Ridges in the Martian northern plains

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The proverbial cast of thousands, including anyone who has anything to do with MOLA, and Tom Watters

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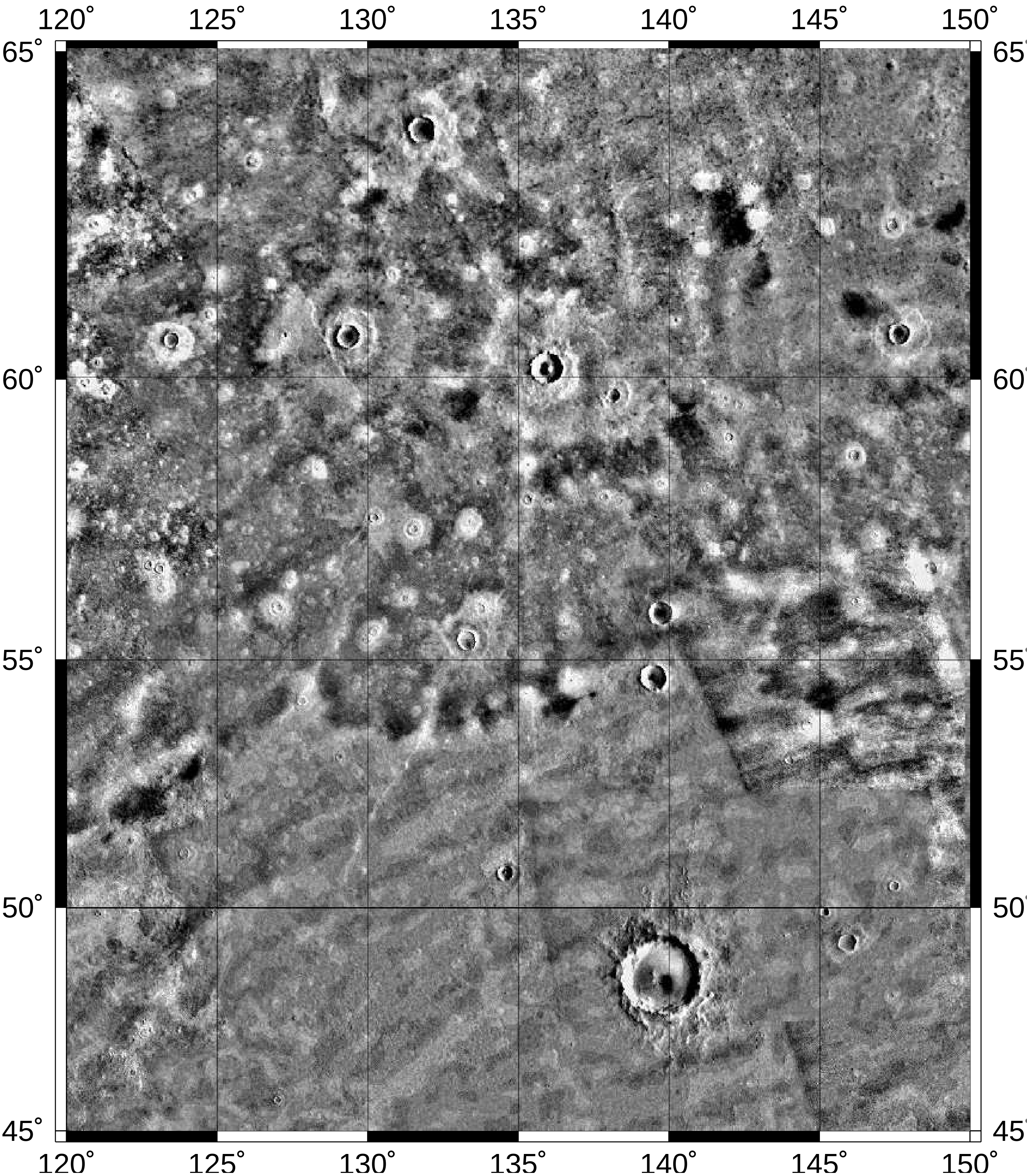
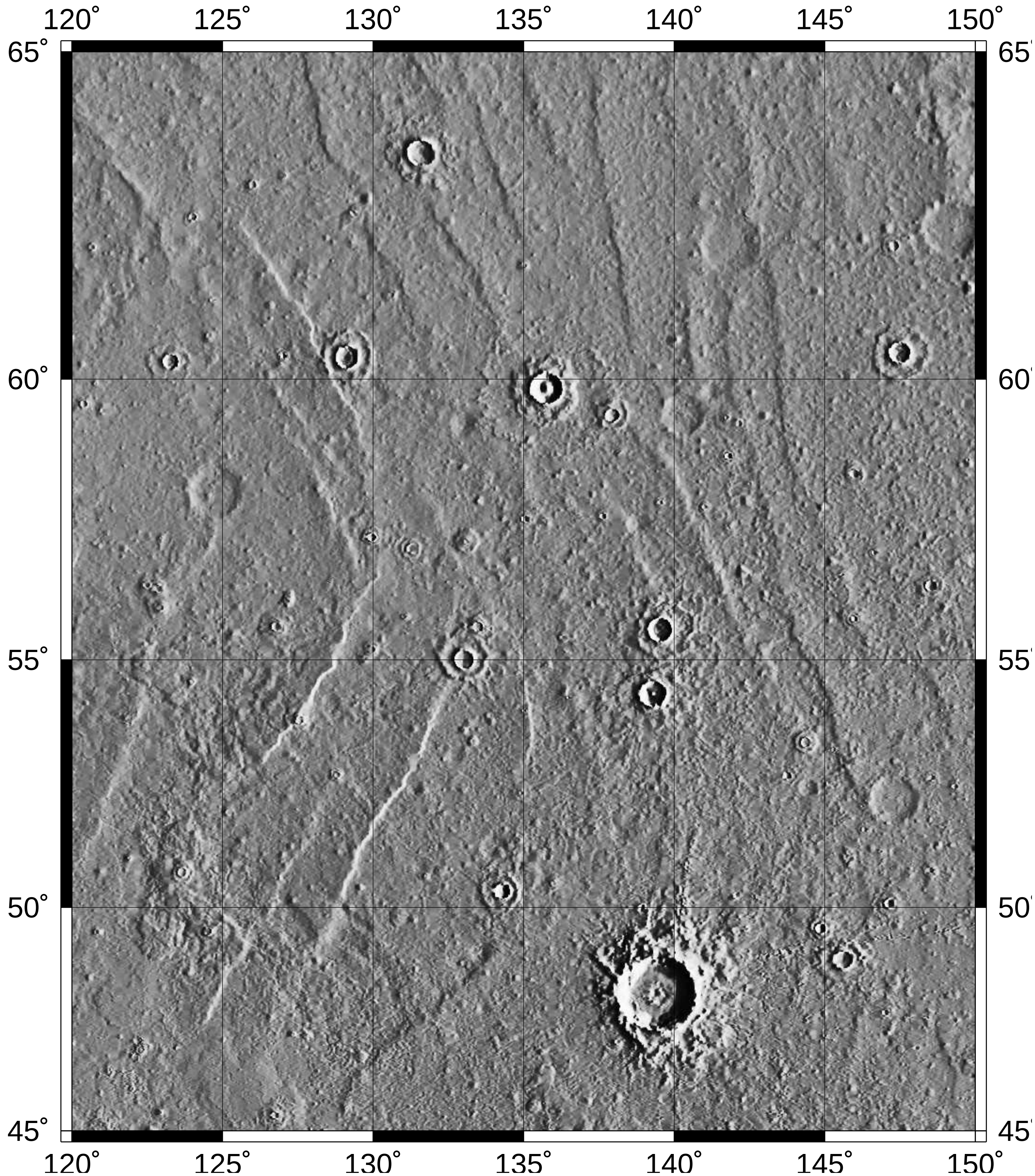
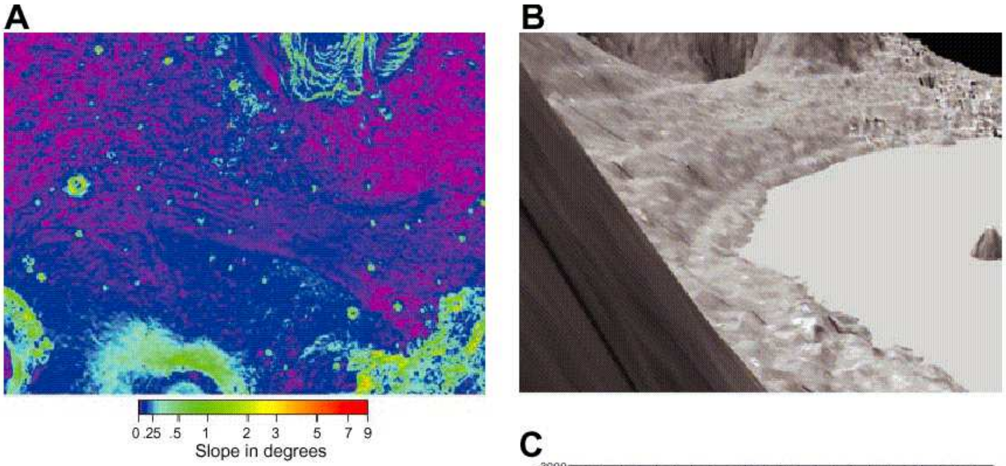
Viking Photograph



