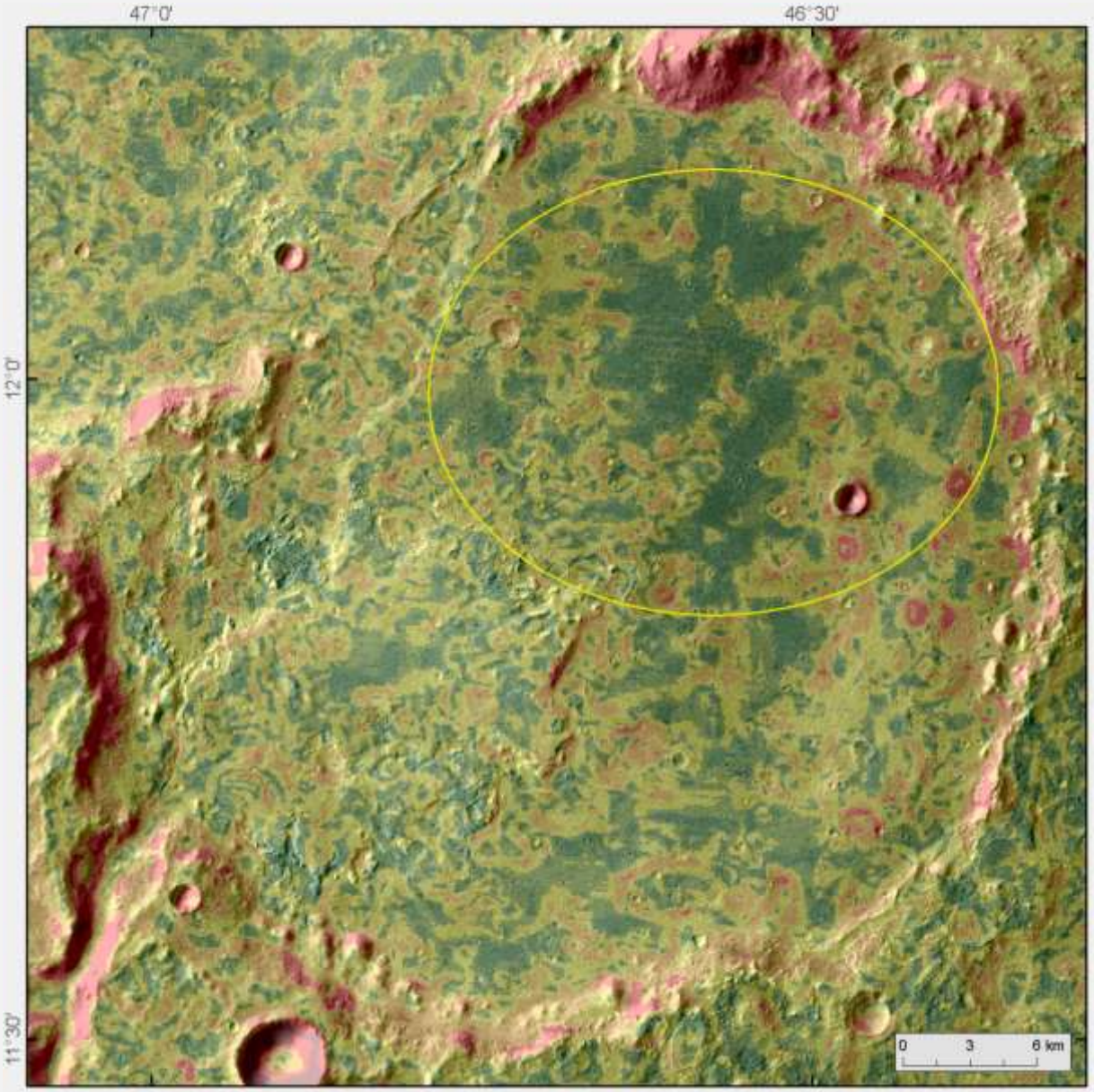


Elevation

HRSC DTM 75 m/px

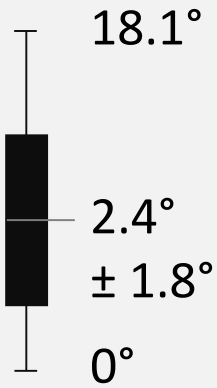


HRSC orbit
h0894_0000



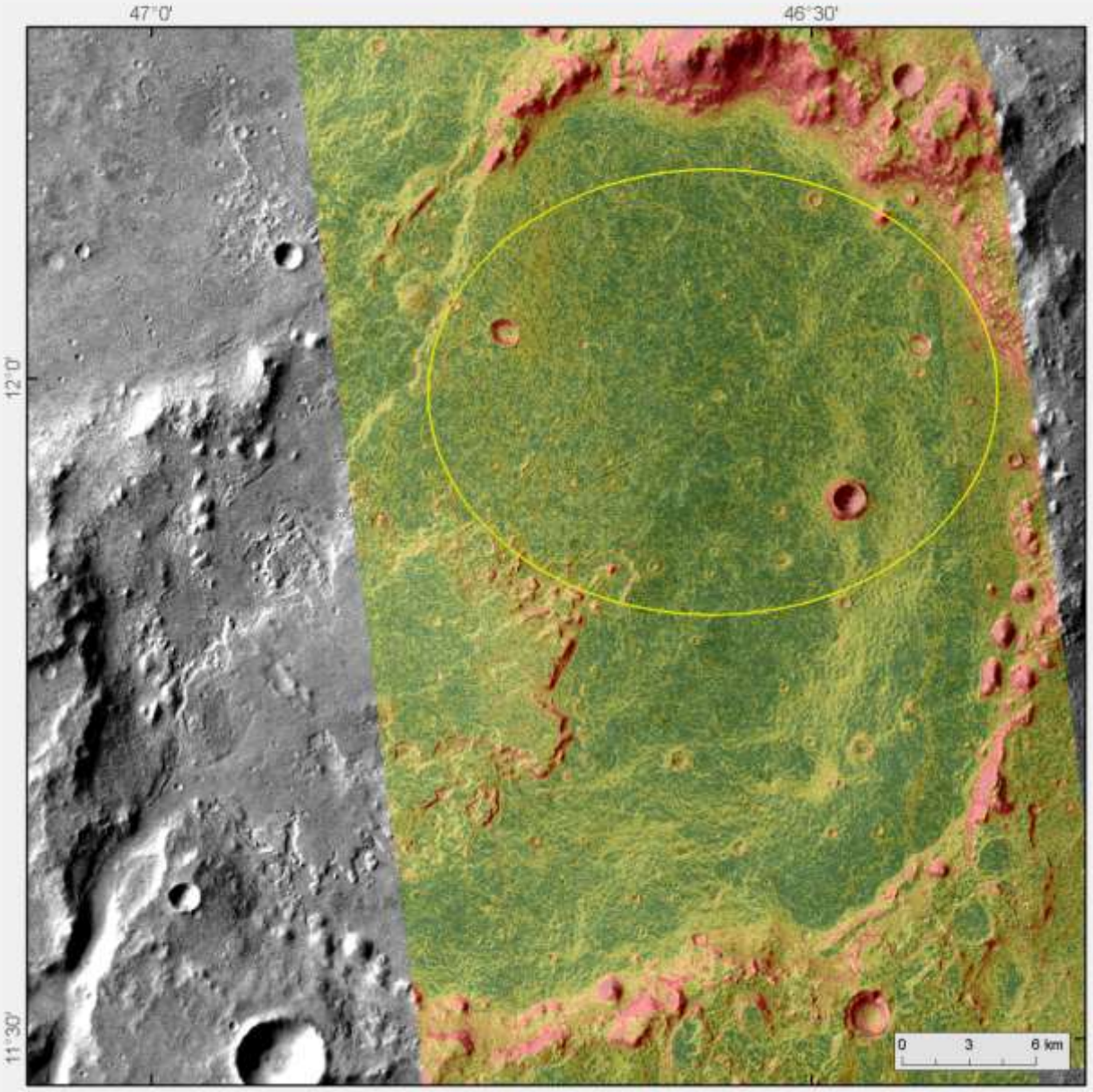
Slope

HRSC DTM 75 m/px



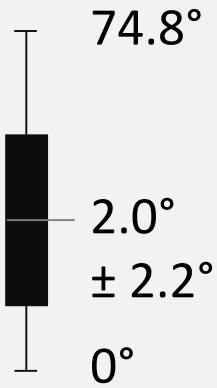
- <1°
- 1-2°
- 2-4°
- 4-8°
- 8-16°
- >16°

