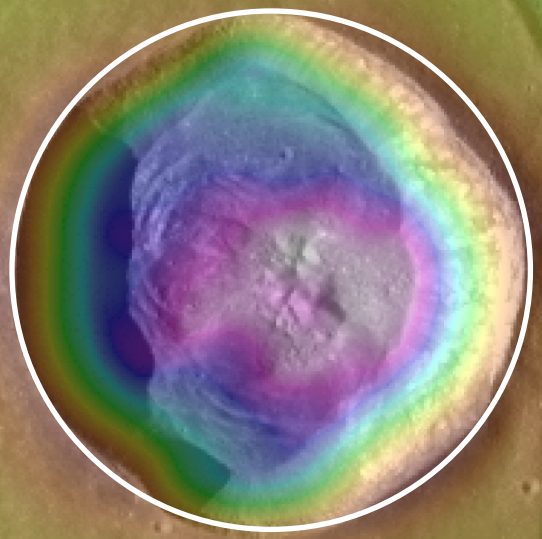
Rim Crest Variations Measured at Dawes Crater: Do they Reflect Pre-existing Target Weaknesses?

Virgil L. Sharpton (*Lunar and Planetary Institute, 3600 Bay Area Blvd., Houston, TX 77058*)
buck.sharpton@lpi.usra.edu



D=18.65 km

Data Sets: LRO LOLA-WAC DEM; LRO WAC Mosaic; LRO NAC images; Clementine M/S

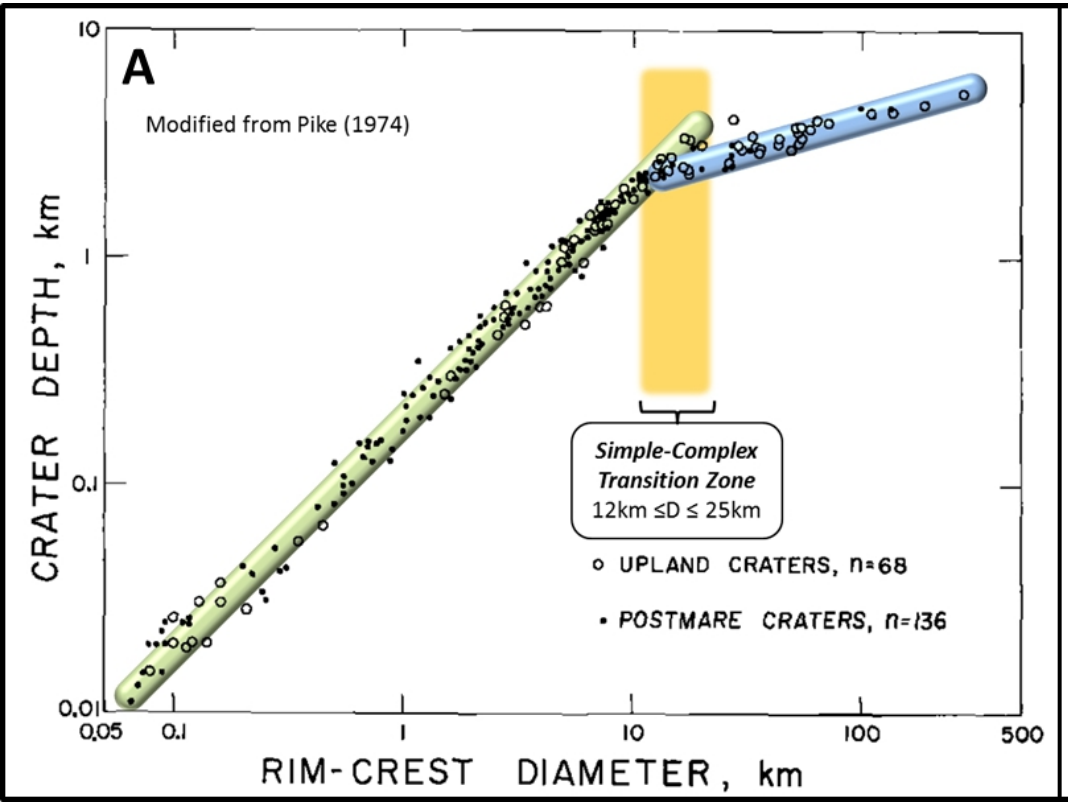
Motivation

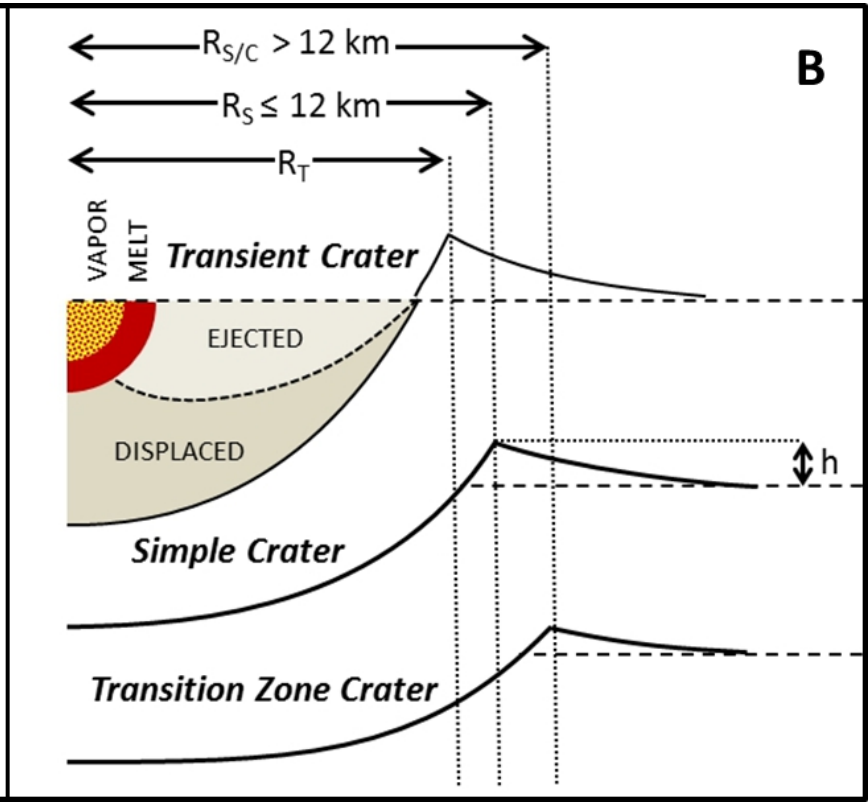
- Understand the Simple-Complex Transition.