MOLA Data



Linear slope changes have been interpreted as shorelines of an ocean. However, these changes are ubiquituous in the northern plains and are primarily seen in association with tectonic structures such as Alba or Utopia. They are not preferentially parallel to topographic contours. Specifically, terrace/ridge pairs have been interpreted as shoreline indicators. However, terraces are sometimes upslope from ridges and sometimes vice versa, which is hard to understand in the context of shorelines.



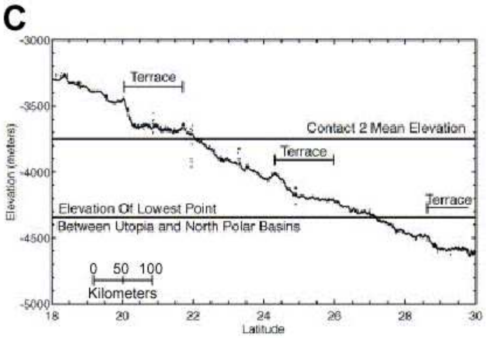


Fig. 4. (**A**) Slope map of the northern lower flanks of Alba Patera, showing the absolute value of surface slope at ~15-km baseline derived from the 1/8 degree per pixel digital elevation model (*15*). Parallel lines (middle) representing linear slope changes are seen between Alba Patera (bottom) and the North Polar cap (top). Width of map is ~3000 km. (**B**) Perspective view of the southern margin of Utopia Planitia looking west from the flank of Elysium Mons showing topographic terraces parallel to contact 2; MOLA digital elevation model with Viking Orbiter mosaic superposed, and the basin flooded to just below the −4350-m contour, the elevation where the Utopia and North Polar basins become interconnected. Vertical exaggeration is ~×200. (**C**) MOLA profile (10190) in southern Utopia Planitia.

