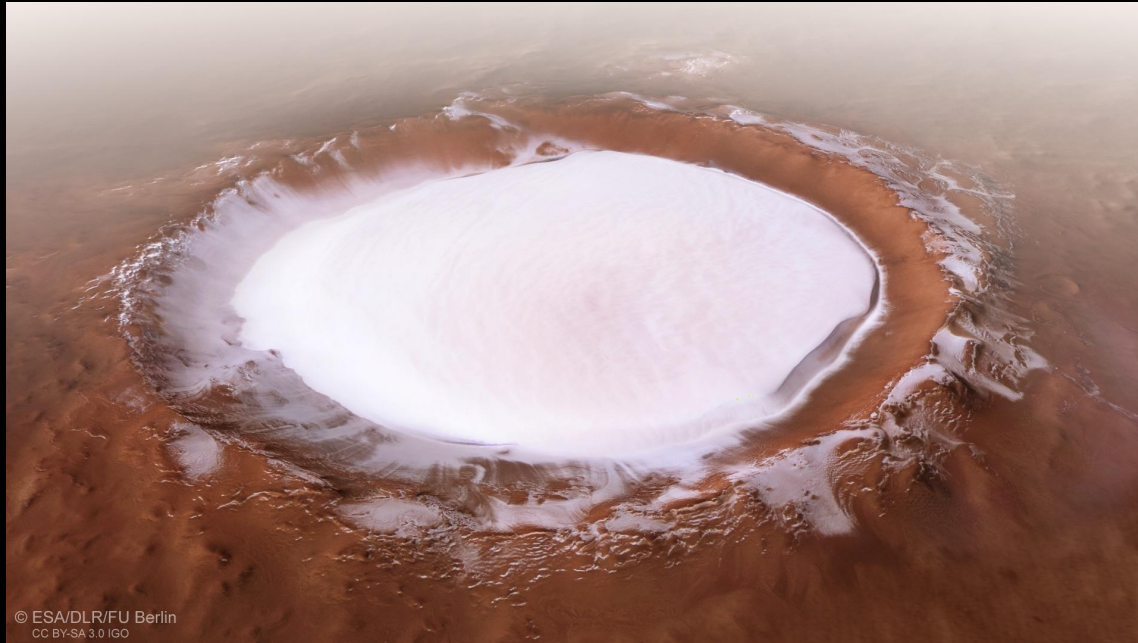


Radar Observations of Outlier Polar Ice Deposits on Mars

Riley A. McGlasson, Ali M. Bramson, Gareth A. Morgan, Michael M. Sori

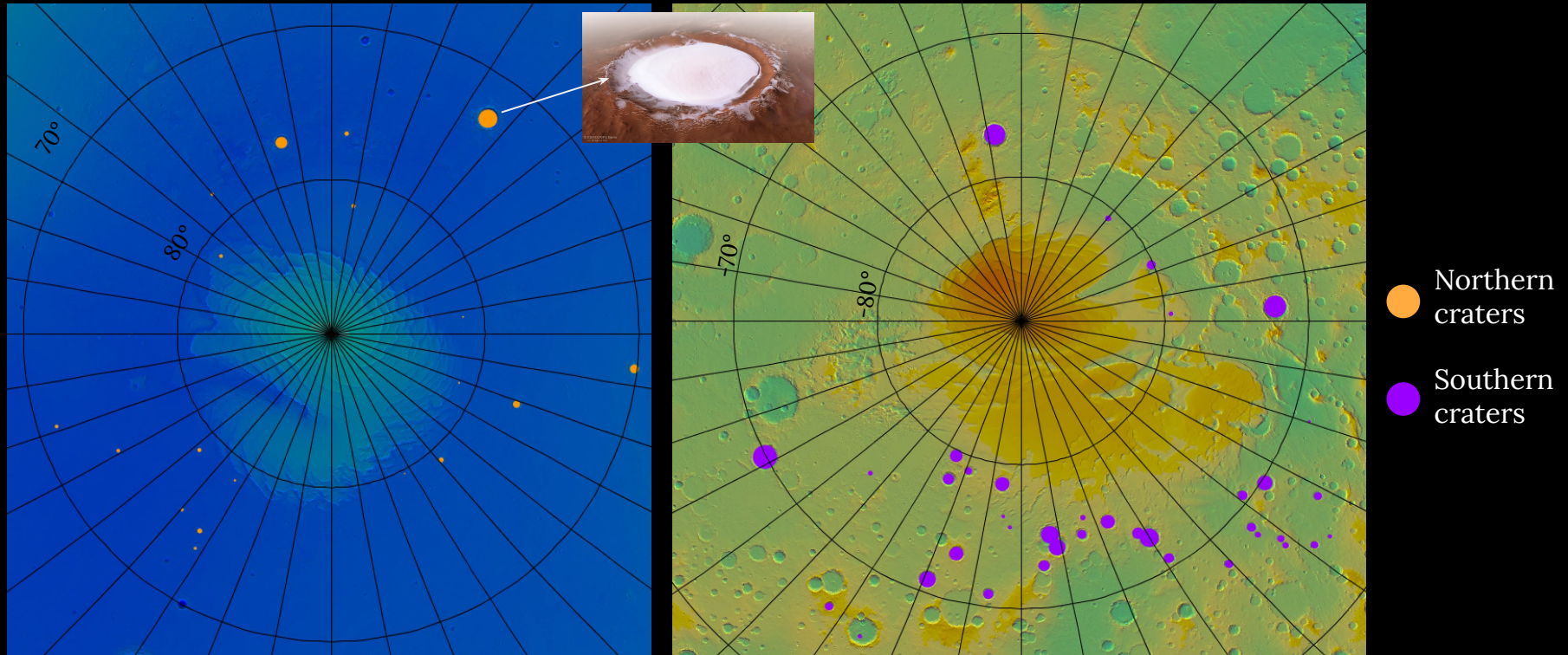


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P

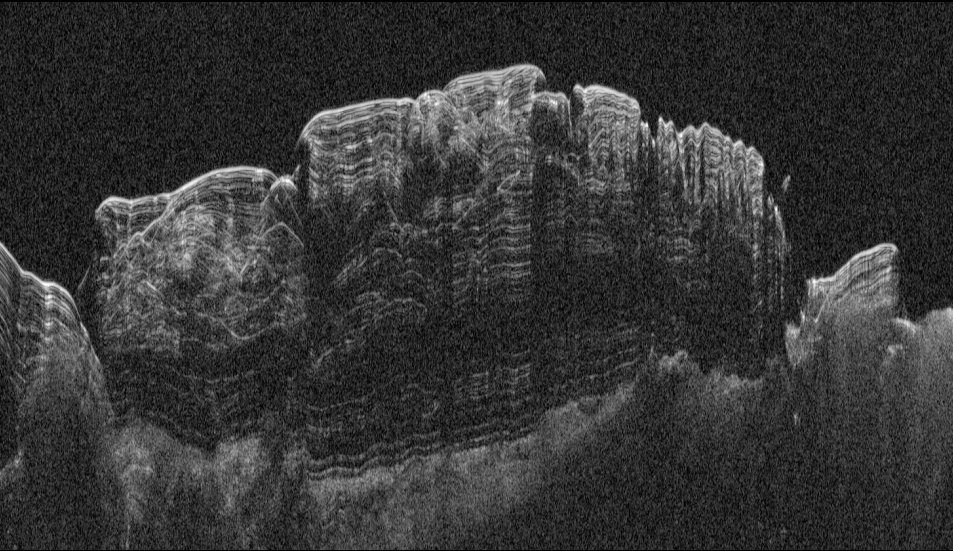