  SCT craters likely provide clues to target structure

- Understand nature and degree of target uplift in rim zone.

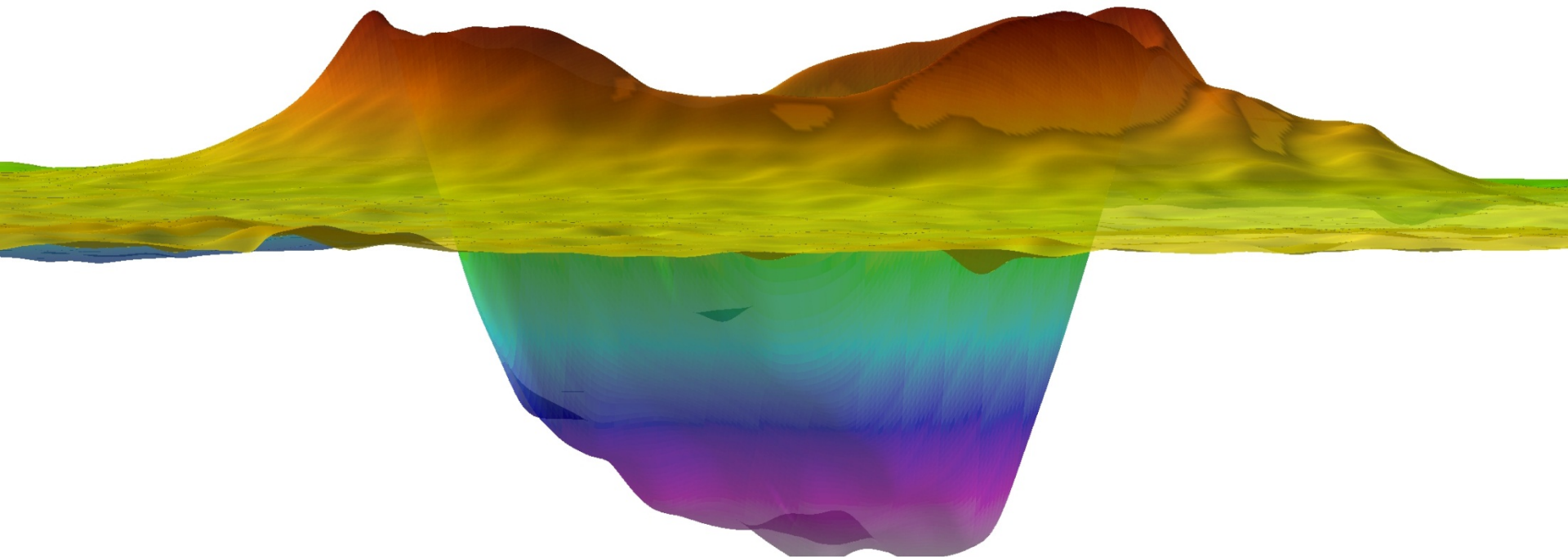
  Required to understand crater excavation mechanisms and measure ejecta thickness at rim.