Possible Ancient Oceans on Mars: Evidence from Mars Orbiter Laser Altimeter Data

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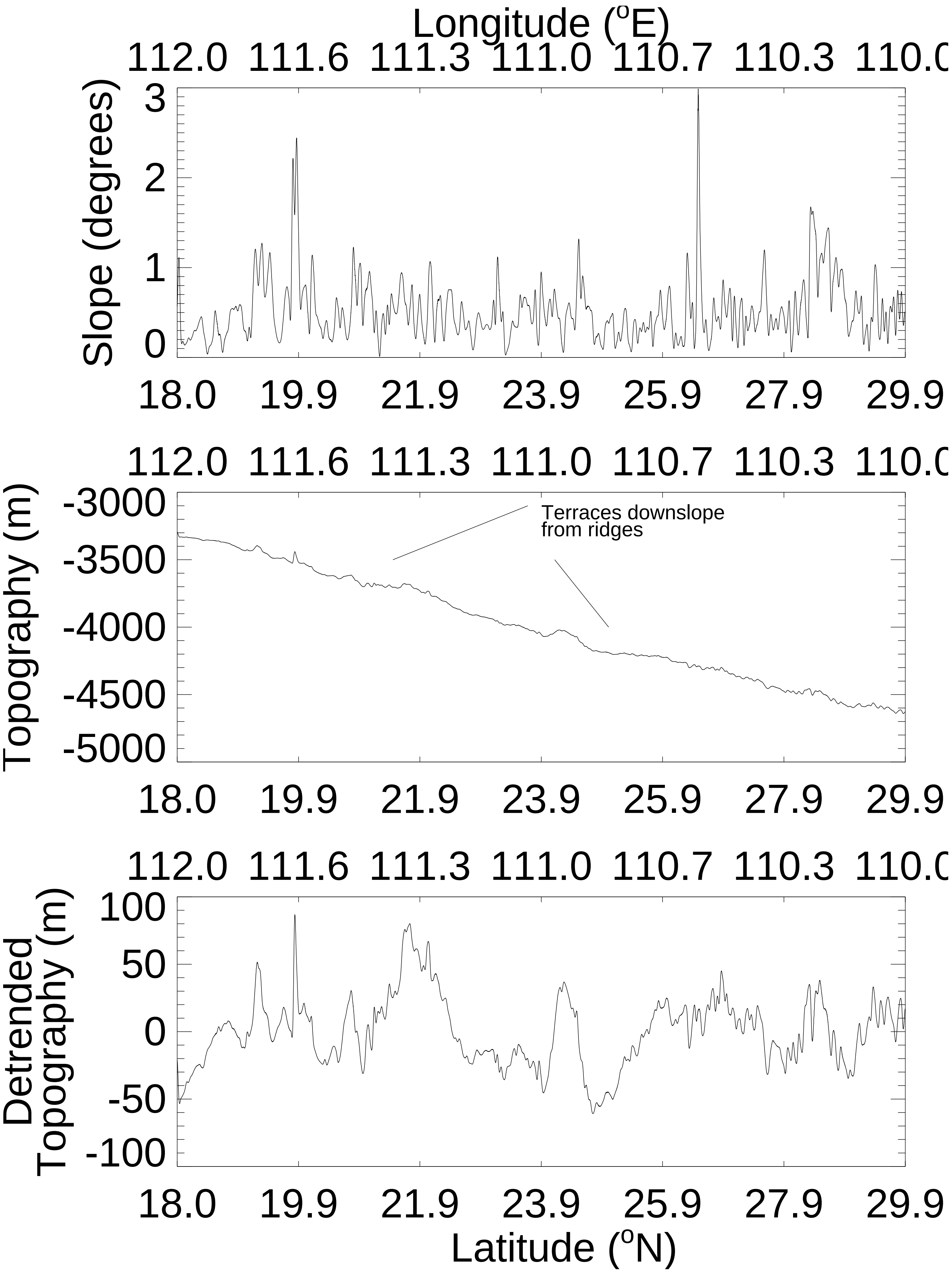
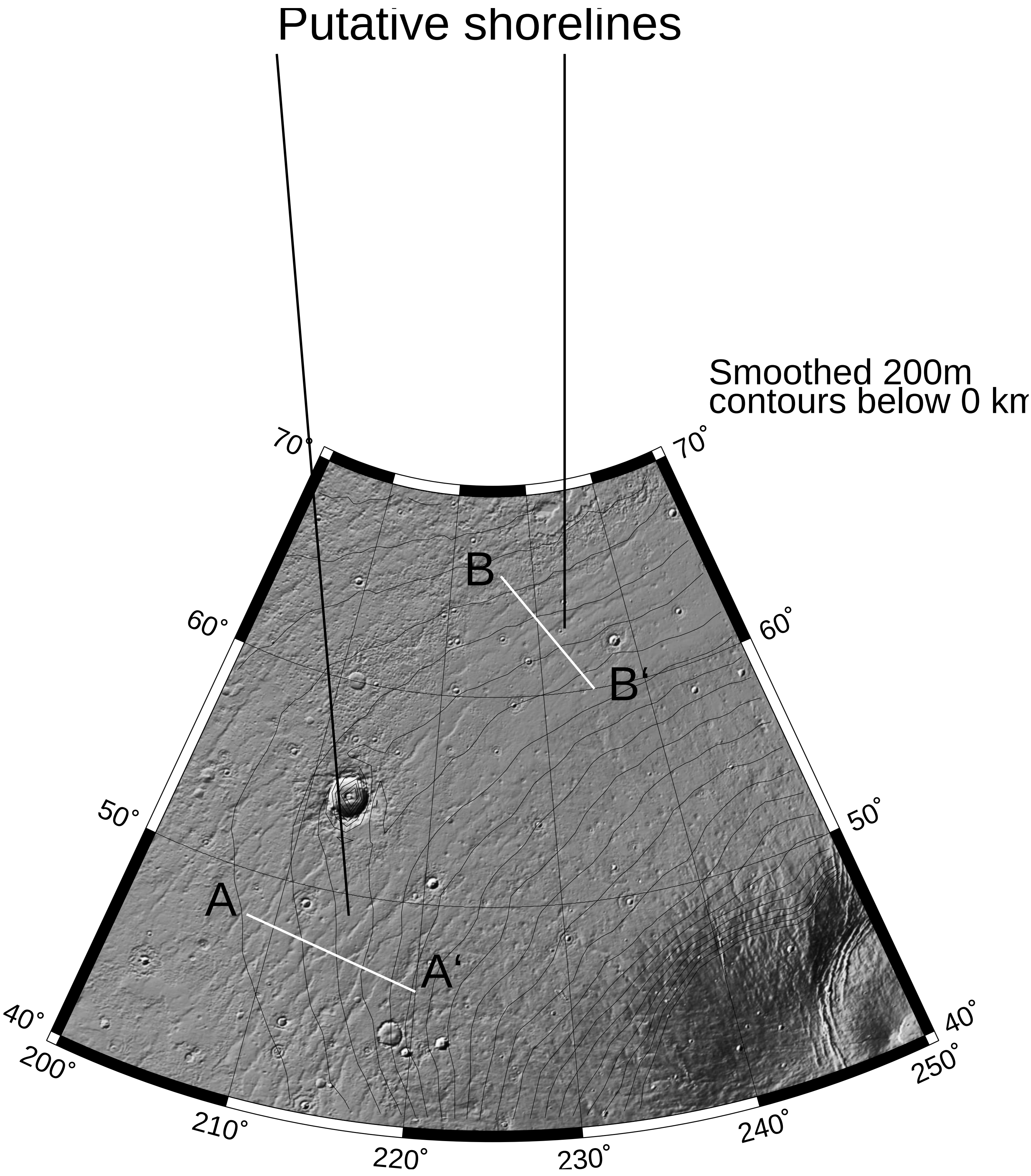
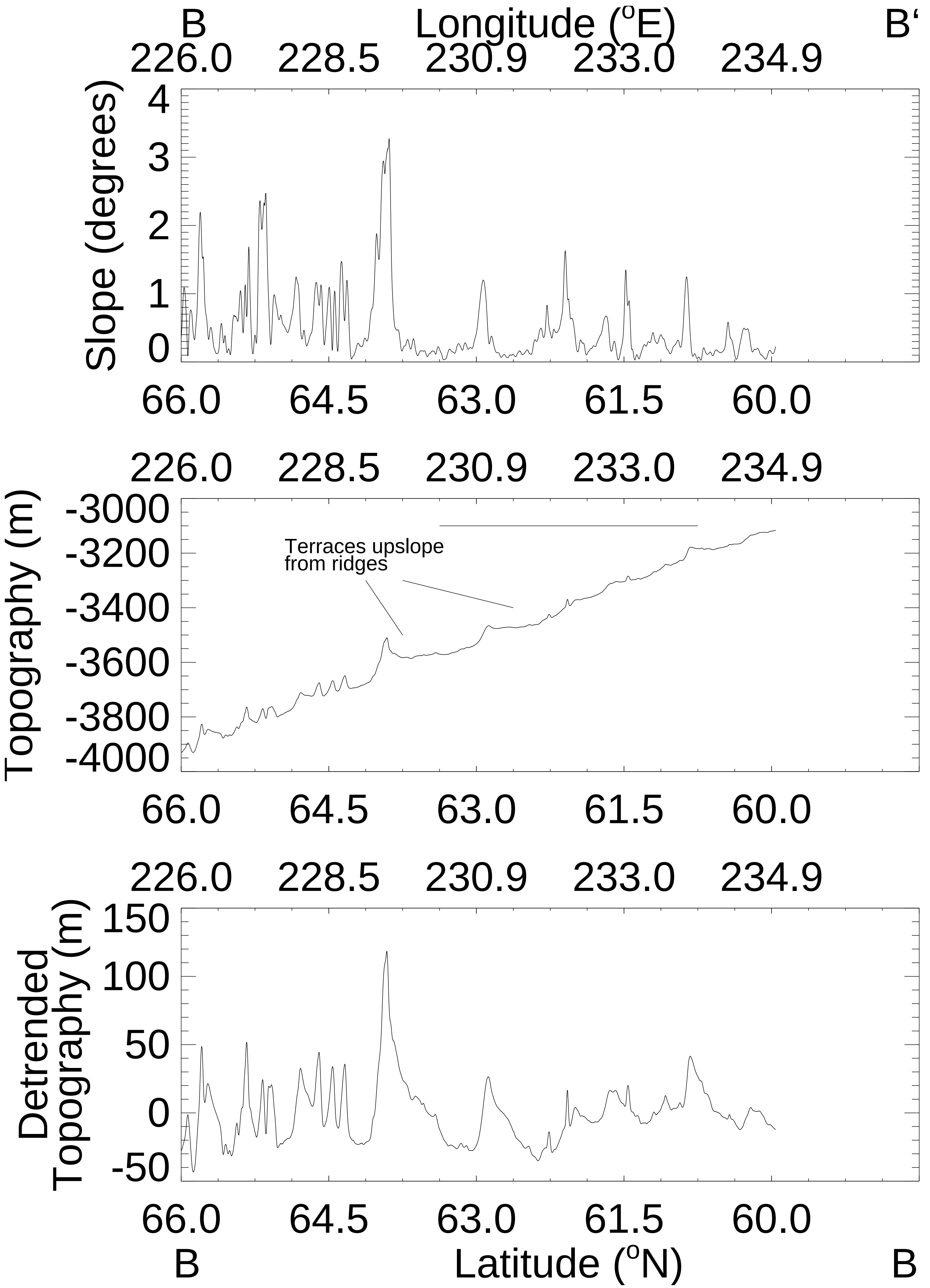