These 'outlying' ice deposits are located near the north and south polar layered deposits.

Northern deposits: Conway et al. (2012) Southern deposits: Sori et al. (2019)

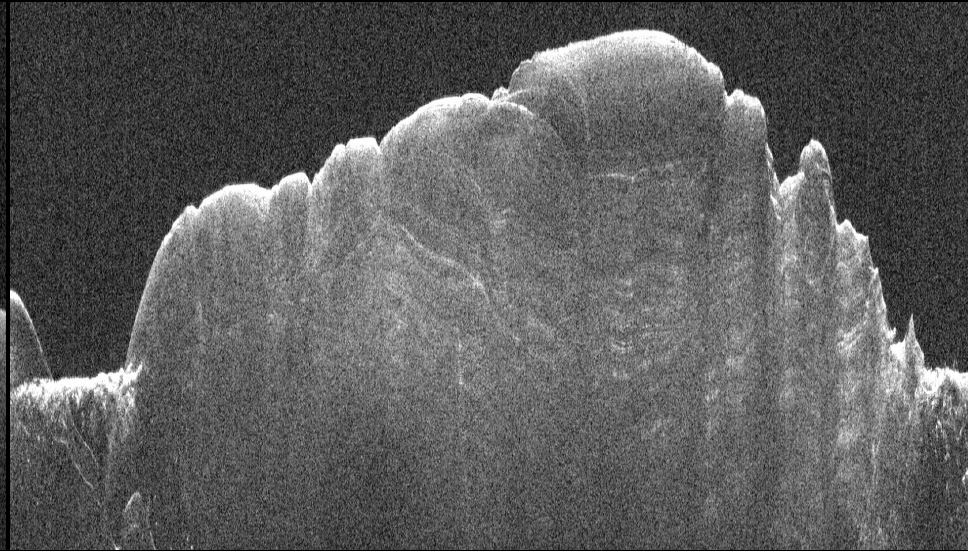


Do the outlier crater deposits share characteristics (and perhaps histories?) of their respective PLD?

We use SHARAD radargrams to examine the subsurface ice in these crater deposits.