HRSC orbit
h0894_0000



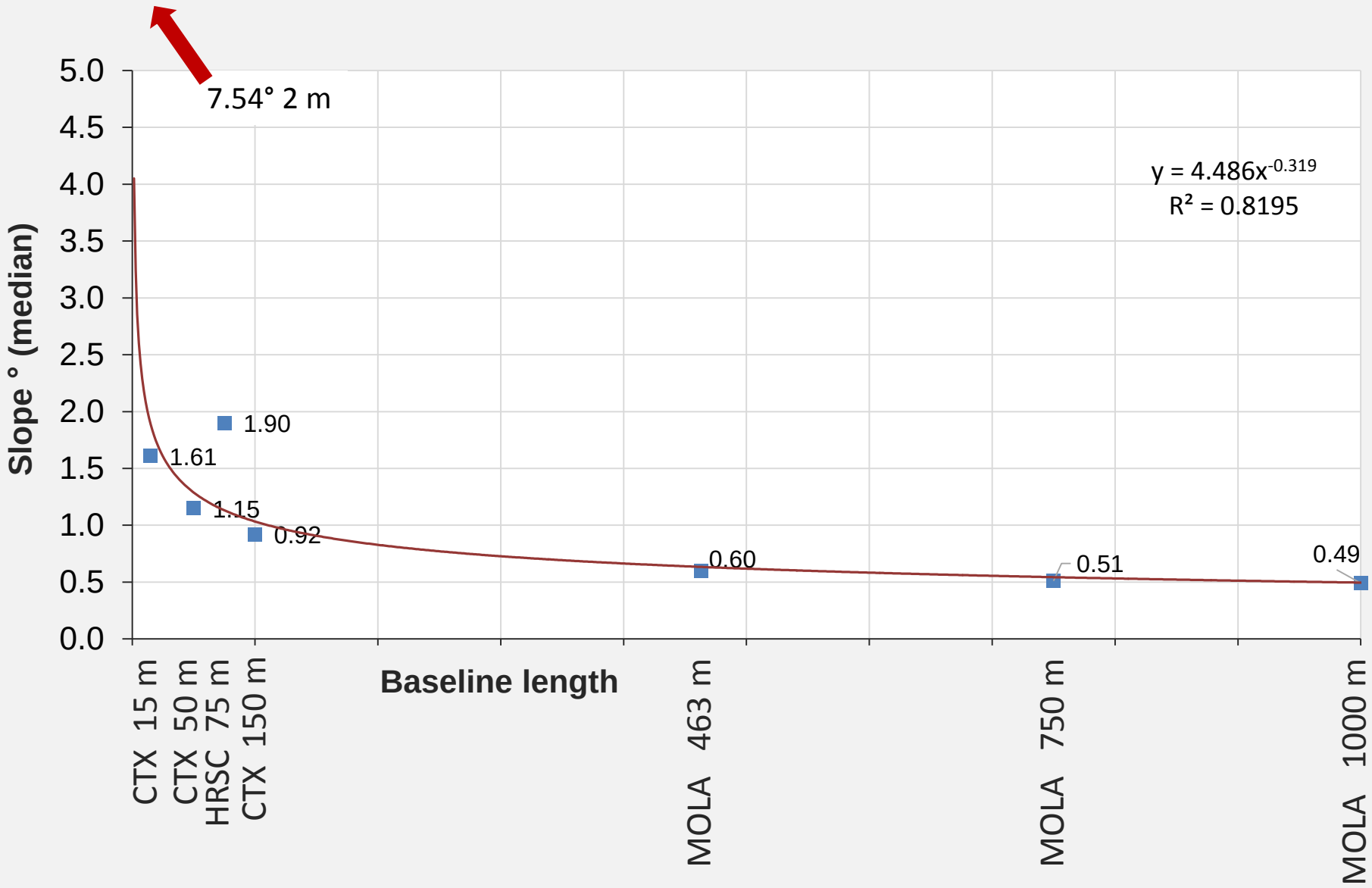
Slope