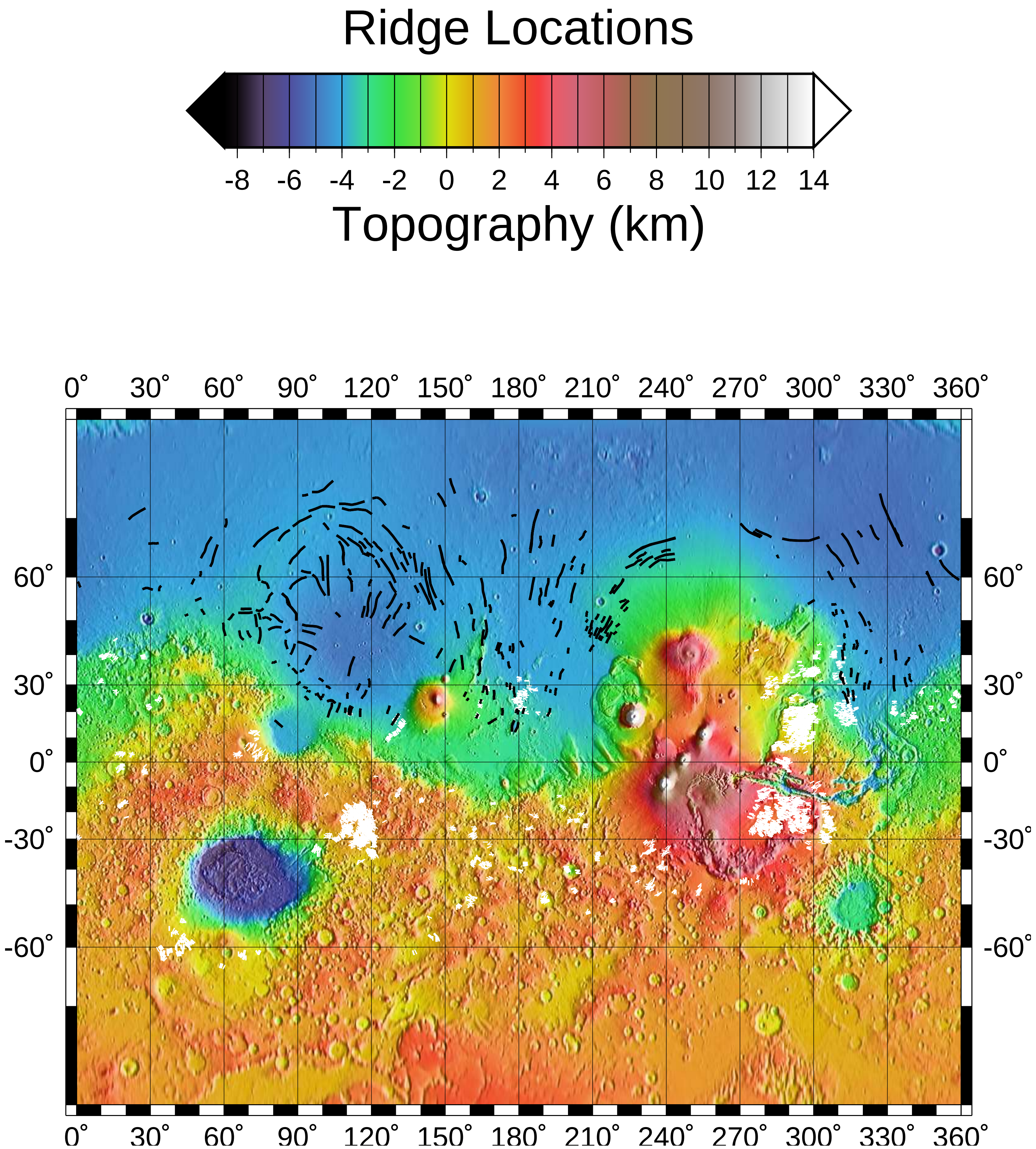
Longitude (oE)
112.0 111.6 111.3 111.0 110.7 110.3 110.0
Slope (degrees)
3
2
1
0
18.0 19.9 21.9 23.9 25.9 27.9 29.9
112.0 111.6 111.3 111.0 110.7 110.3 110.0
Topography (m)
-3000
-3500
-4000
-4500
-5000
Terraces downslope from ridges
18.0 19.9 21.9 23.9 25.9 27.9 29.9
112.0 111.6 111.3 111.0 110.7 110.3 110.0
Detrended Topography (m)
100
50
0
-50
-100
18.0 19.9 21.9 23.9 25.9 27.9 29.9
Latitude (oN)