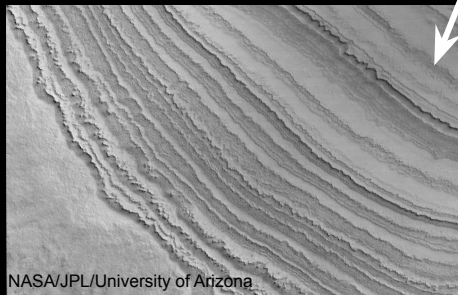
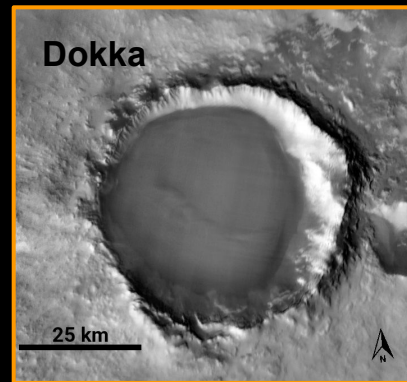
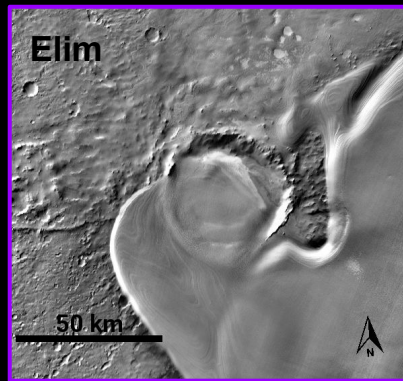
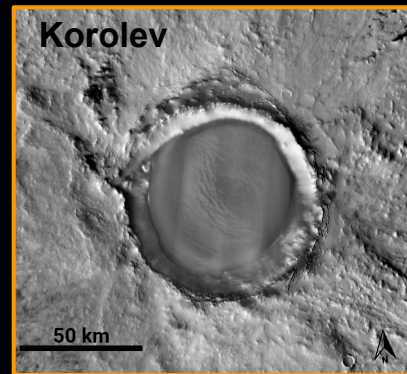
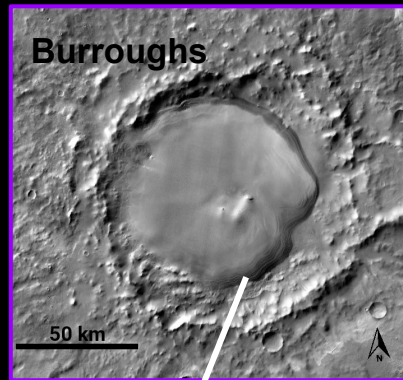
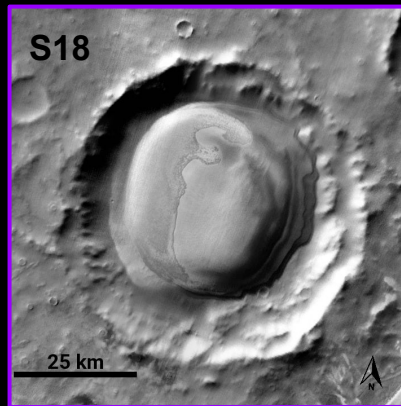
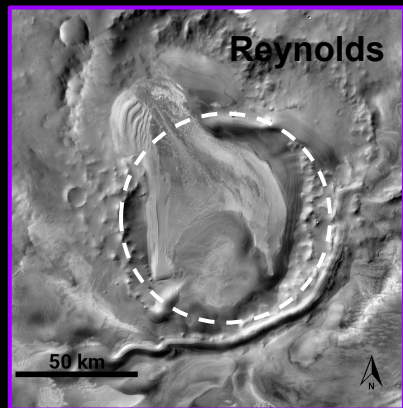


SHARAD radargram of the NPLD

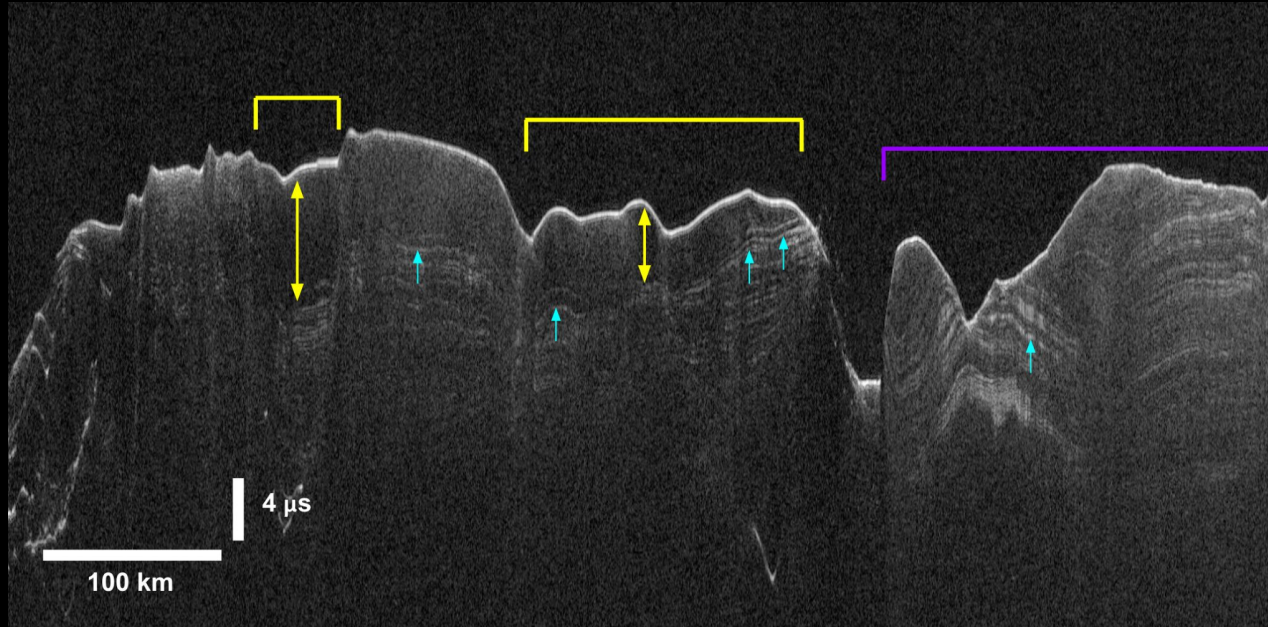


SHARAD radargram of the SPLD

We selected the largest deposits (>25 km) identified by Conway et al. 2012 (North) and Sori et al. 2019 (South)