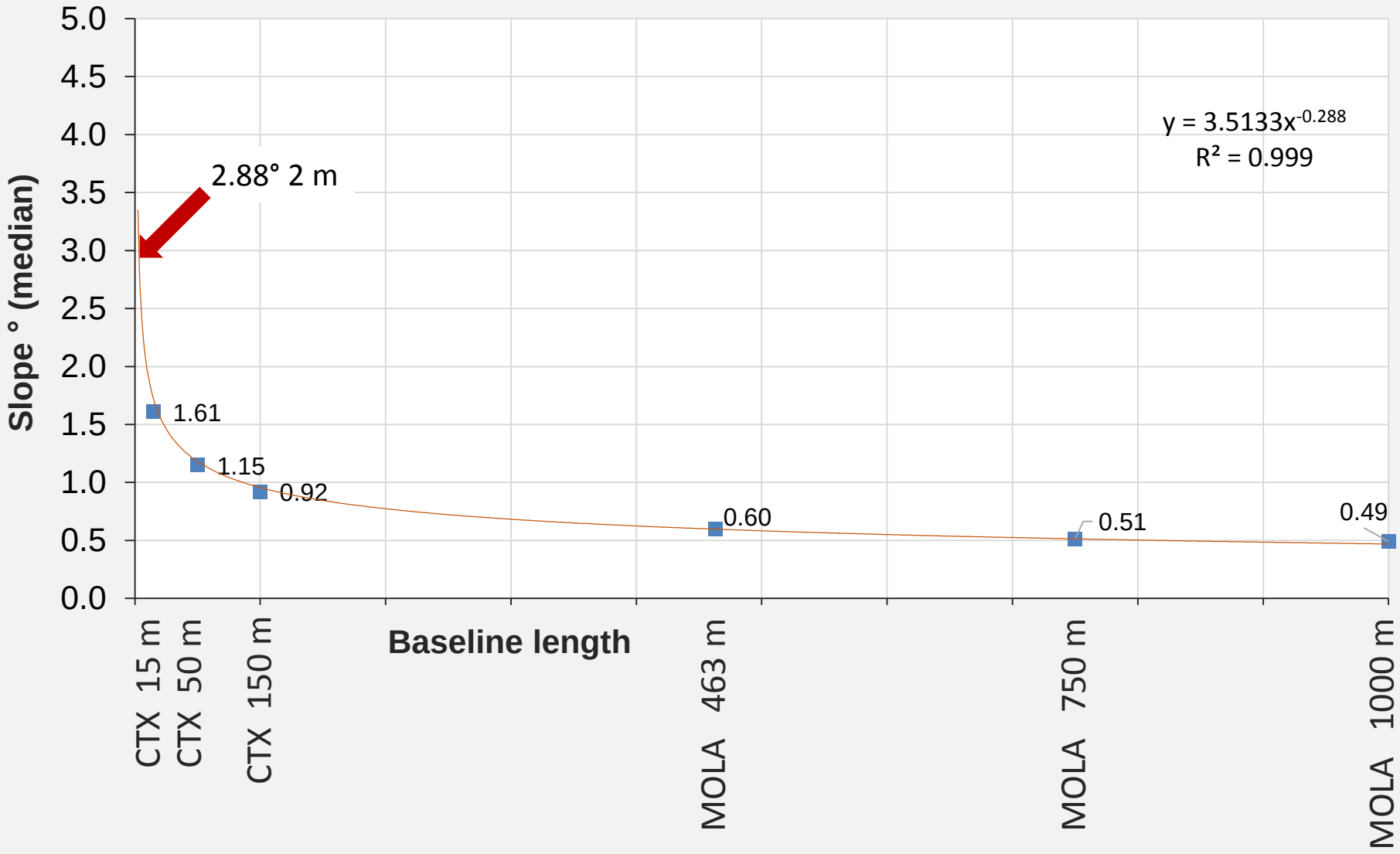
CTX DTM 15 m/px

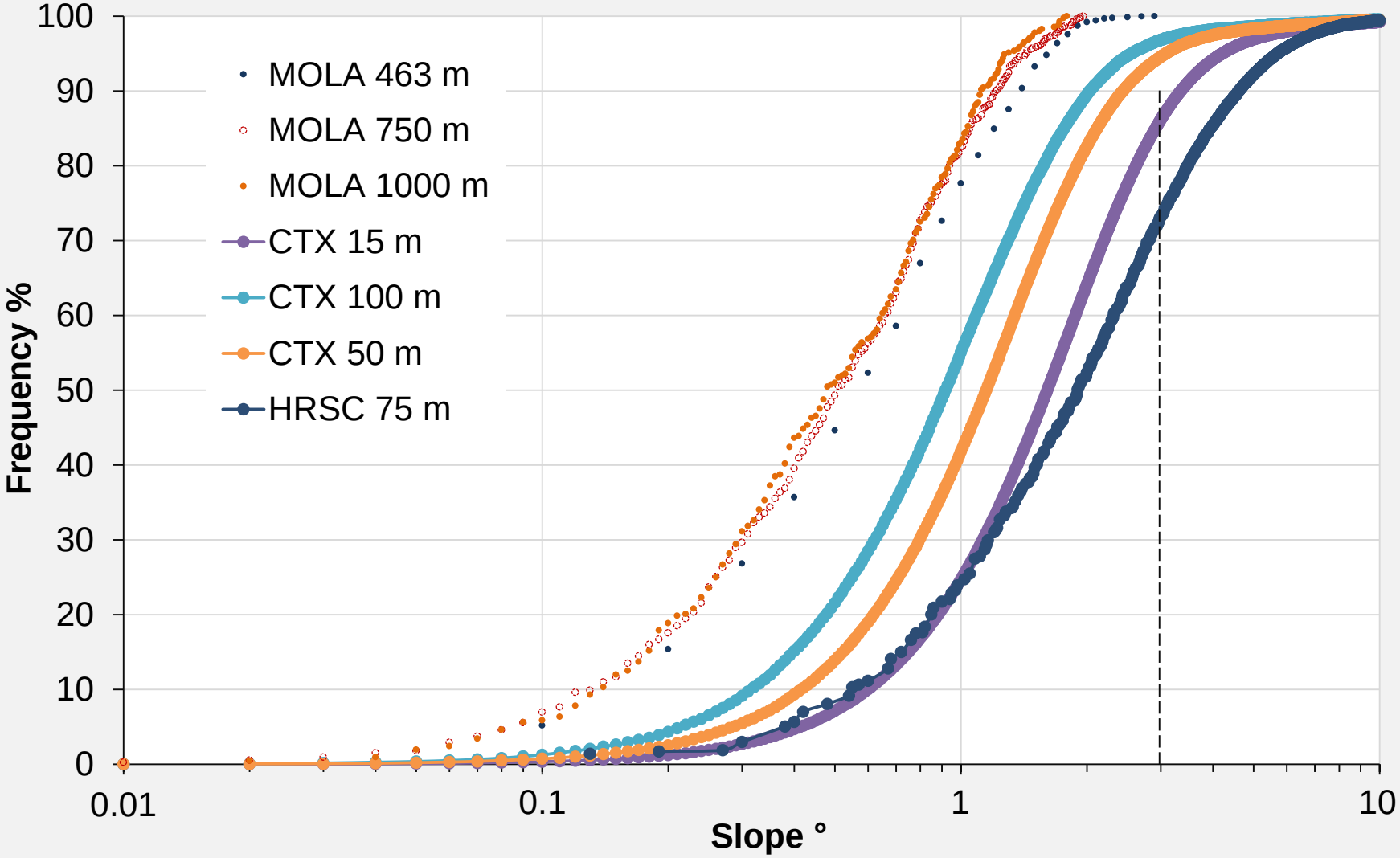