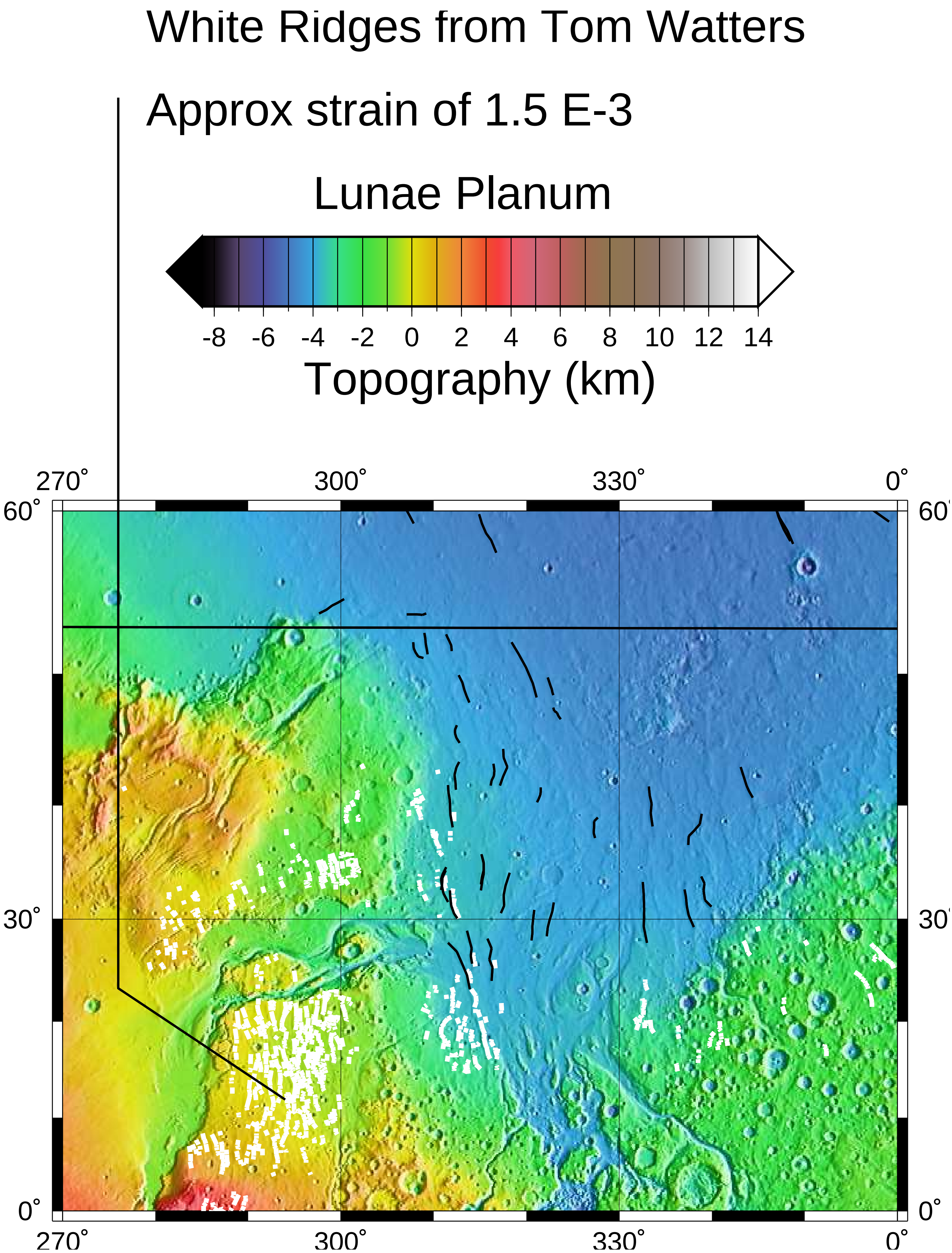


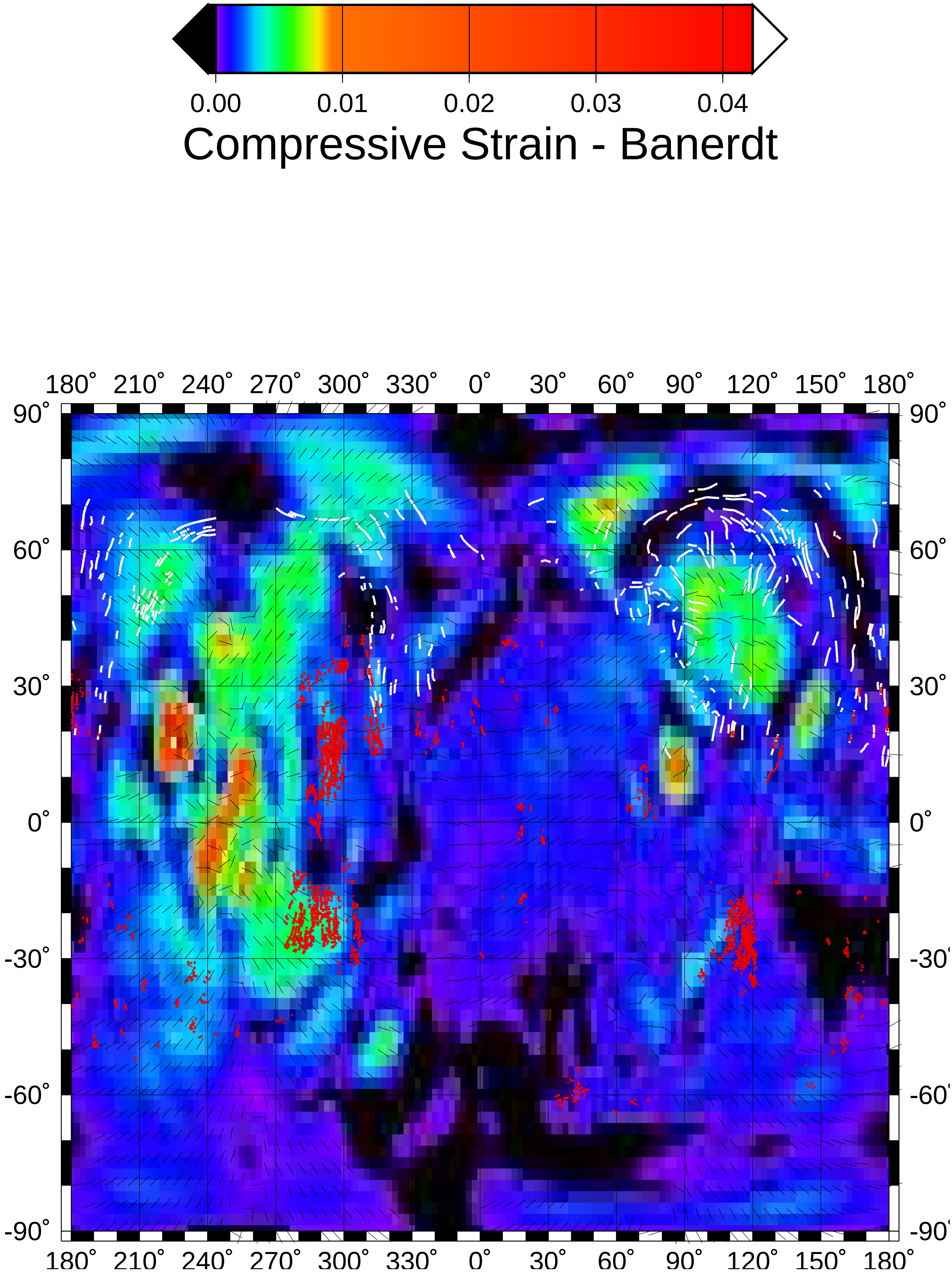
Putative shorelines
Smoothed 200m
contours below 0 km
B
B'
A
A'
70°
70°
60°
60°
50°
50°
40°
40°
200°
210°
220°
230°
240°
250°

