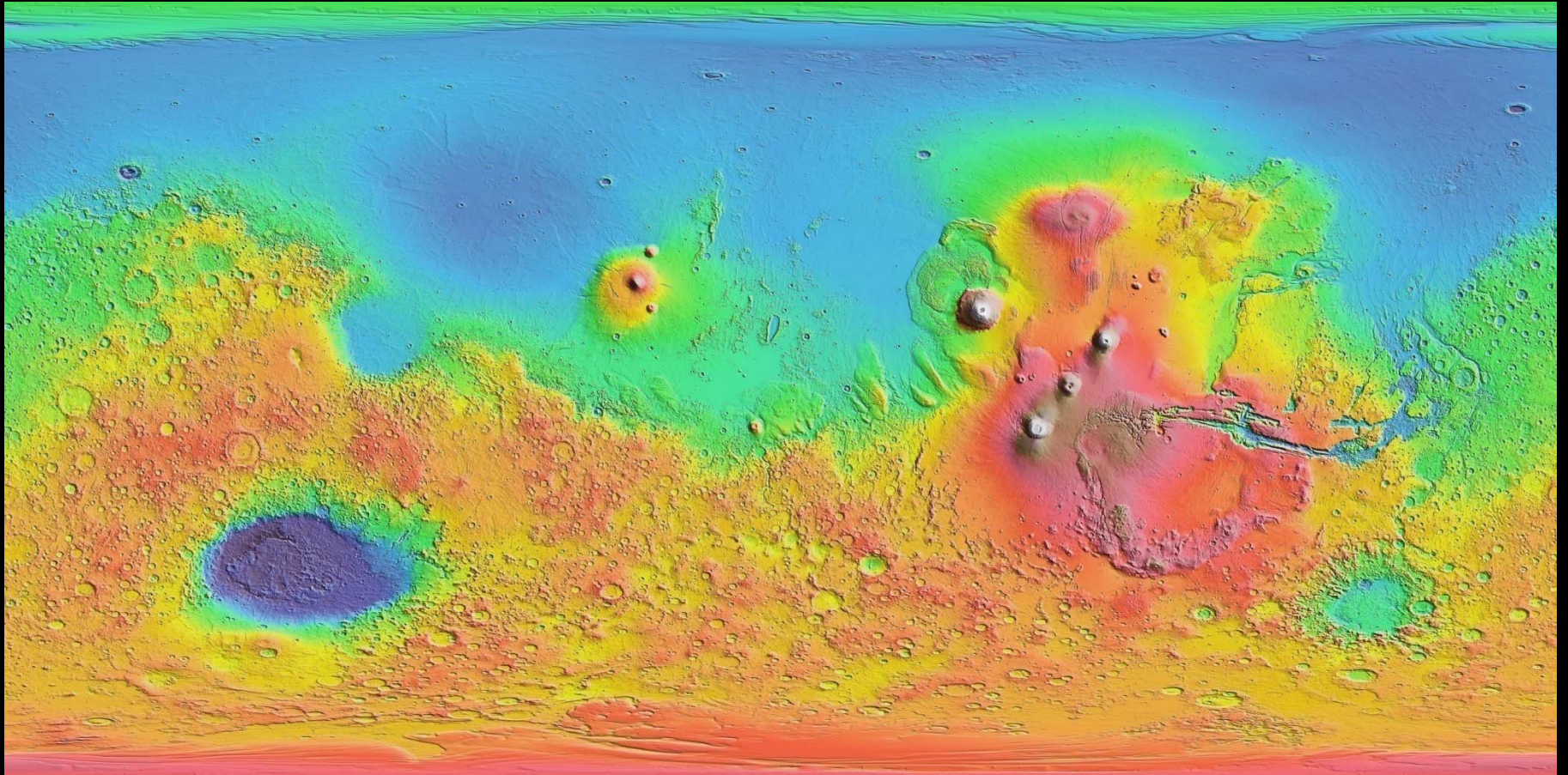


Mars Orbiter Laser Altimetry Data

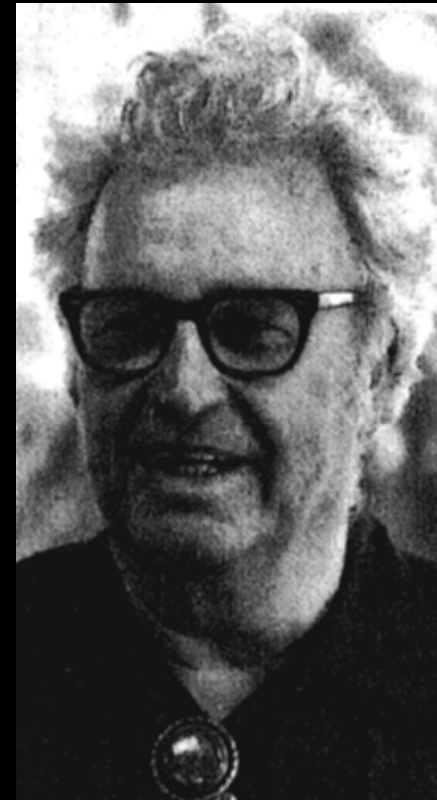




From “Geoblemes” To “Astroblemes”