Subsurface features



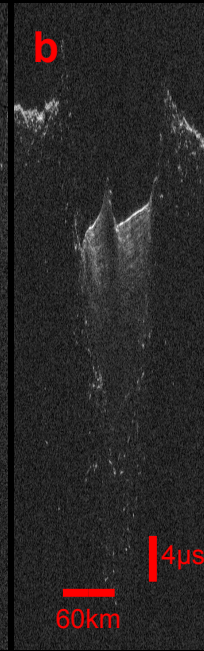
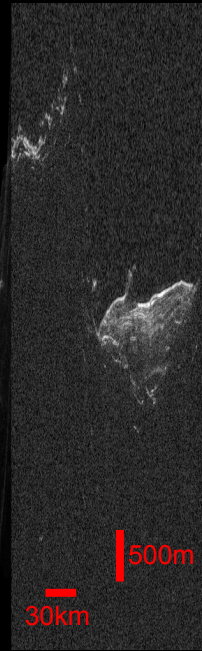
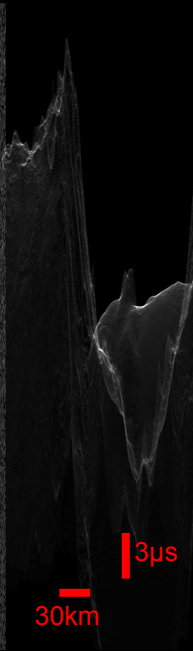
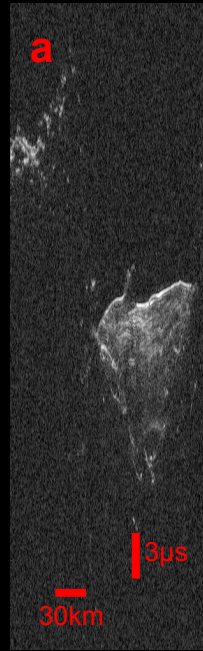
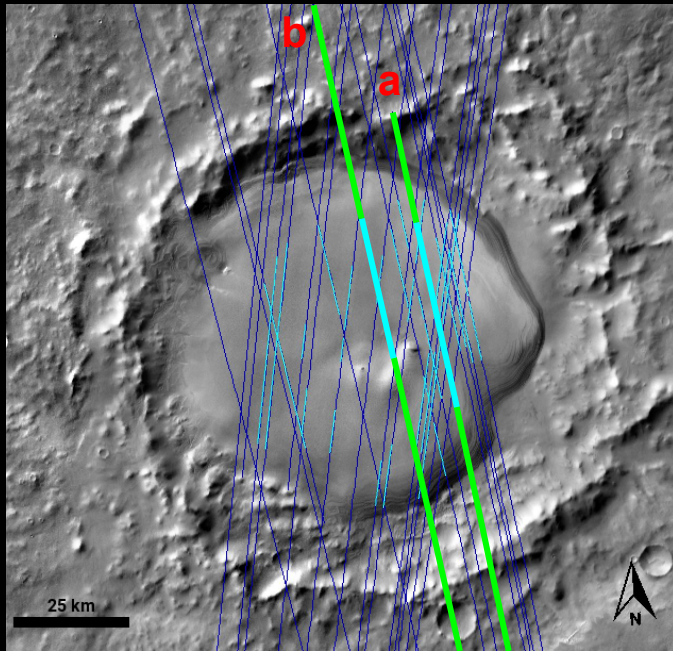
Light blue arrows point at subsurface radar reflectors.

The purple bracket marks the presence of radar fog.

Yellow brackets indicate the presence of a low reflectance zone (LRZ), with the yellow arrows denoting the vertical extent of the LRZ.