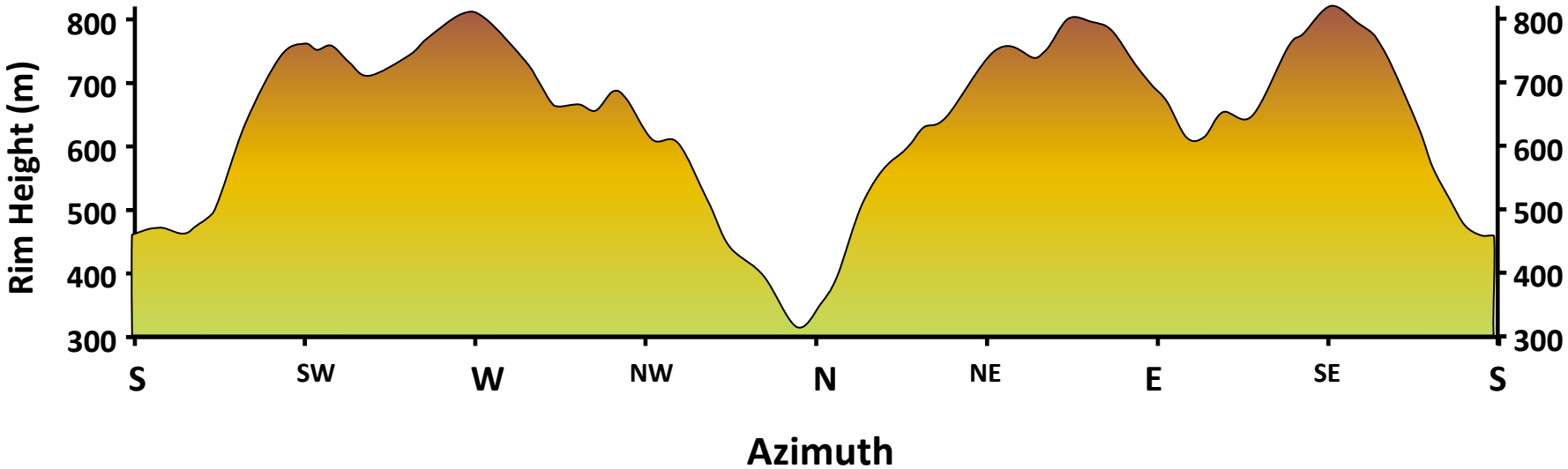


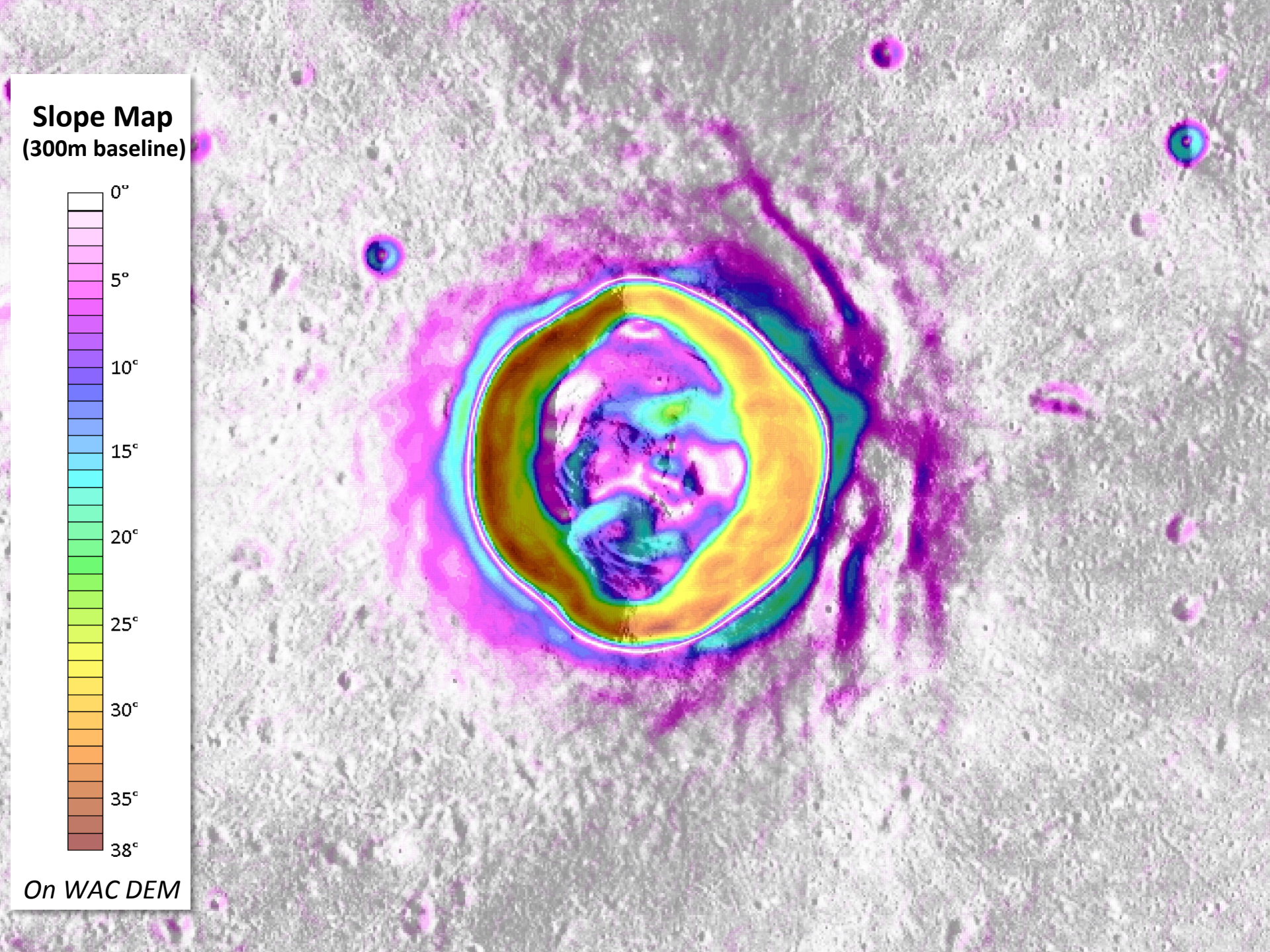


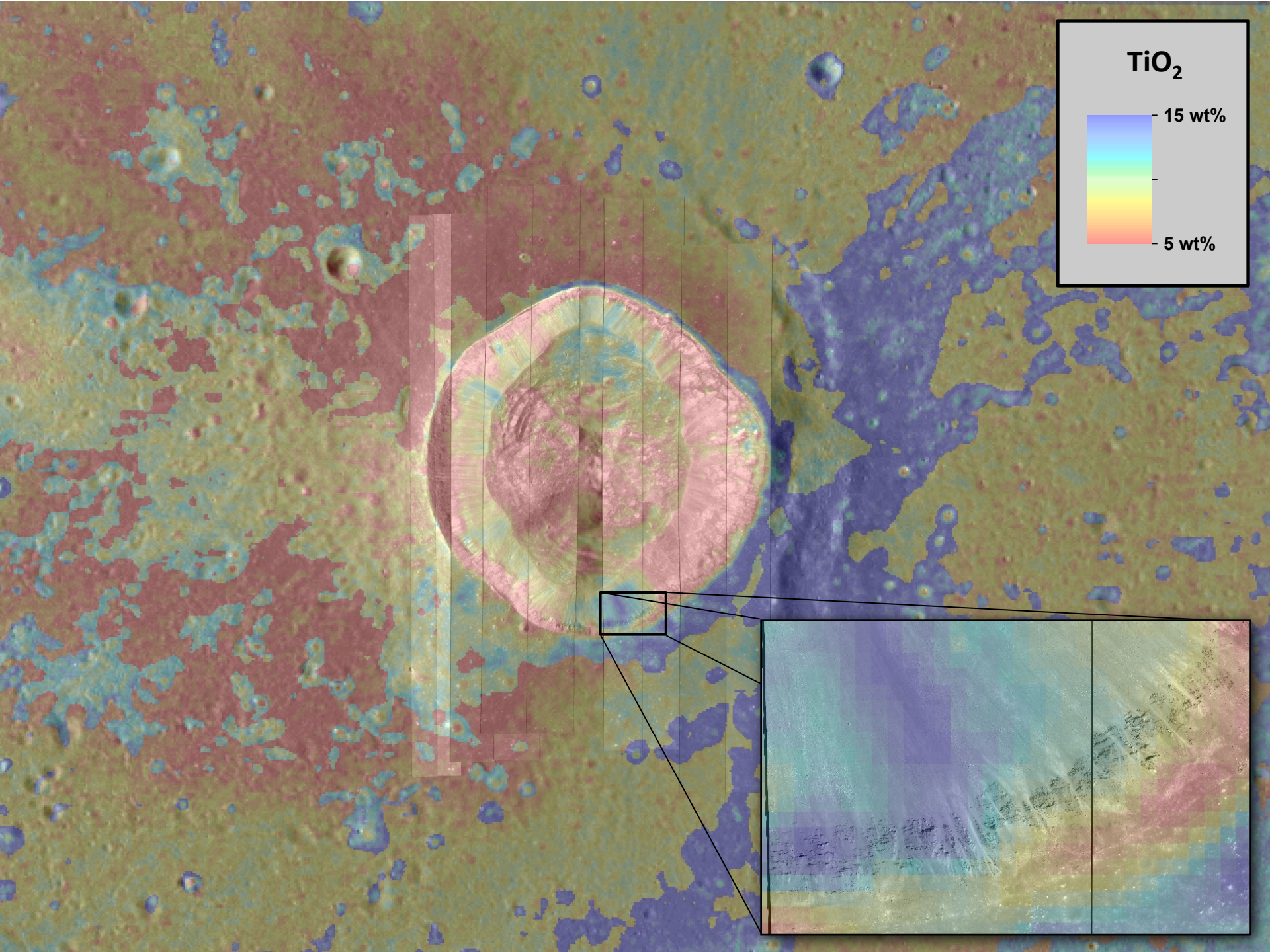
Rima Dawes
AS17-M-1659

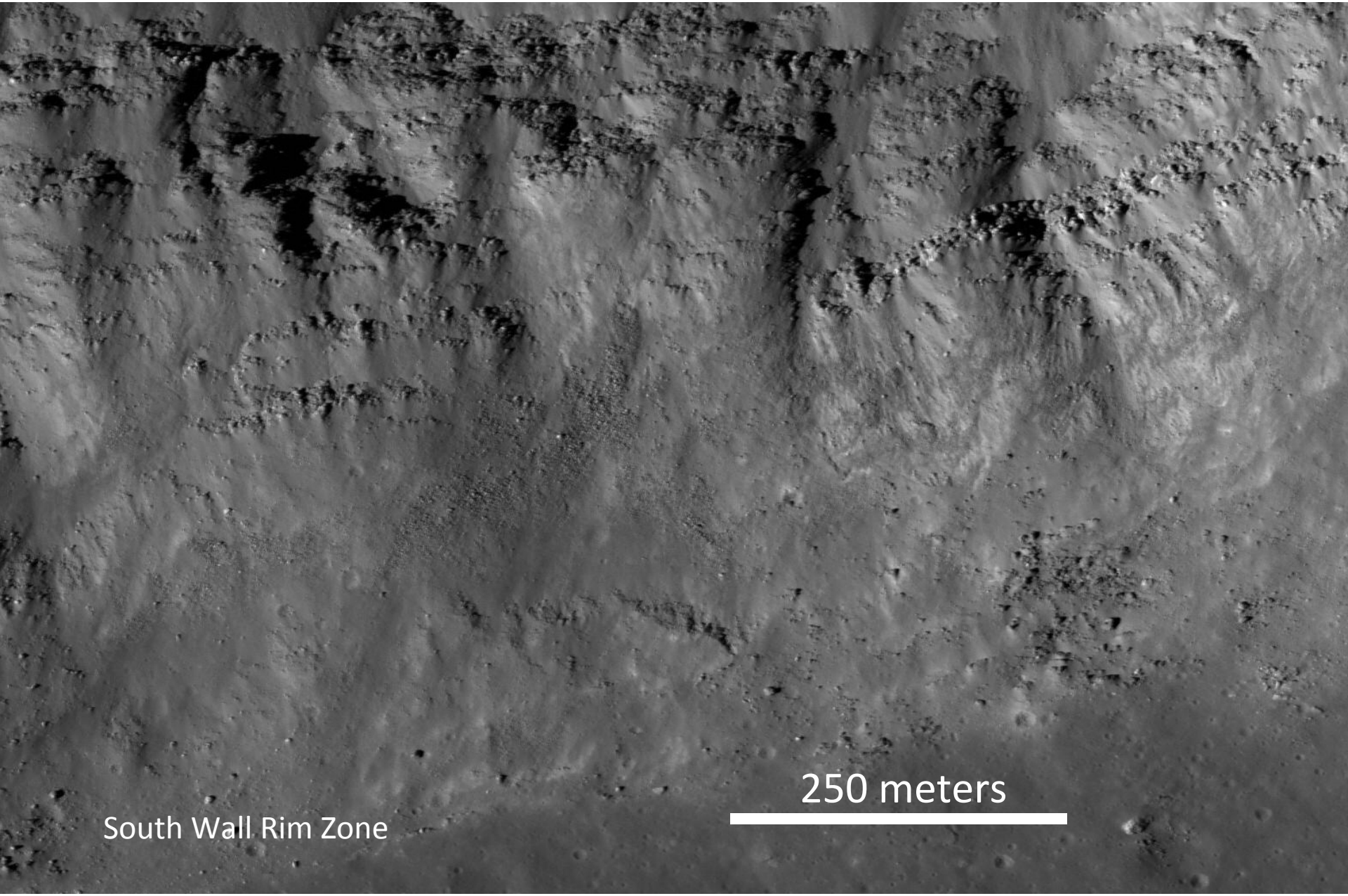