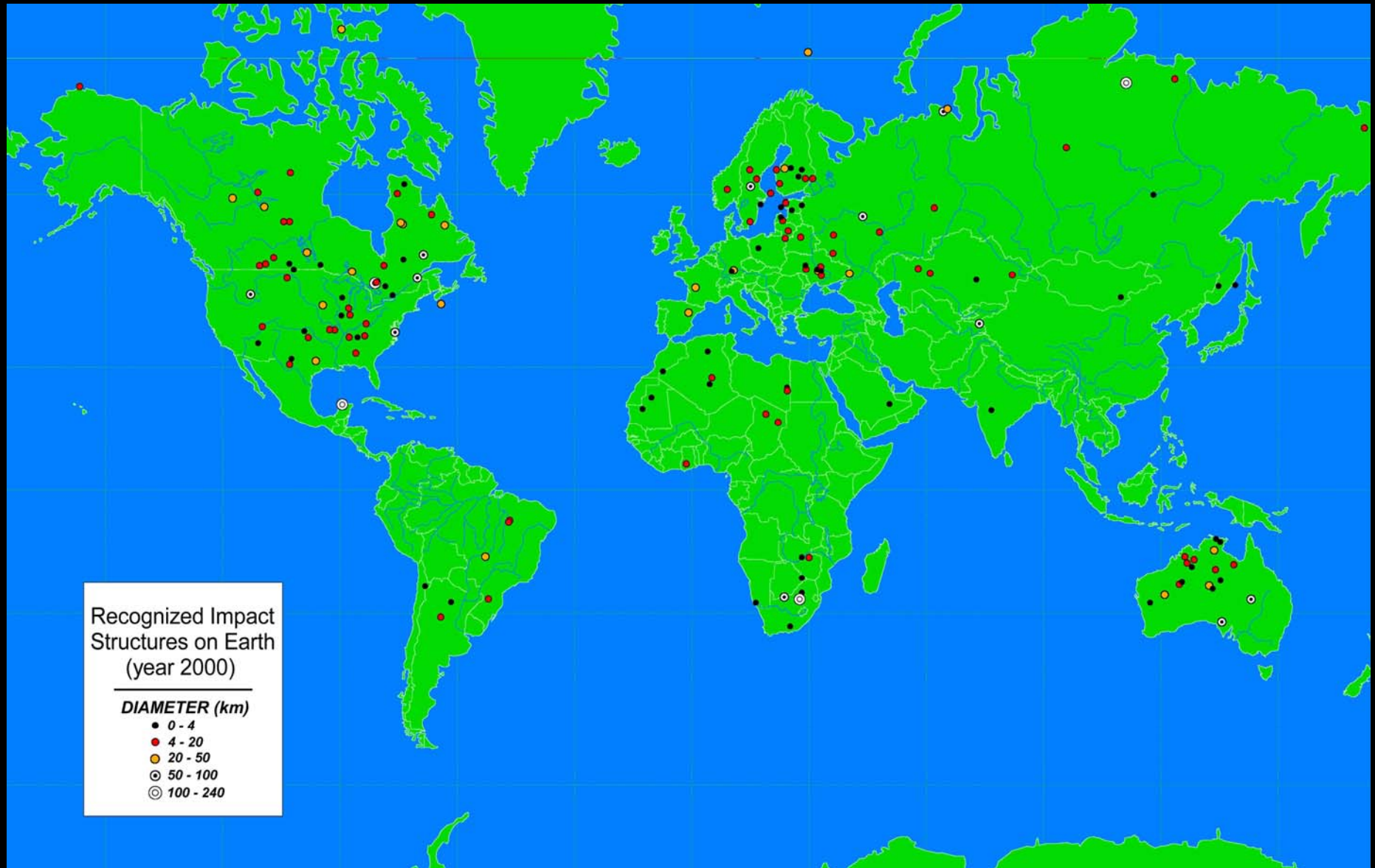


Grove K. Gilbert
(1843-1918)