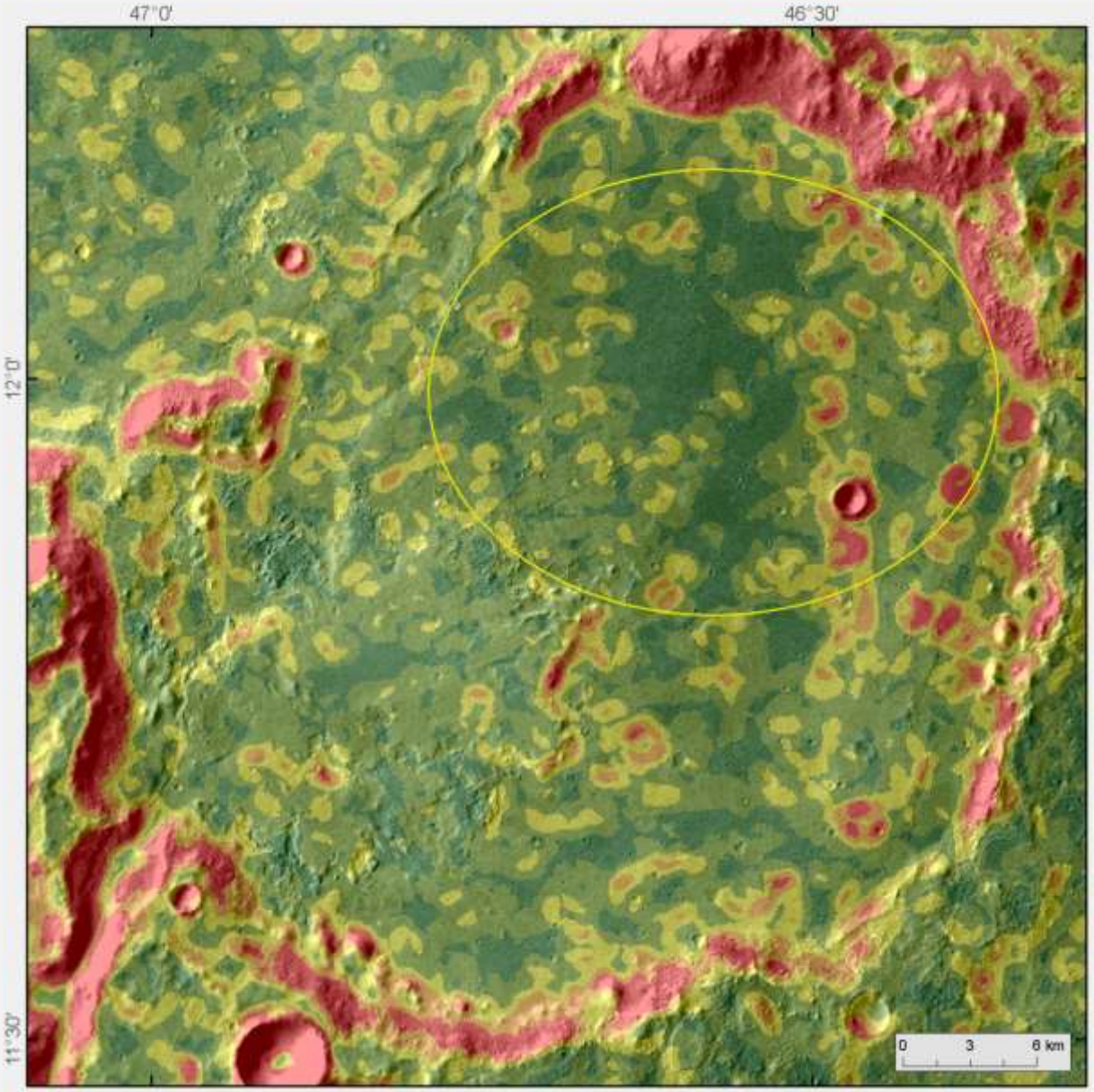
- <1°
- 1-2°
- 2-4°
- 4-8°
- 8-16°
- >16°