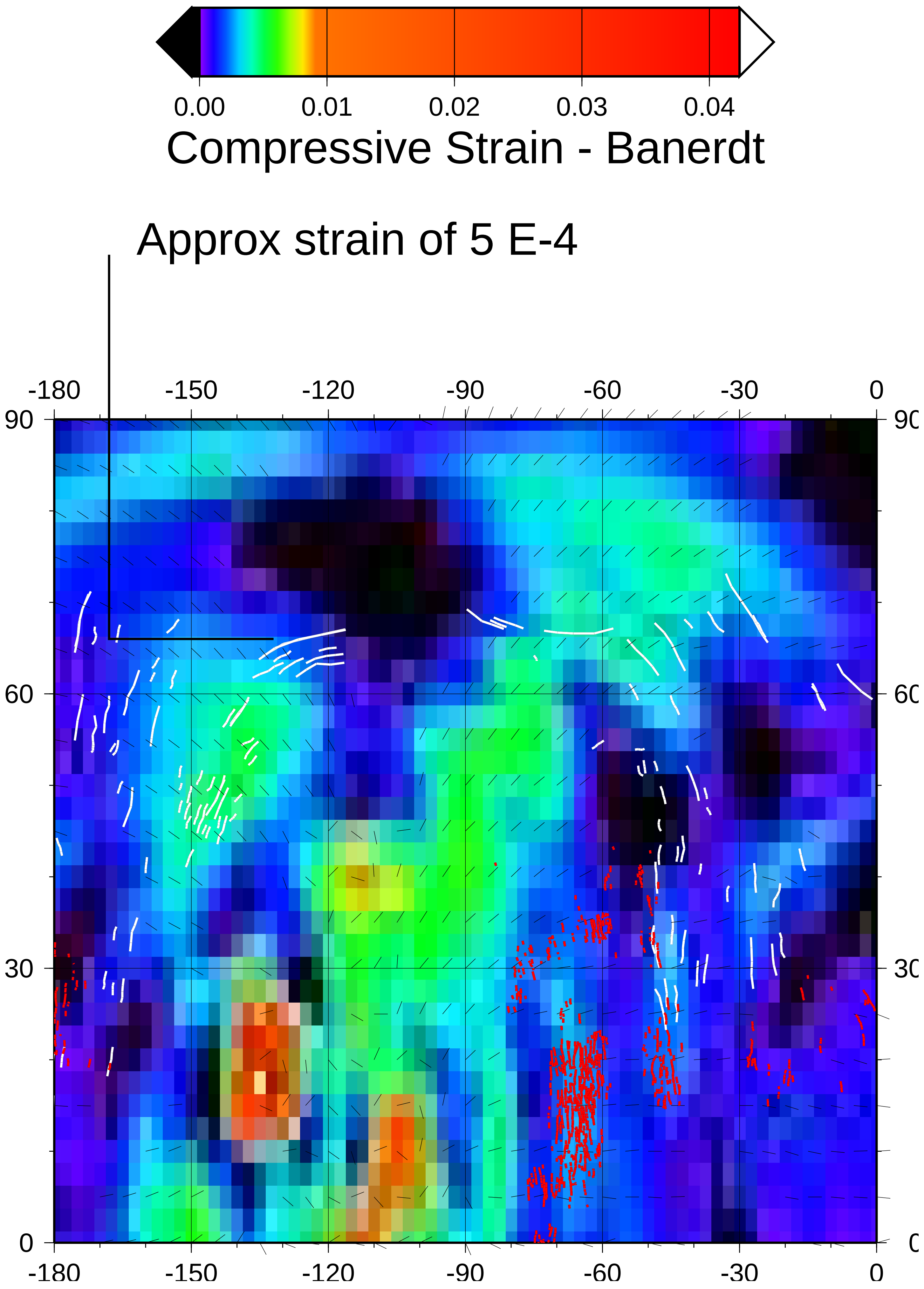

B
Longitude (°E)
B'
226.0
228.5
230.9
233.0
234.9
Slope (degrees)
4
3
2
1
0
66.0
64.5
63.0
61.5
60.0
Topography (m)
-3000
-3200
-3400
-3600
-3800
-4000
Terraces upslope
from ridges
Detrended
Topography (m)
150
100
50
0
-50
B
Latitude (°N)
B