Looking North

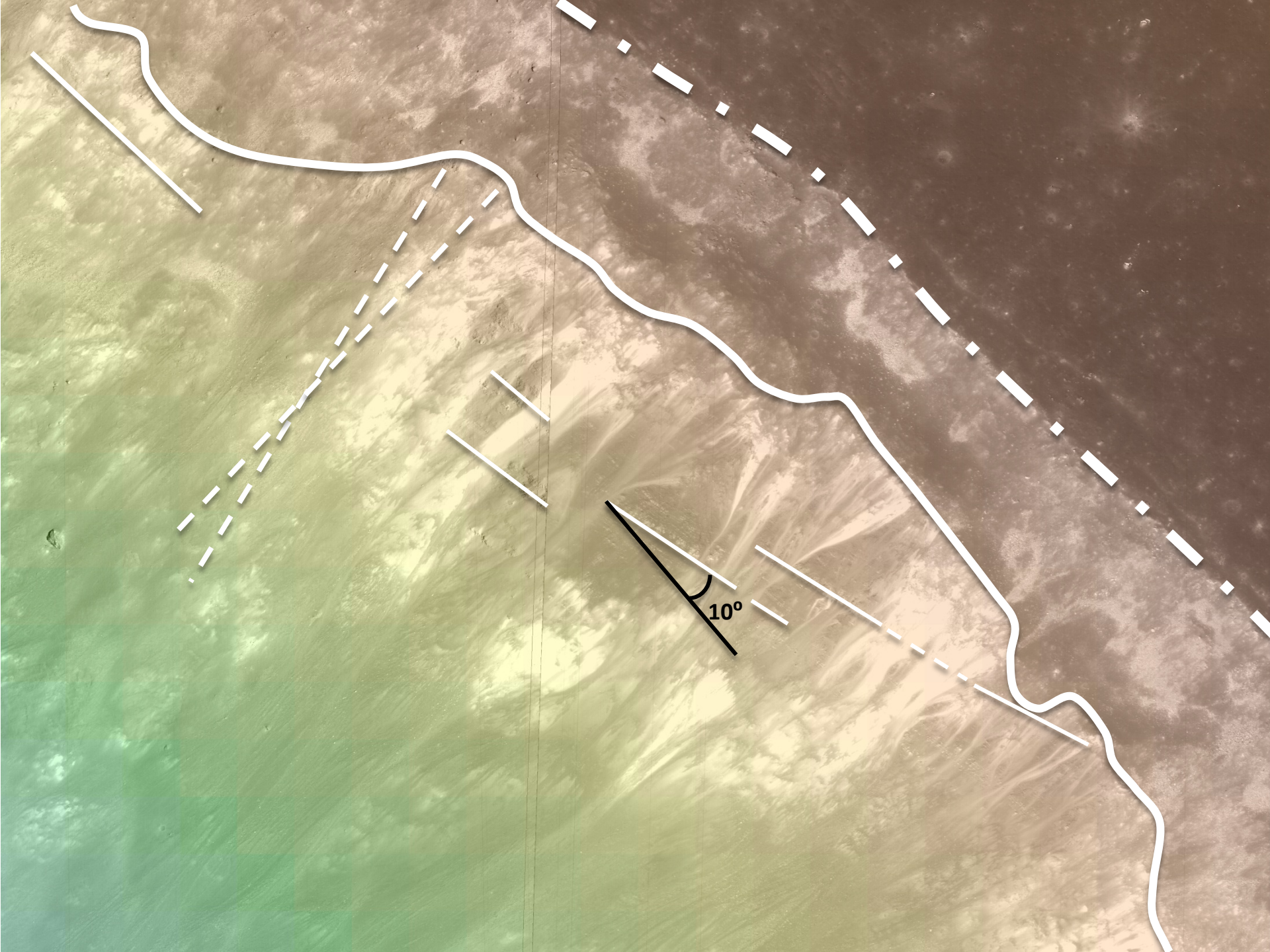


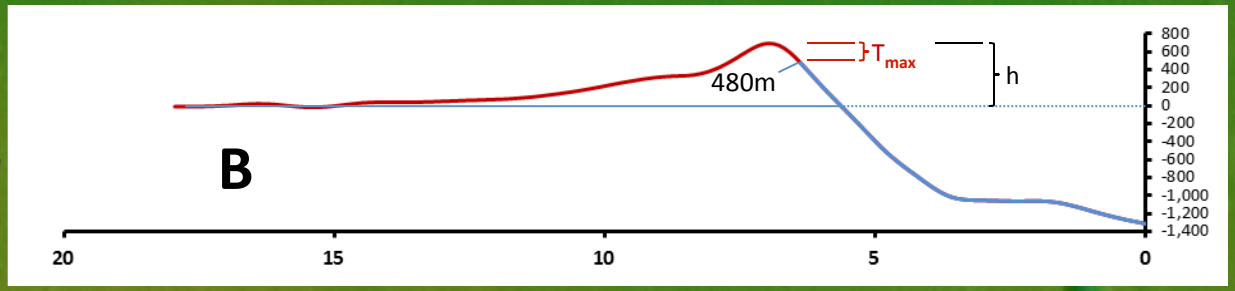



Slope Map
(300m baseline)
0°
5°
10°
15°
20°
25°
30°
35°
38°
On WAC DEM


TiO_2
15 wt%