CTX DTM
D01_027656_1920
D07_029845_1921
D07_029990_1921
G23_027168_1920

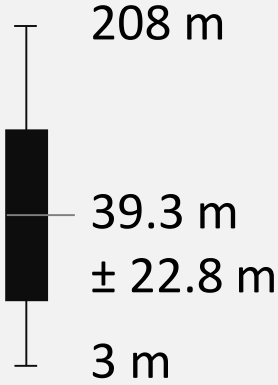

7.54° 2 m
y = 4.486x^-0.319
R² = 0.8195
Slope ° (median)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.90
1.61
1.15
0.92
0.60
0.51
0.49
Baseline length
CTX 15 m
CTX 50 m
HRSC 75 m
CTX 150 m
MOLA 463 m
MOLA 750 m
MOLA 1000 m


5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Slope ° (median)
2.88° 2 m
y = 3.5133x^-0.288
R² = 0.999
1.61
1.15
0.92
0.60
0.51
0.49
CTX 15 m
CTX 50 m
CTX 150 m
MOLA 463 m
MOLA 750 m
MOLA 1000 m
Baseline length

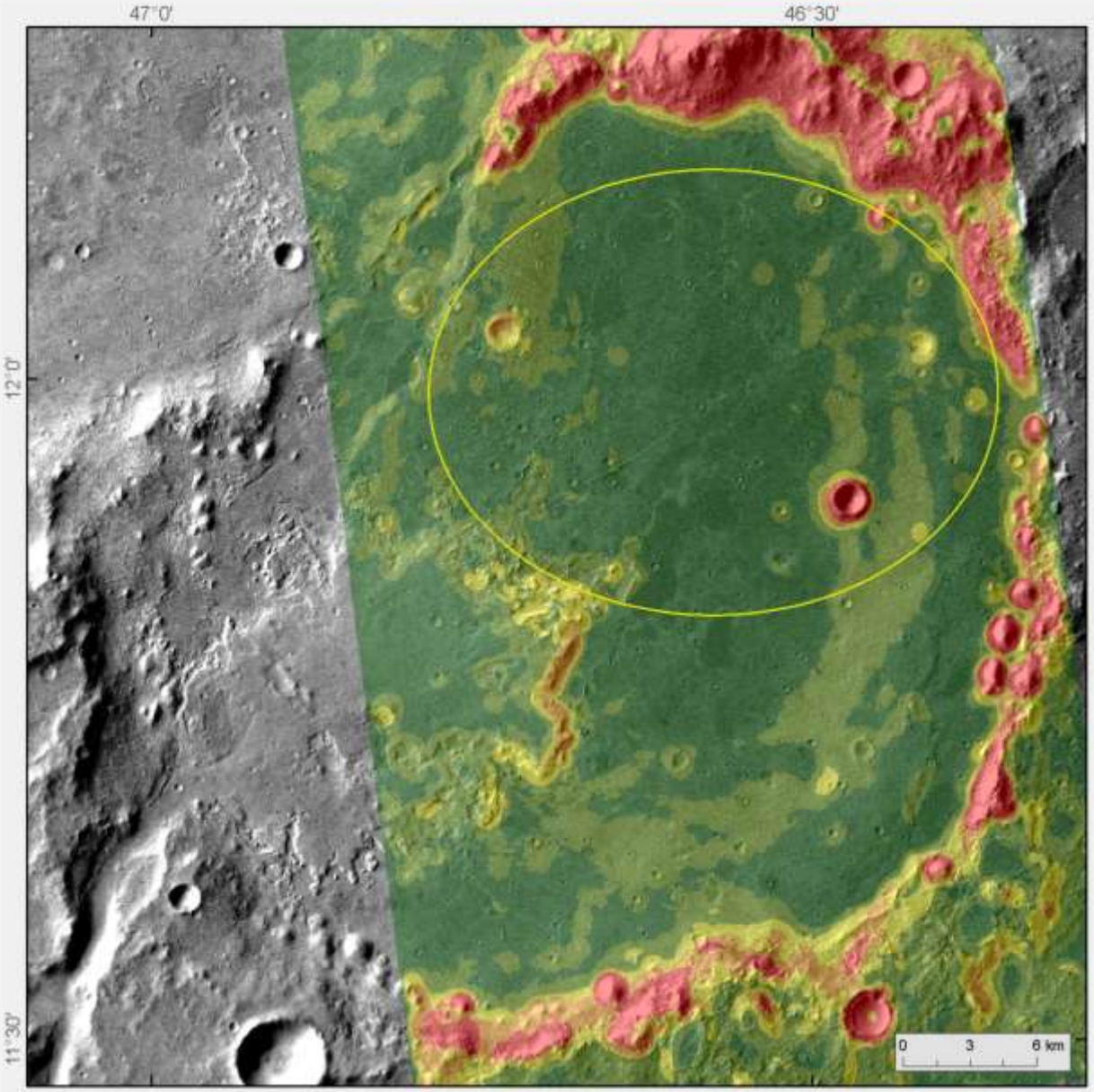

MOLA 463 m
MOLA 750 m
MOLA 1000 m
CTX 15 m
CTX 100 m
CTX 50 m
HRSC 75 m
Frequency %
Slope °
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10