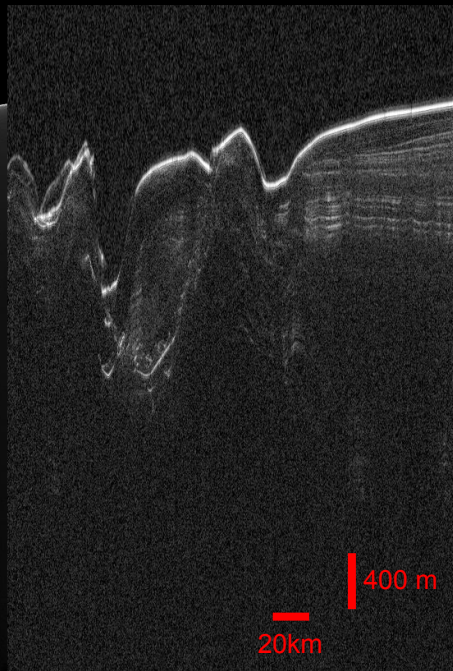
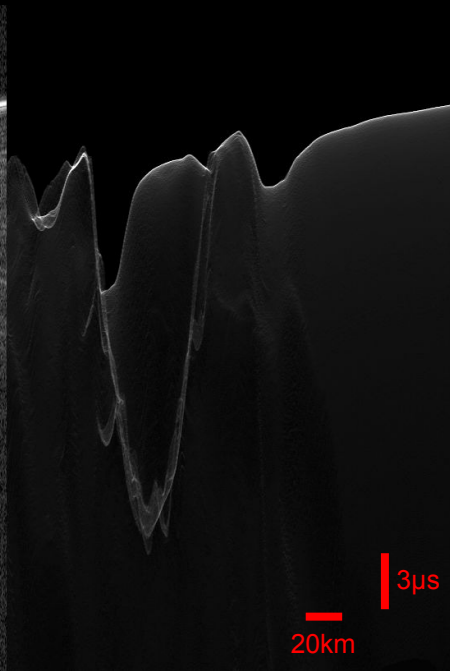
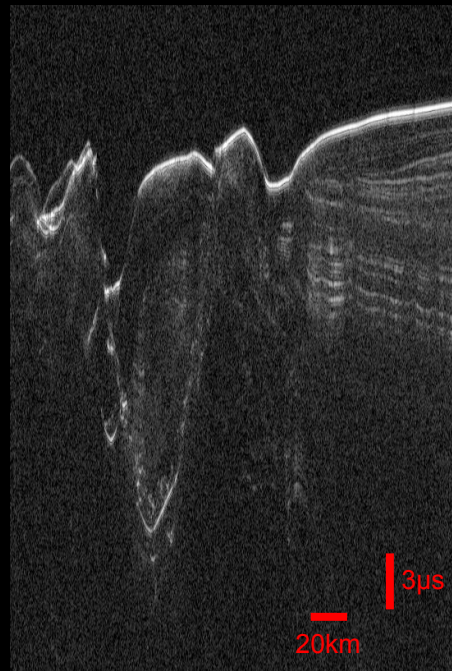
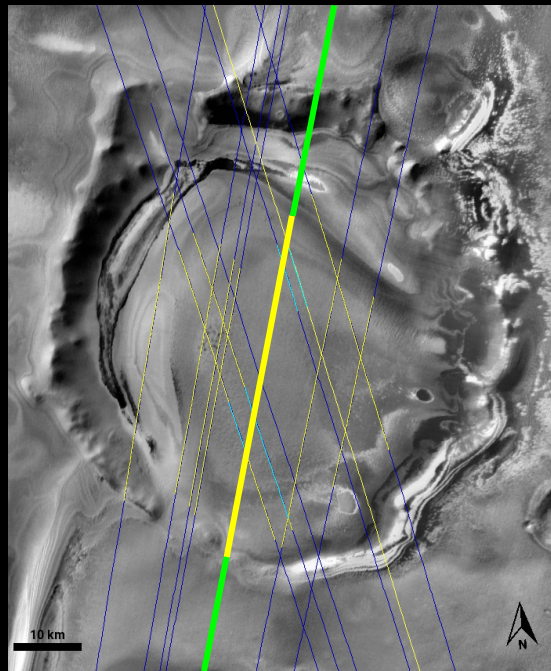
Radargrams

Burroughs crater (south)