5 wt%


250 meters
South Wall Rim Zone

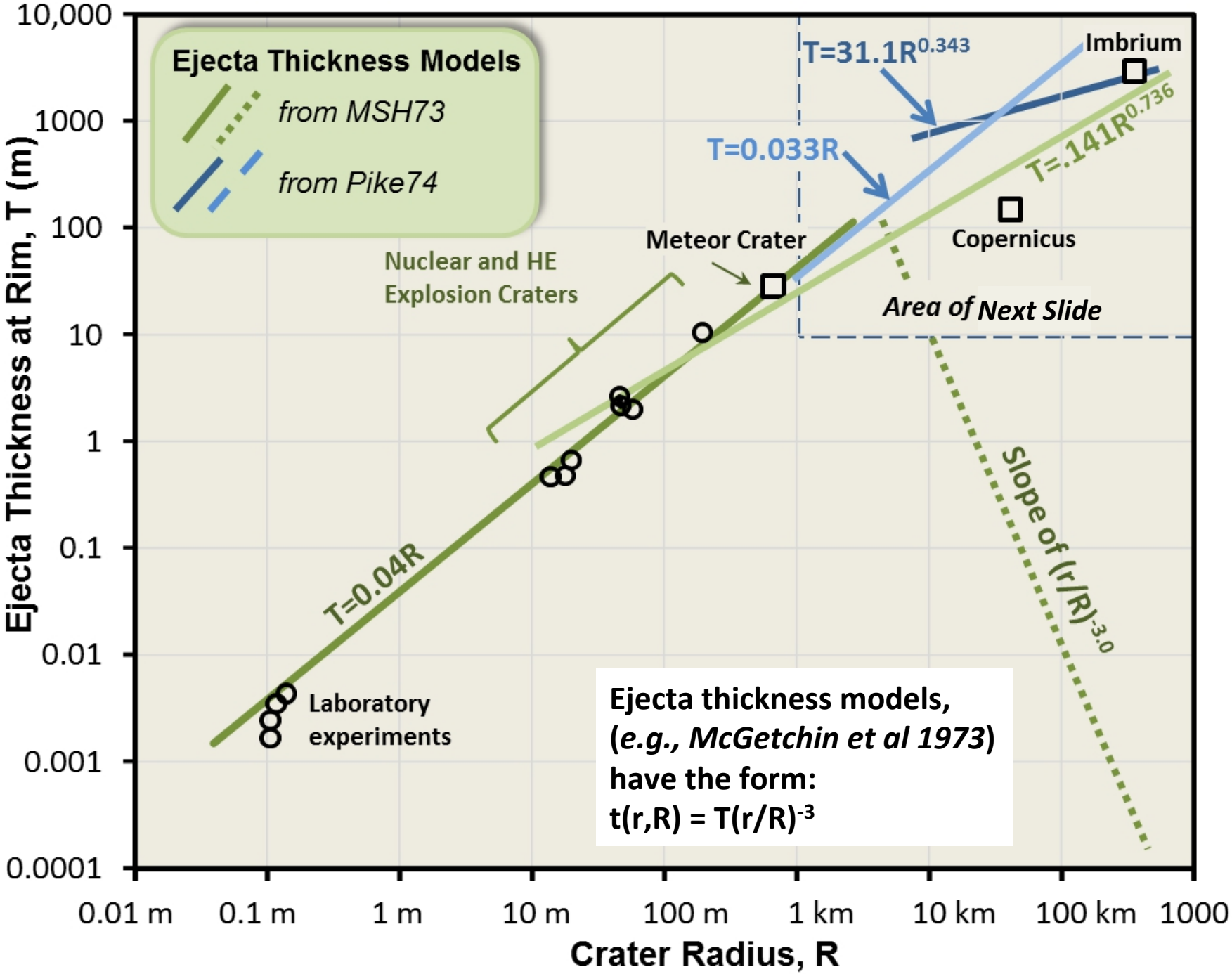

10º

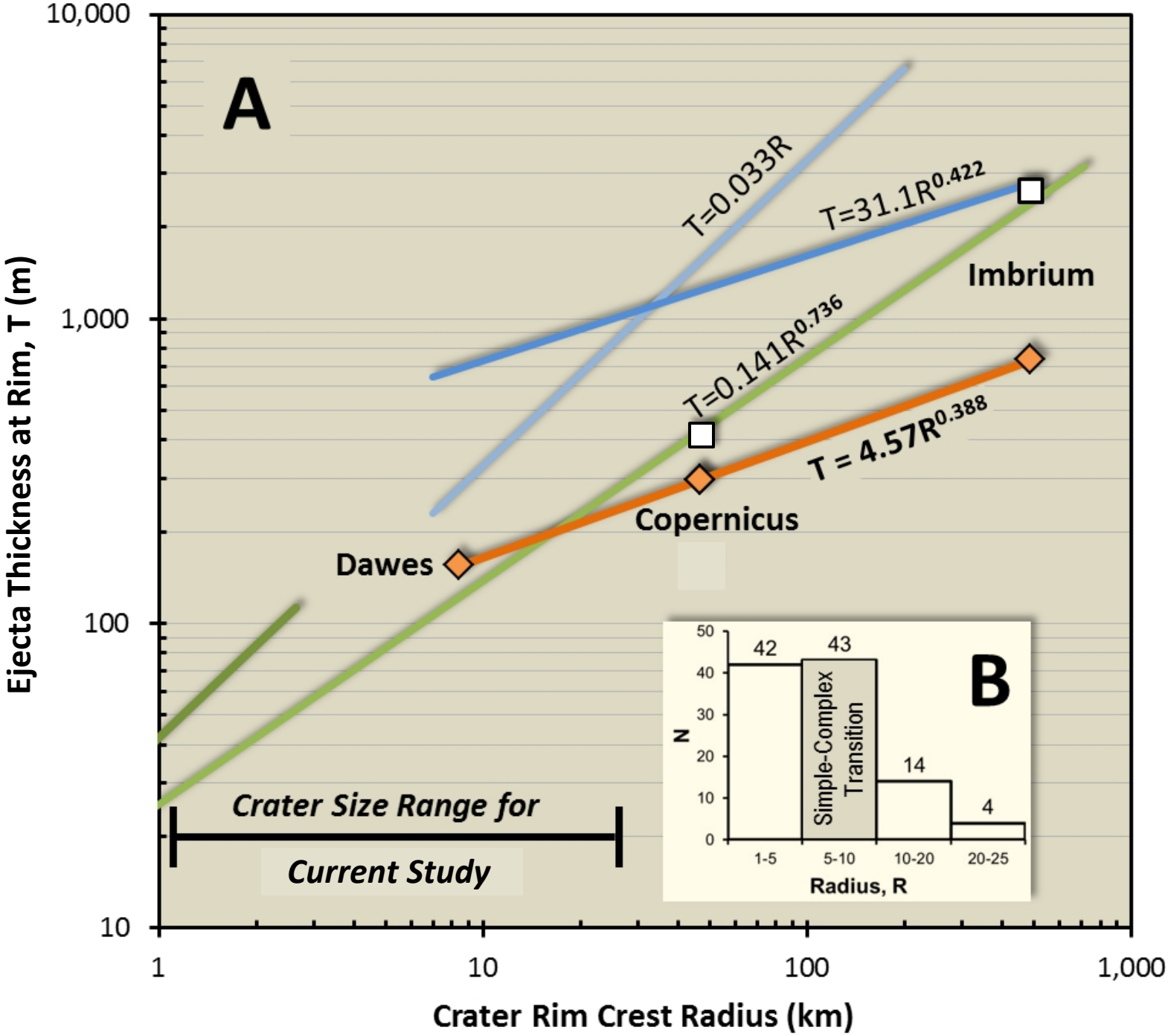


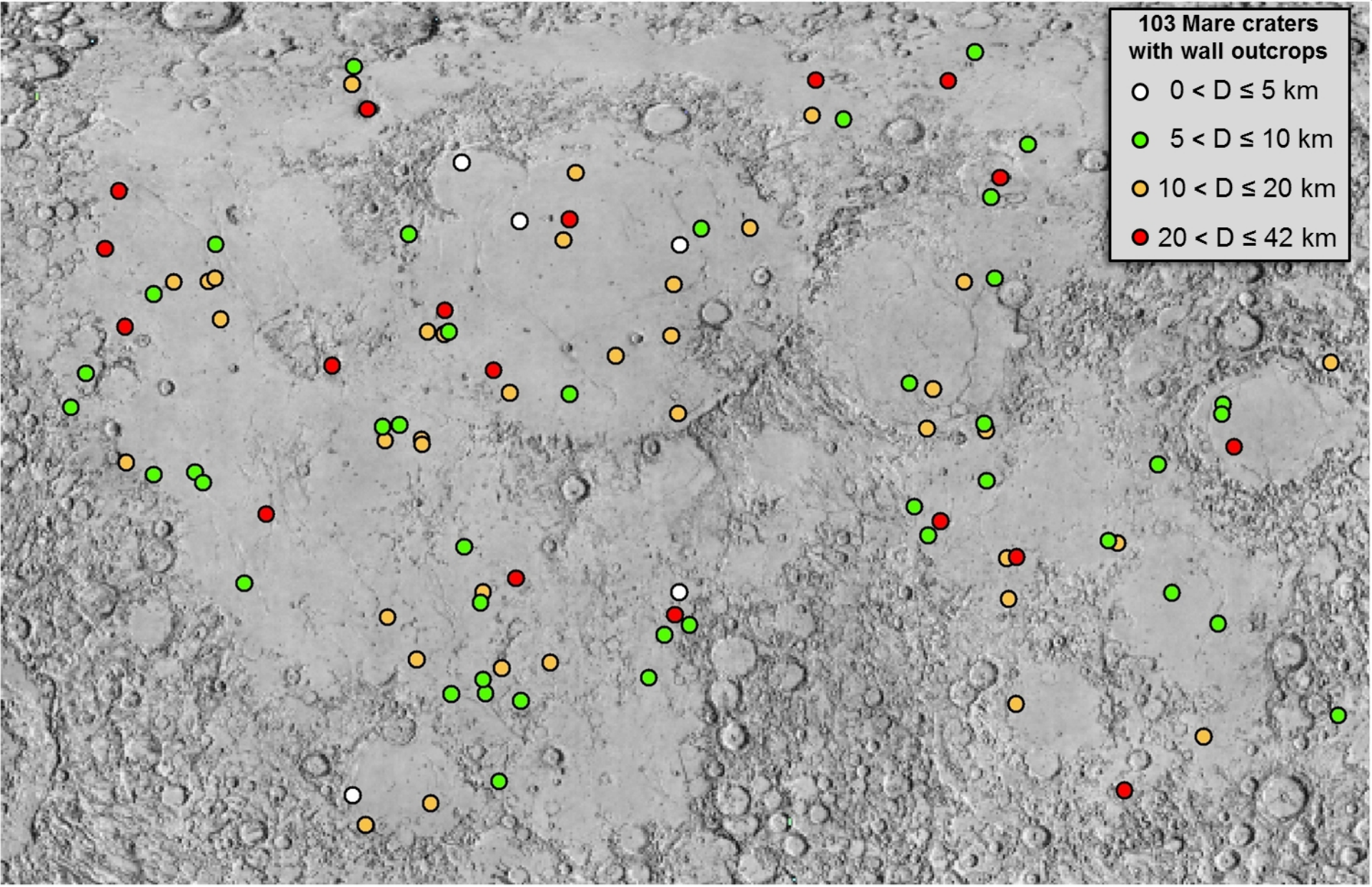
Measured Elevations (meters above estimated pre-impact surface) *from 20 measurements around Dawes Crater*			
	Range	Average	Standard deviation
Outcrop (upper extent)	**622-200**	**423**	**119**
Rim crest (h)	**815-370**	**576**	**143**
Max. Ejecta Thickness (T_{MAX})	**75-240**	**153**	**53**
T_{MAX}/h	**0.13-0.4**	**0.27**	**0.08**

Expected T/h ≥ 0.5 (McGetchin et al 1973; Melosh 1989)