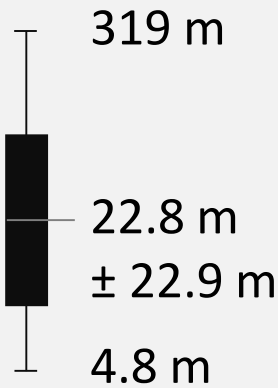
Relief (500 m radius)
HRSC DTM 75 m/px



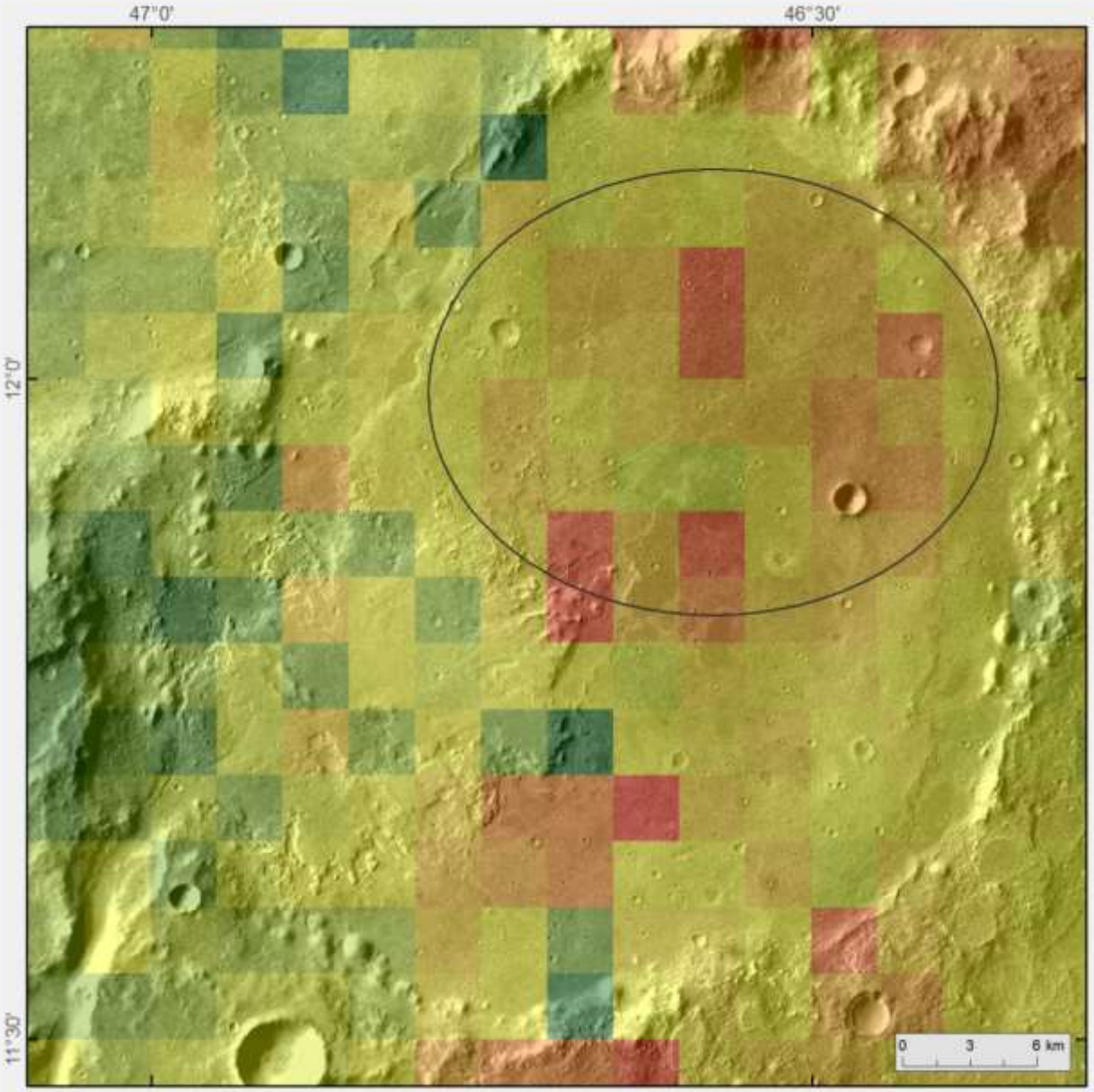
- <25 m
- 25-50 m
- 50-75 m
- 75-100 m
- >100 m



Relief (500 m radius)
CTX DTM 15 m/px

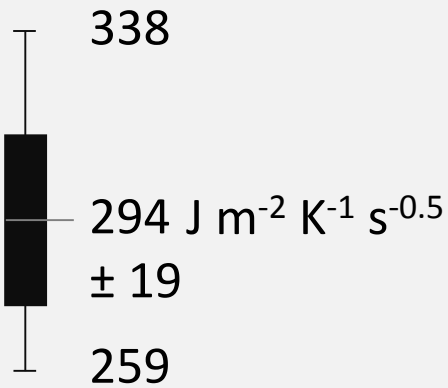


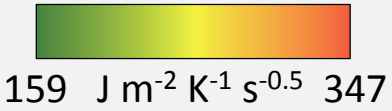
- <25 m
- 25-50 m
- 50-75 m
- 75-100 m
- >100 m