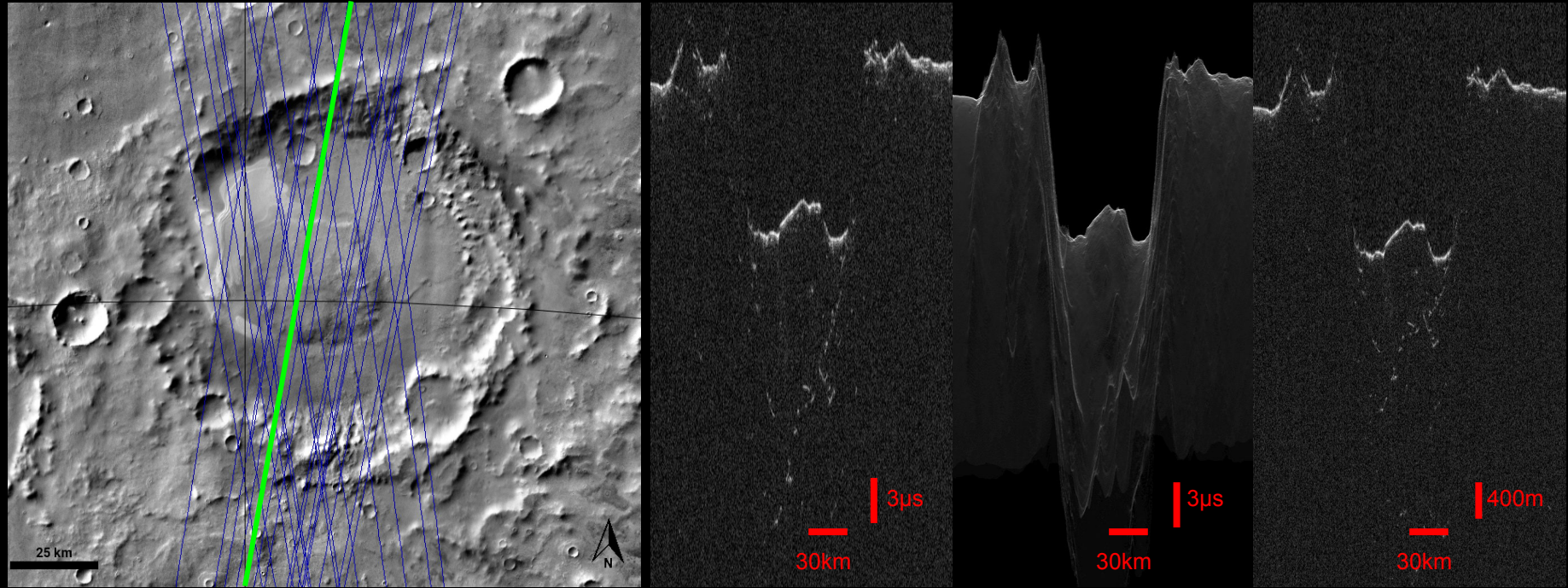


Radargrams

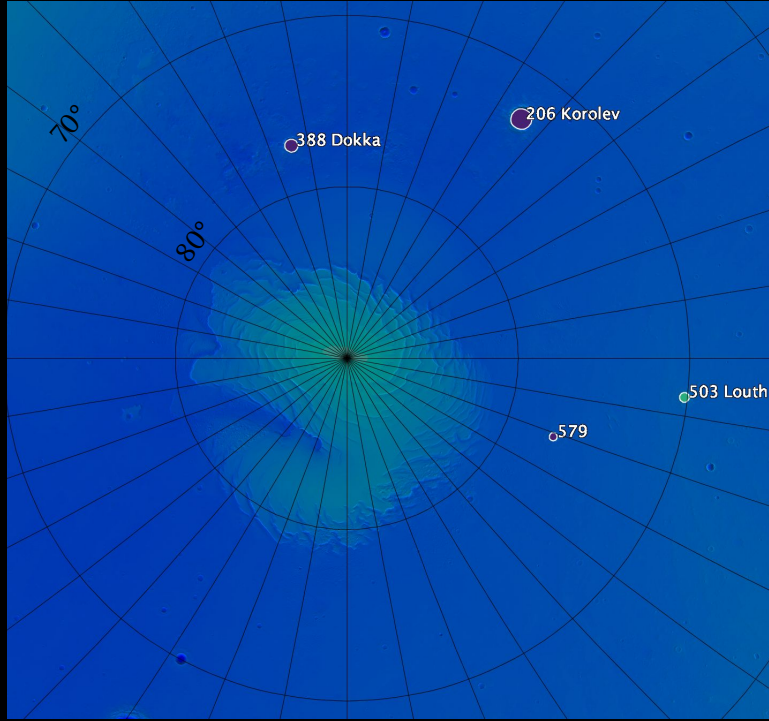
S37 (south)



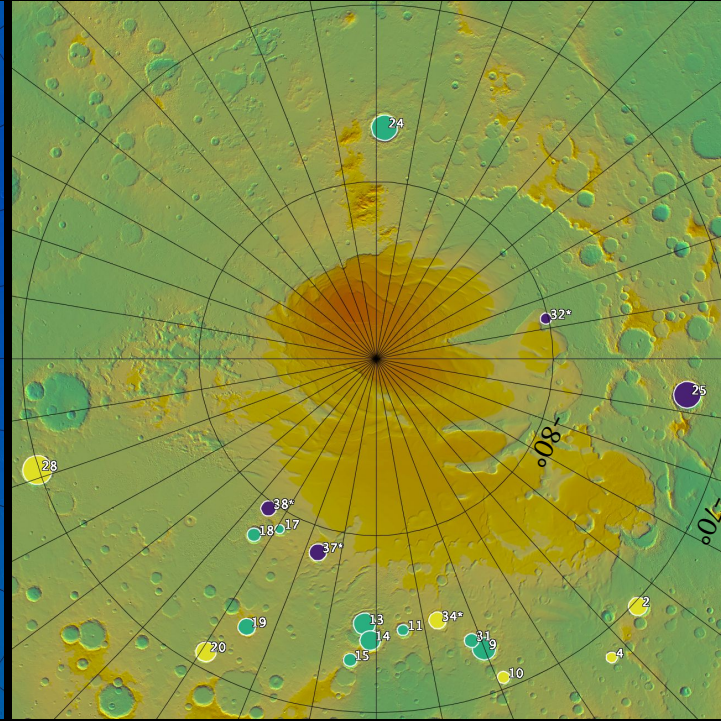
No radar layering – Agassiz crater (South)



Subsurface layers are present in some, but not all, of the outlying crater deposits.



