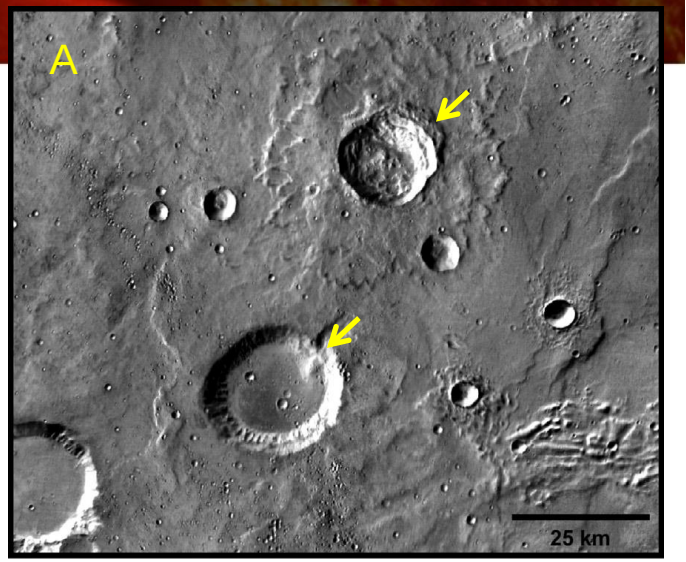
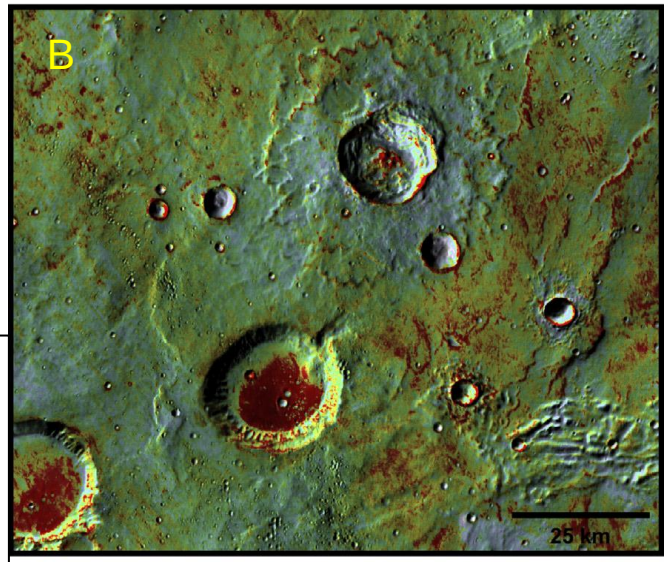
Filled Craters: Evidence of Mantle Material

The formation of filled craters on Mars provides evidence for widespread impact induced decompression of the early Martian mantle.

Flat-floored craters have long been recognized on Mars and hypothesized to have a sedimentary origin. However, high-resolution thermal inertia data show that these craters contain some of the rockiest materials on the planet, inconsistent with poorly consolidated sedimentary materials. In a recent study, the majority of the ~2800 rocky crater floors identified were filled at ~3.5 Ga and are associated with the highest thermal inertia values and some of the most mafic materials identified on the planet.

- The most likely scenario is volcanic infilling through fractures created by the impact event.
- That volcanic infilling of craters appears to have occurred only in early Martian history when the lithosphere was still relatively thin and the thermal gradient was high.
- This process was widespread and responsible for the eruption of significant volumes of material, inside and likely outside of craters.





THEMIS daytime mosaic (A) and THEMIS colorized nighttime temperature mosaic overlain on the THEMIS daytime global mosaic (B). The highly degraded crater (bottomarrow) has no visible ejecta blanket, central peak or rim, and has been in-filled with volcanic materials. In contrast, the fresh crater (top arrow) has a clearly visible ejecta blanket, central peak, well defined rim, and has not been significantly modified or in-filled. This typical observations shows fresh-looking craters, despite their similar size, are not in-filled with volcanic materials, indicating that the process responsible for infilling occurred early in Martian history.

Edwards et al. (2013) Icarus

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