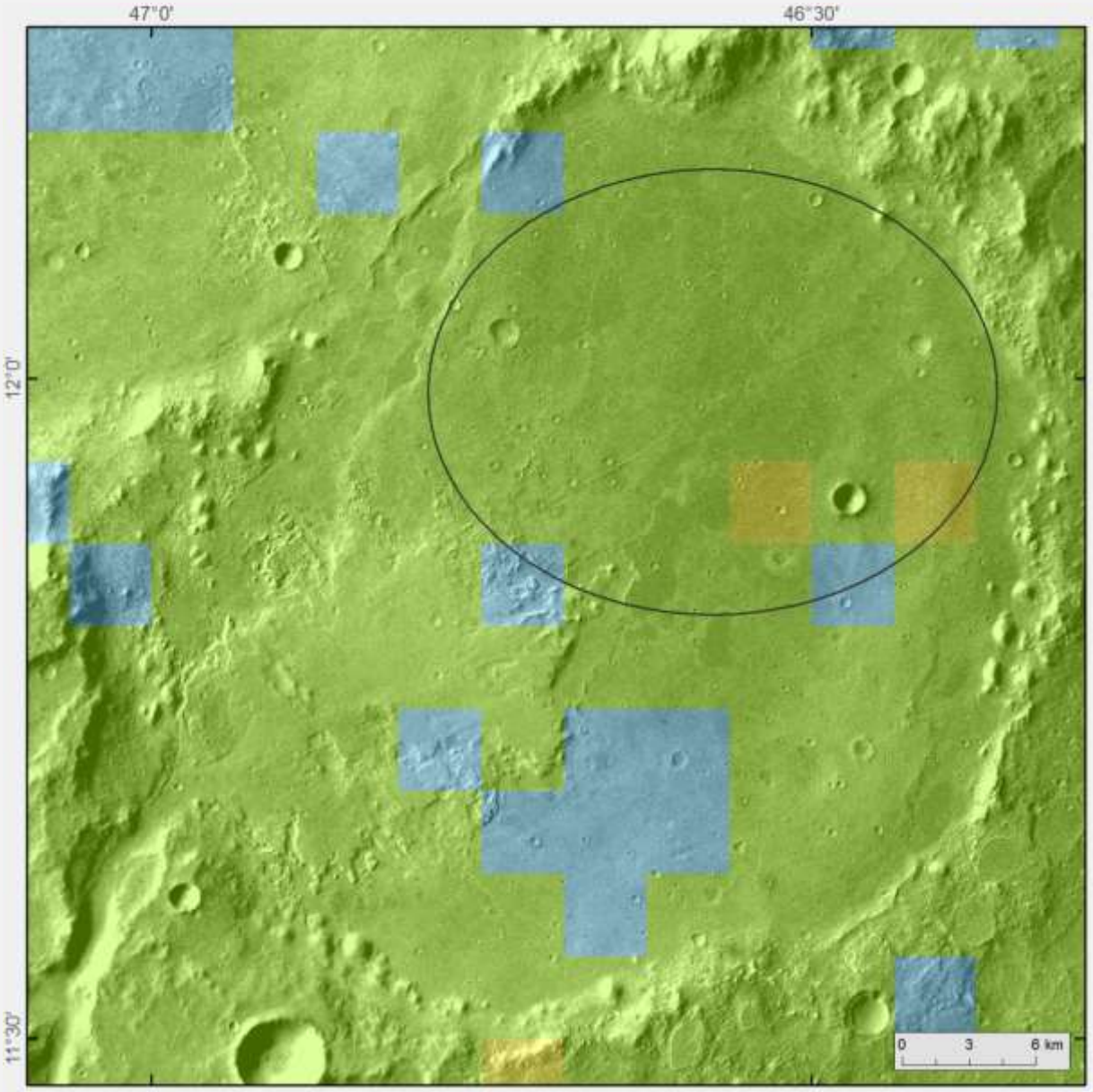
Thermal inertia

TES nighttime 2.96 km/px



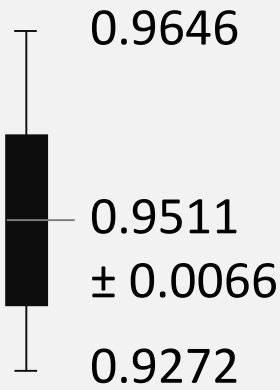


Putzig et al. (2007)