A


Ejecta Thickness Models
from MSH73
from Pike74
T=31.1R^0.343
Imbrium
T=0.033R
T=.141R^0.736
Meteor Crater
Copernicus
Nuclear and HE
Explosion Craters
Area of Next Slide
Slope of (r/R)^-3.0
T=0.04R
Laboratory
experiments
Ejecta thickness models,
(e.g., McGetchin et al 1973)
have the form:
t(r,R) = T(r/R)^-3
Ejecta Thickness at Rim, T (m)
10,000
1000
100
10
1
0.1
0.01
0.001
0.0001
0.01 m
0.1 m
1 m
10 m
100 m
1 km
10 km
100 km
1000
Crater Radius, R

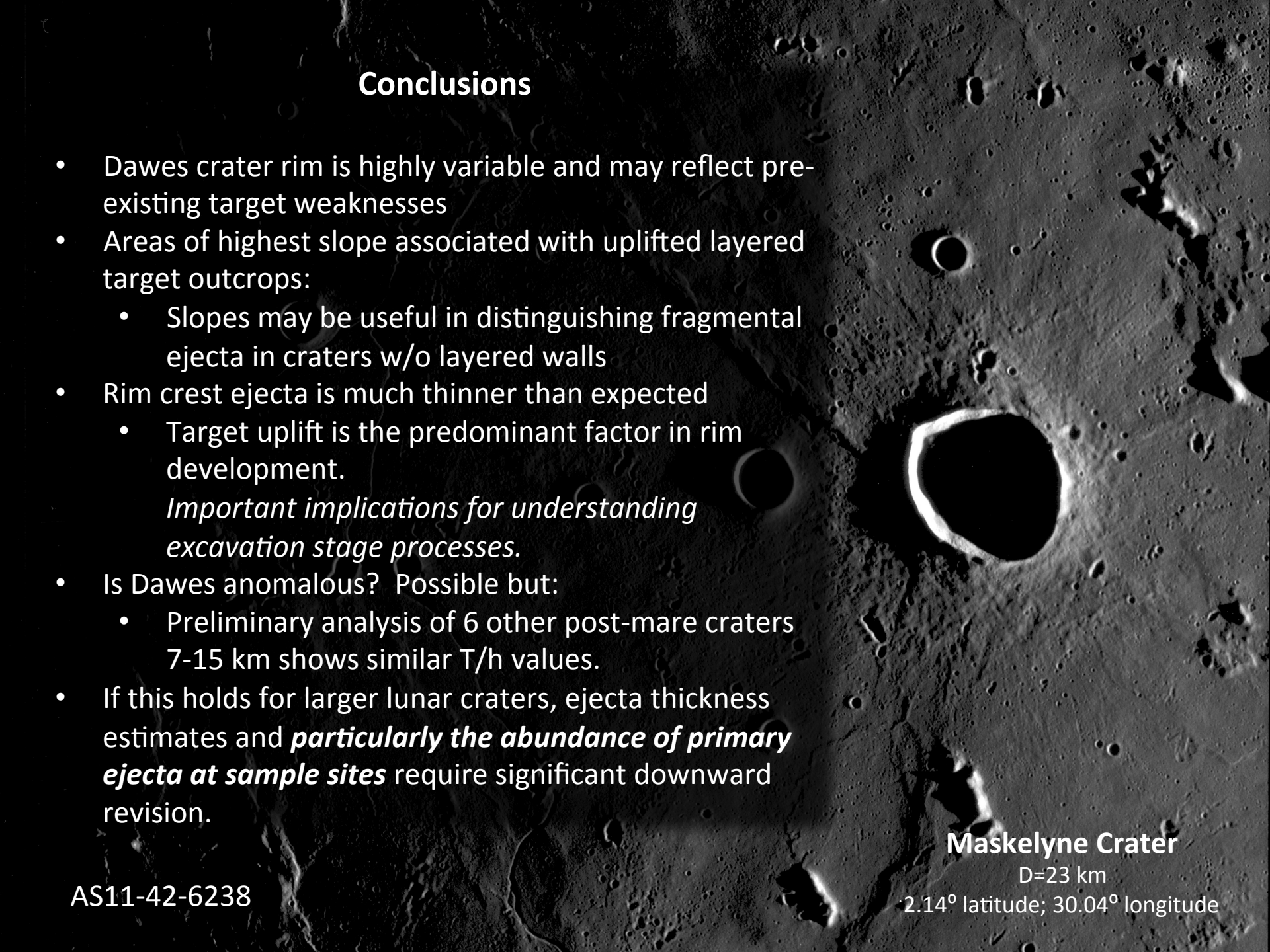

A
B
T=0.033R
T=31.1R^0.422
T=0.141R^0.736
T = 4.57R^0.388
Imbrium
Copernicus
Dawes
Crater Size Range for
Current Study
Simple-Complex
Transition
42
43
14
4
N
Radius, R
1-5
5-10
10-20
20-25
Ejecta Thickness at Rim, T (m)
Crater Rim Crest Radius (km)
10,000
1,000
100
10
1
10
100
1,000



Team members: Paul Spudis and David Kring (LPI), Mark Robinson, (ASU), Robert Herrick (UAF)

Conclusions

- Dawes crater rim is highly variable and may reflect pre-existing target weaknesses
- Areas of highest slope associated with uplifted layered target outcrops:
  - Slopes may be useful in distinguishing fragmental ejecta in craters w/o layered walls
- Rim crest ejecta is much thinner than expected
  - Target uplift is the predominant factor in rim development.
    Important implications for understanding excavation stage processes.
- Is Dawes anomalous? Possible but:
  - Preliminary analysis of 6 other post-mare craters 7-15 km shows similar T/h values.
- If this holds for larger lunar craters, ejecta thickness estimates and ***particularly the abundance of primary ejecta at sample sites*** require significant downward revision.



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Maskelyne Crater
D=23 km
2.14° latitude; 30.04° longitude