White Ridges from Tom Watters

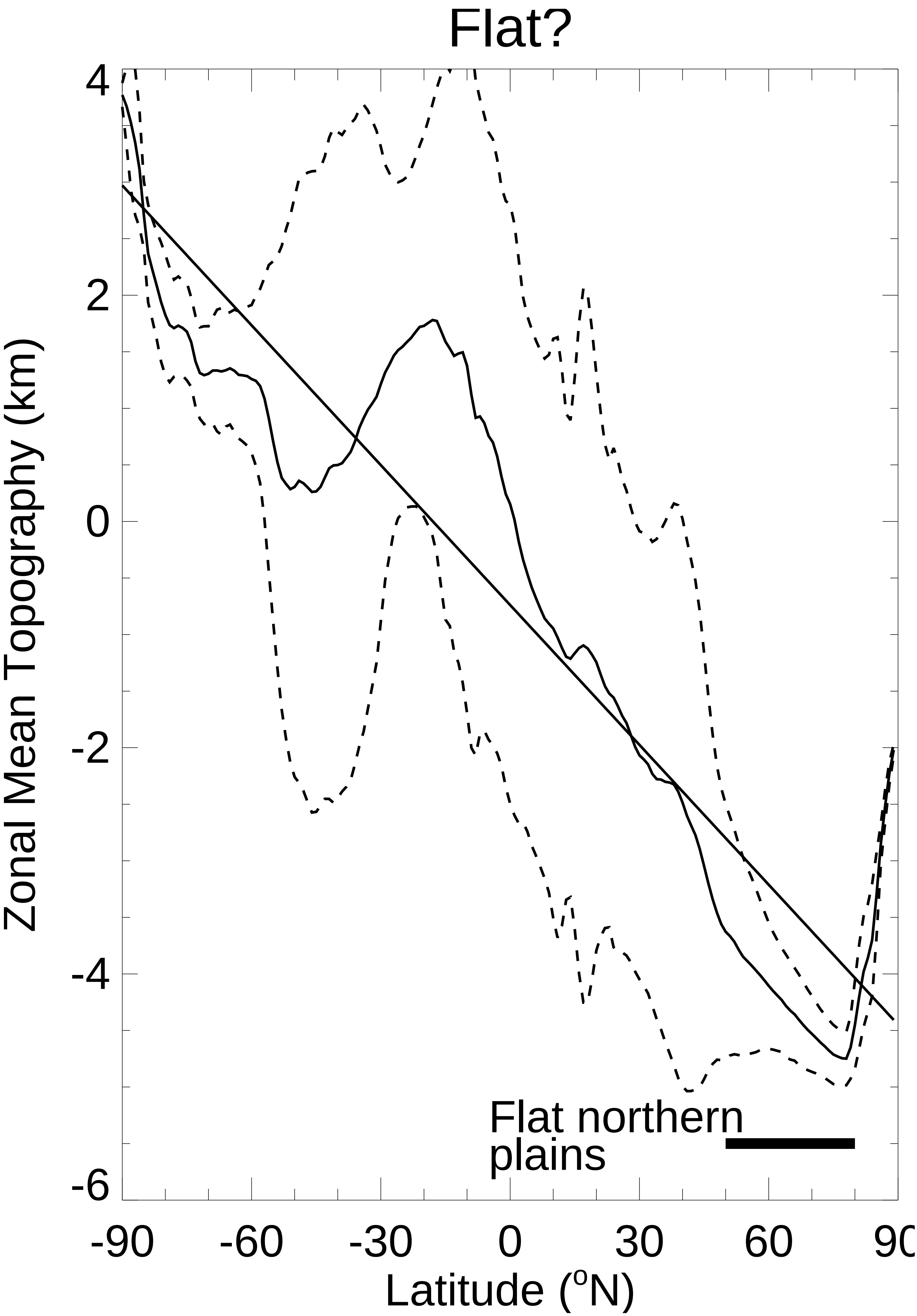



White Ridges from Tom Watters
Approx strain of 1.5 E-3
Lunae Planum
-8 -6 -4 -2 0 2 4 6 8 10 12 14
Topography (km)
270˚
300˚
330˚
0˚
60˚
30˚
0˚


0.00
0.01
0.02
0.03
0.04
Compressive Strain - Banerdt
180˚ 210˚ 240˚ 270˚ 300˚ 330˚ 0˚ 30˚ 60˚ 90˚ 120˚ 150˚ 180˚
90˚
60˚
30˚
0˚
-30˚
-60˚
-90˚



0.00
0.01
0.02
0.03
0.04
Compressive Strain - Banerdt
Approx strain of 5 E-4
-180
-150
-120
-90
-60
-30
0
90
60
30
0



Flat?
Zonal Mean Topography (km)
4
2
0
-2
-4
-6
-90
-60
-30
0
30
60
90
Latitude (°N)
Flat northern plains

Pole-to-Pole Slope

Definition: Something that is FLAT is an equipotential surface with respect to the current geoid.

The northern plains are not flat, despite beiing the flattest known surface in the Solar System. Instead, they are level with the current pole-to-pole slope of 0.03 degrees Is this a coincidence?