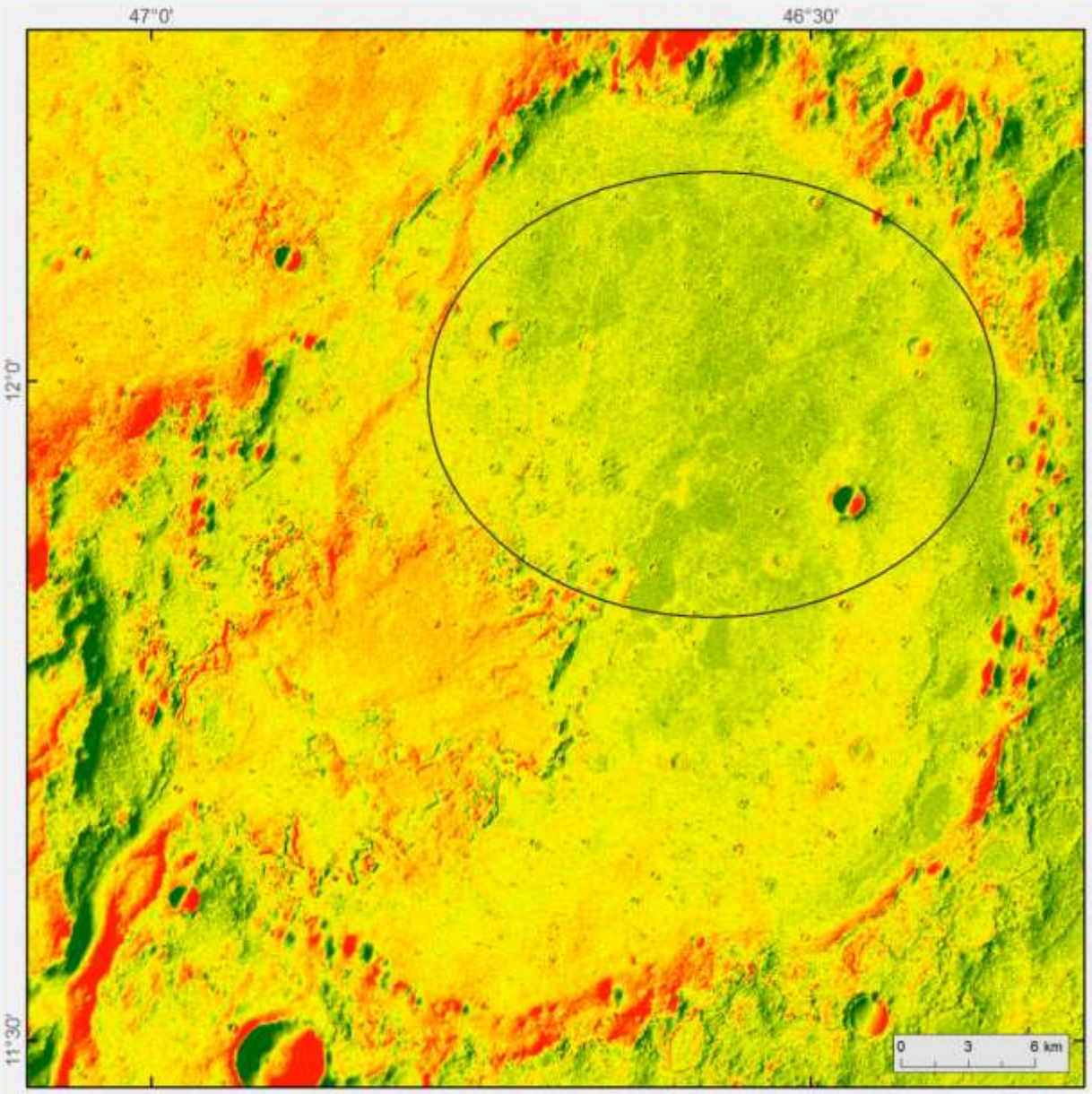
Dust Cover Index

TES 2.96 km/px



- 0.85-0.90
- 0.90-0.92
- 0.92-0.94
- 0.94-0.96
- 0.96-0.98
- 0.98 - 1

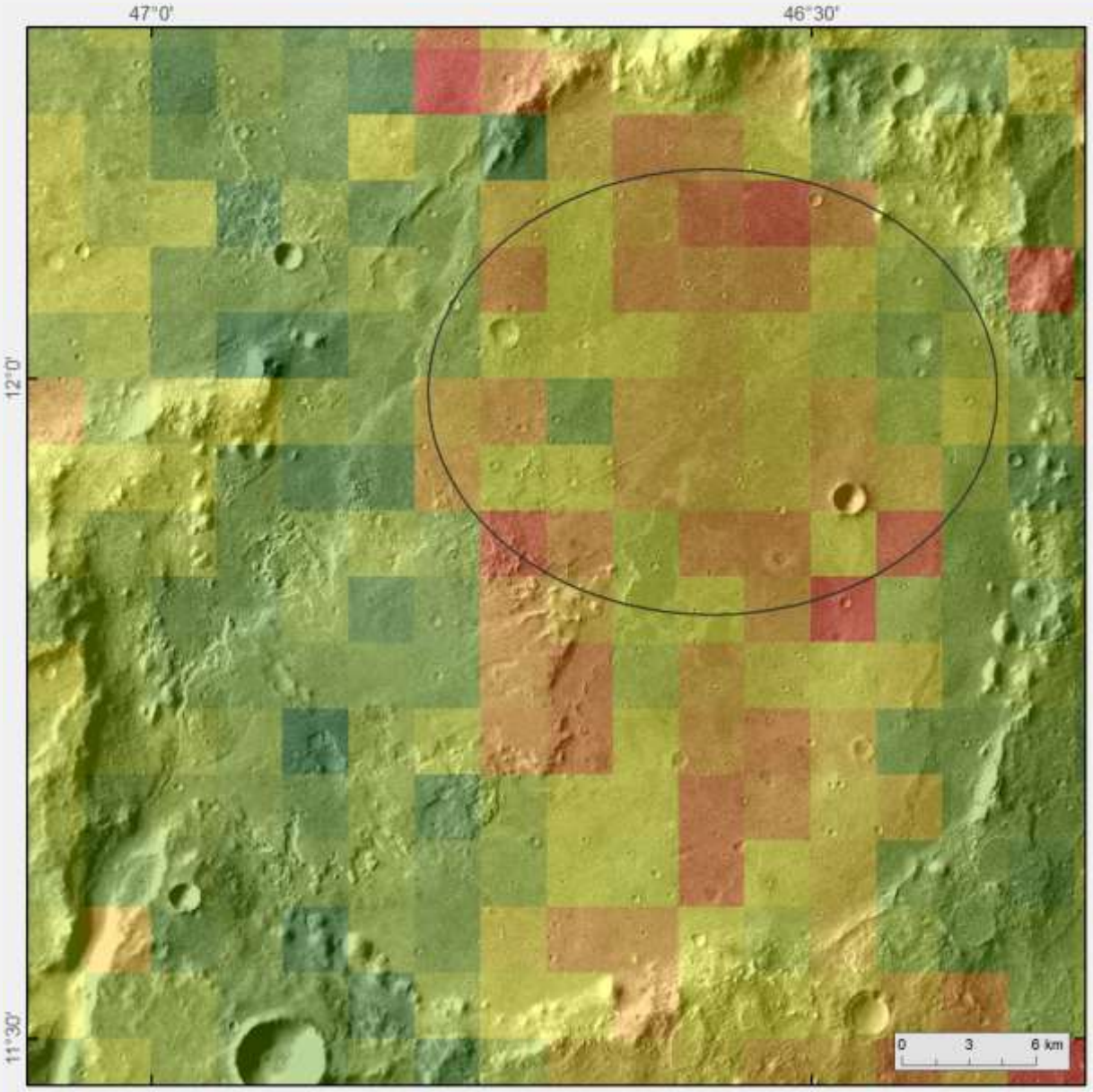
Ruff and Christensen (2002)



TOA albedo

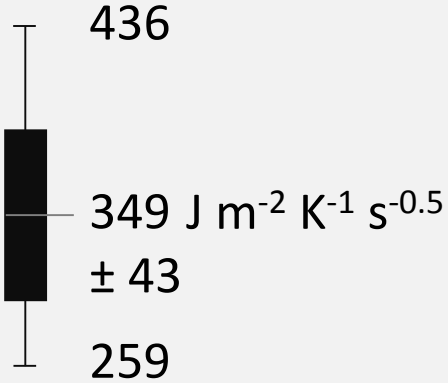
HRSC h0894_0000

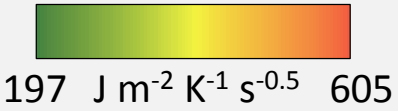
HRSC orbit
h0894_0000



Thermal inertia

TES daytime 2.96 km/px





Putzig et al. (2007)