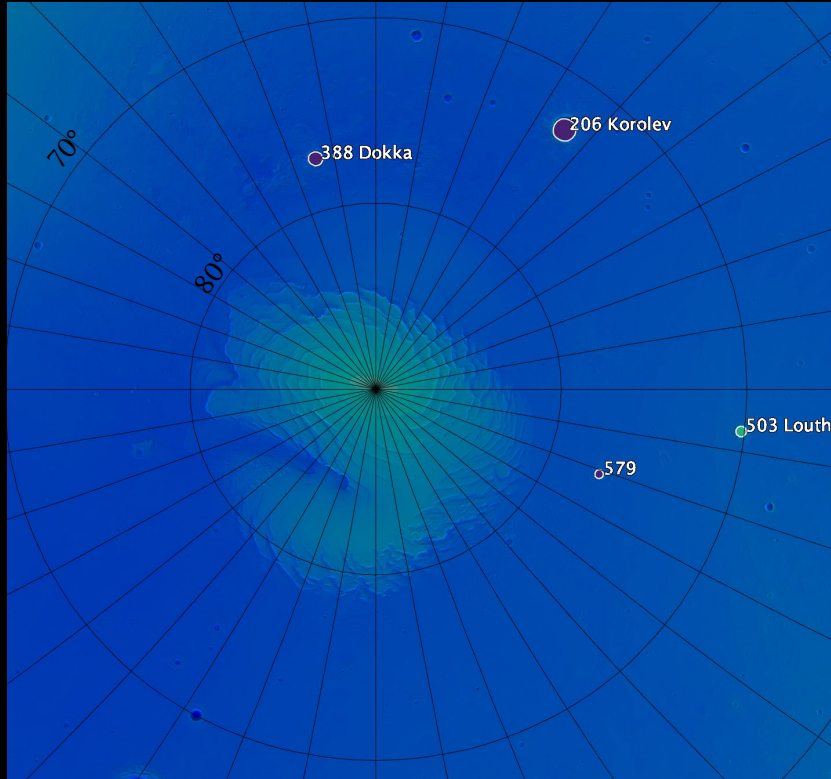
North:
■ : 3 ■ : 1



South:
■ : 4 ■ : 10 ■ : 6

	Surface layers?	Subsurface layers?
■	yes	yes
■	yes	no
■	no	no

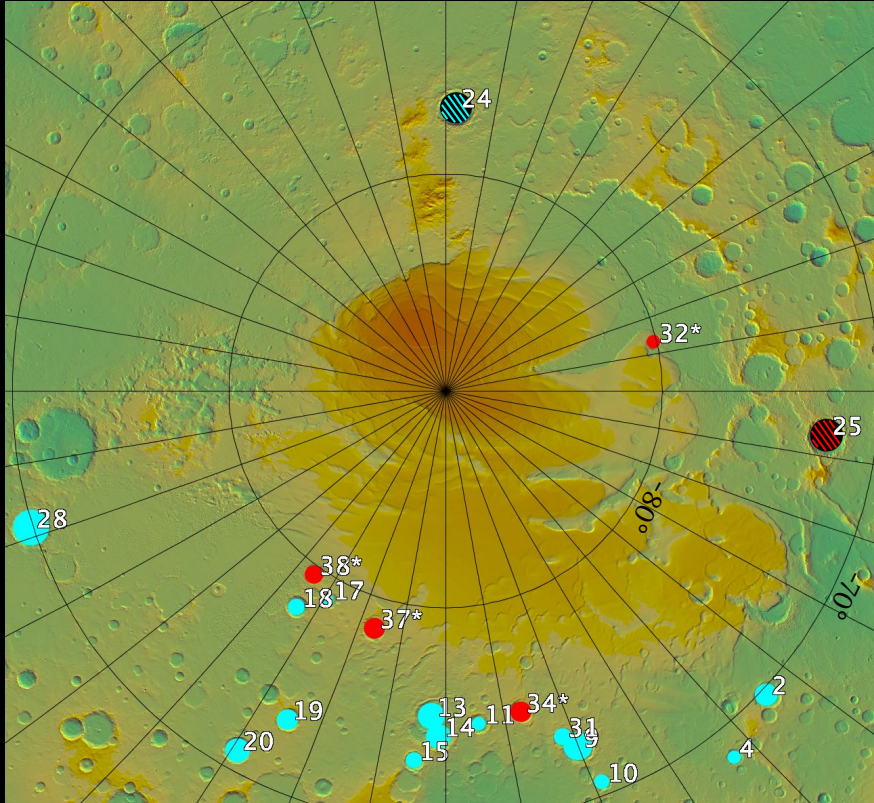
Northern Results



Conway et al. (2012) and Brothers and Holt (2016) propose they are likely NOT a remnant of a past extensive NPLD.

We find that the northern deposits share more common characteristics (clear layers, grouped layer packets, no fog) with the NPLD, so they **may have been emplaced concurrently or at least under similar environmental conditions**

Two groups emerge within the southern crater deposits



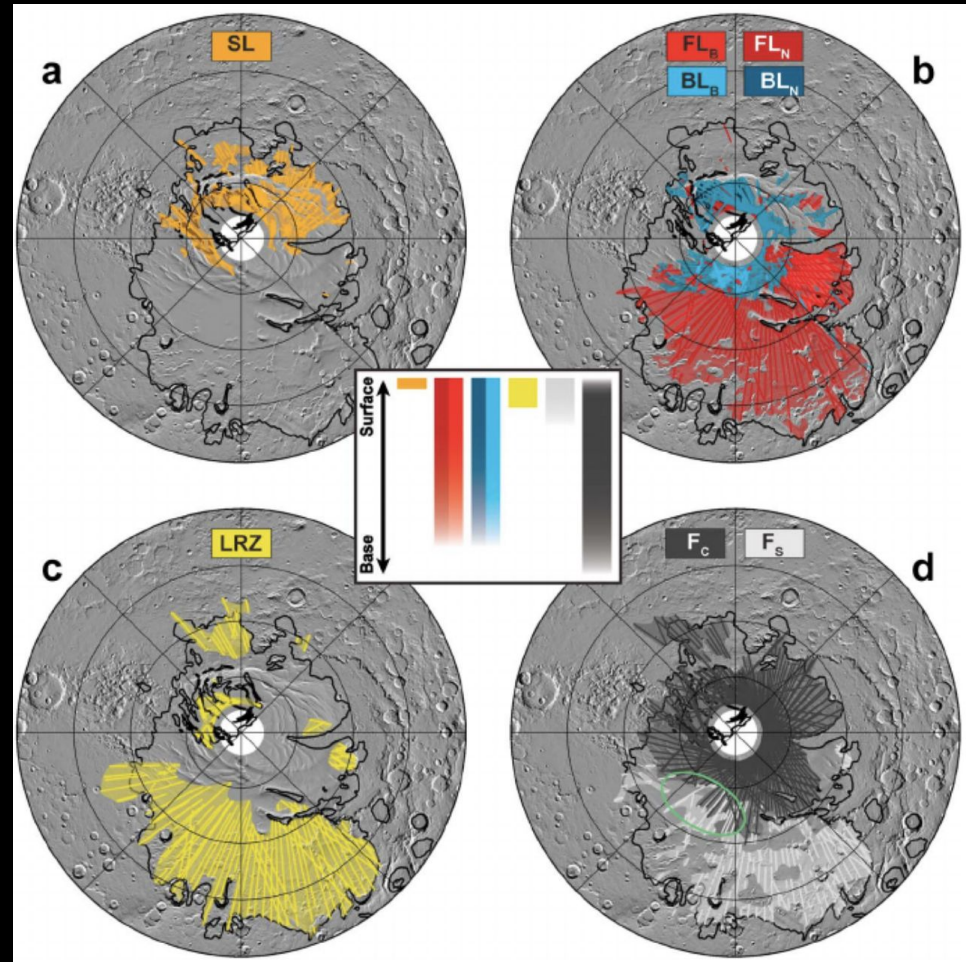
The southern population of outlying crater deposits, colored by deposit group.

The Reynolds cluster group is shown in blue, and the marginal deposit group is shown in red.

The two striped craters, crater 24 (South) and crater 25 (Burroughs) don't fit into either group, but the colored stripes indicate which group they are most similar to.

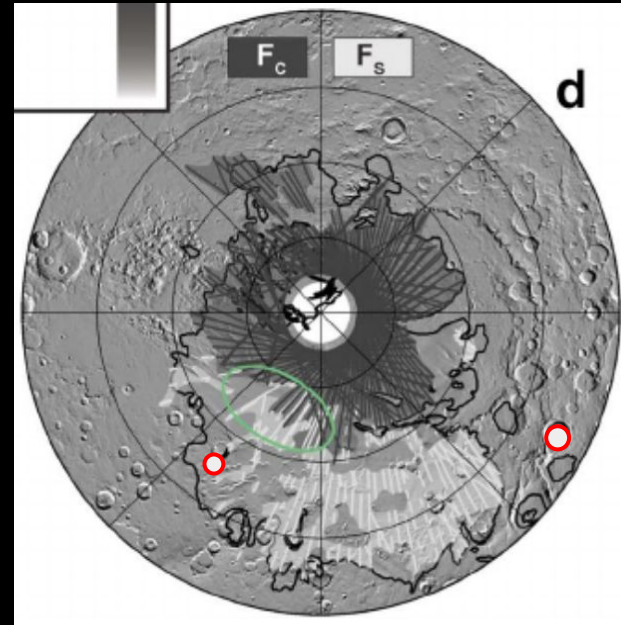
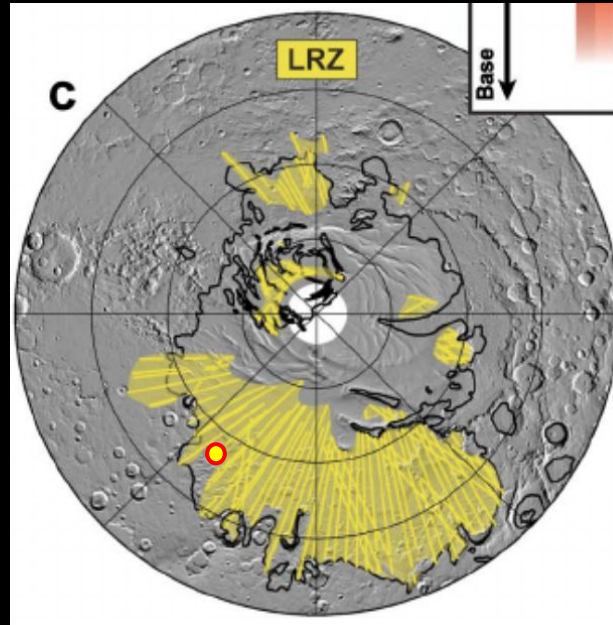
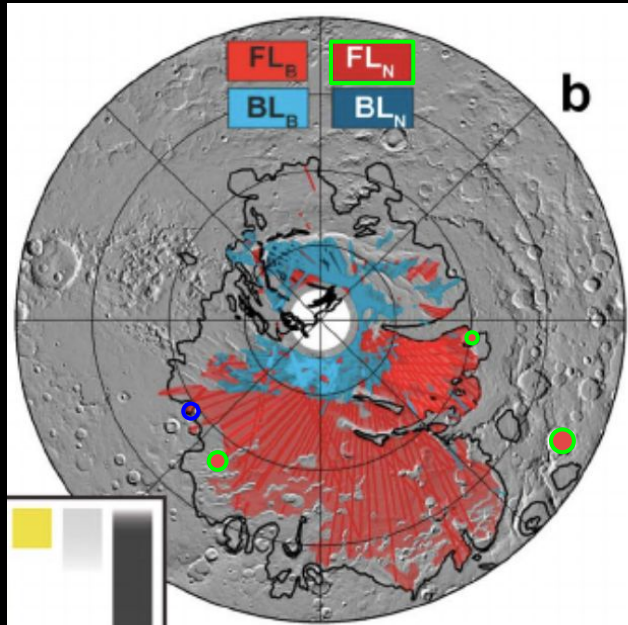
Whitten and Campbell (2018)
produced SPLD maps of:

- a. Shallow layer facies
- b. Focused and blurred layer facies
- c. Low reflectivity zones
- d. Fogs



Whitten and Campbell (2018), Figure 4

Expanded Whitten and Campbell (2018) Maps



In summary:

We have analyzed a total of **517** SHARAD tracks across **24** craters (>25 km diameter)

- North: detected subsurface layers in **3** out of 4 crater deposits
- South: detected subsurface layers in **4** out of 20 crater deposits
 - 3 of these are contiguous with the SPLD

Southern interpretations:

- The marginal deposits likely formed as part of the SPLD
 - Burroughs crater likely formed under similar environmental conditions
- The Reynolds group deposits likely do not have a shared depositional history with the SPLD

Northern interpretations:

- Northern deposits were likely emplaced under similar environmental conditions as the NPLD.