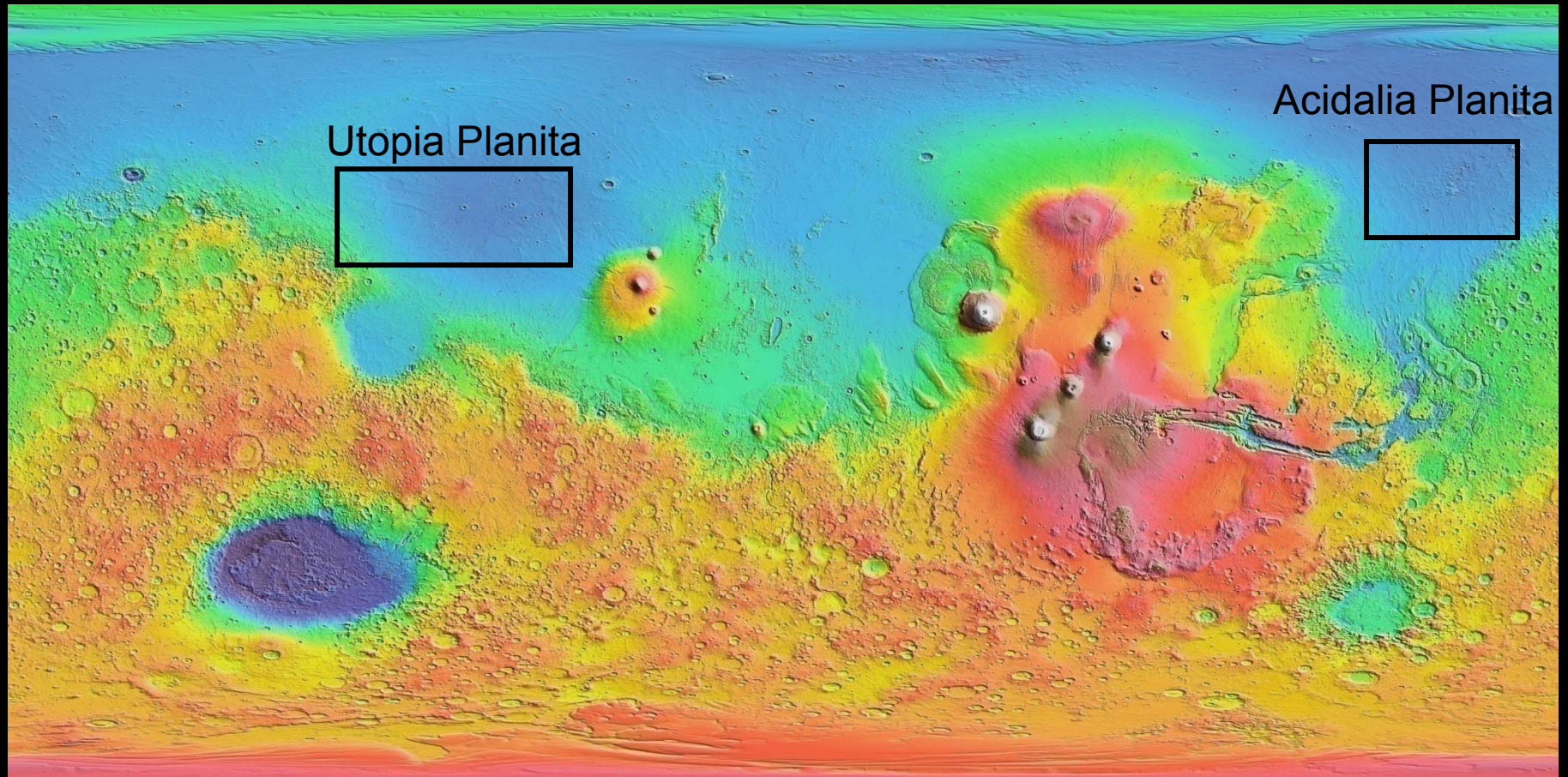


Robert S. Dietz
(1914-1995)

174 Identified Impact Structures On Earth



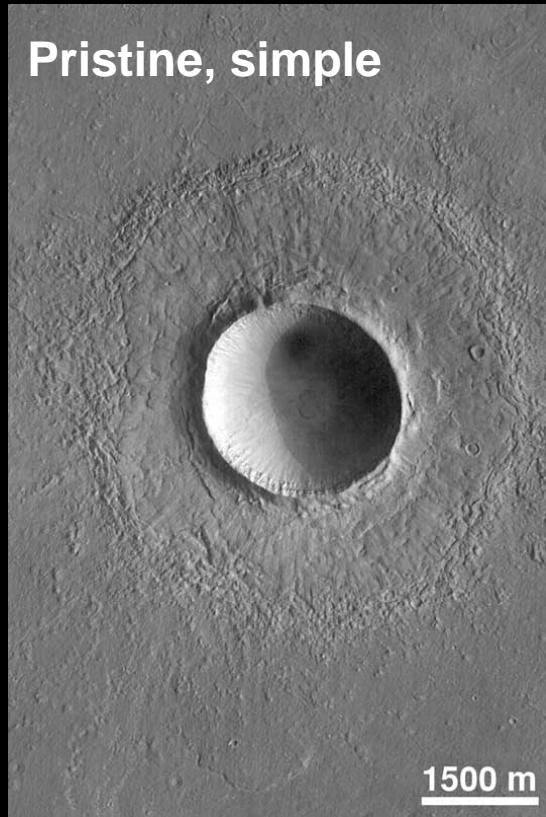
What can we learn by studying Impact Craters on Mars?



Discoveries from Mars

>40,000 crater \geq 5km

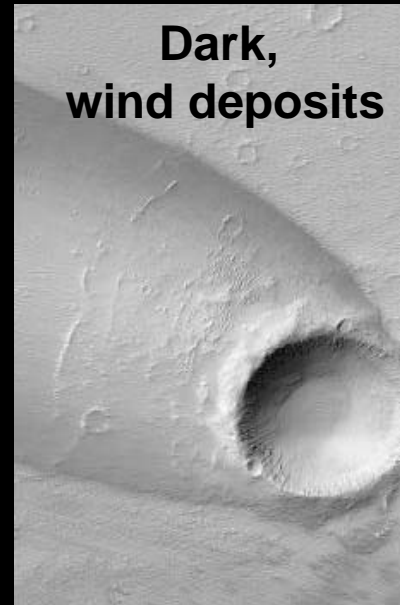
Pristine, simple



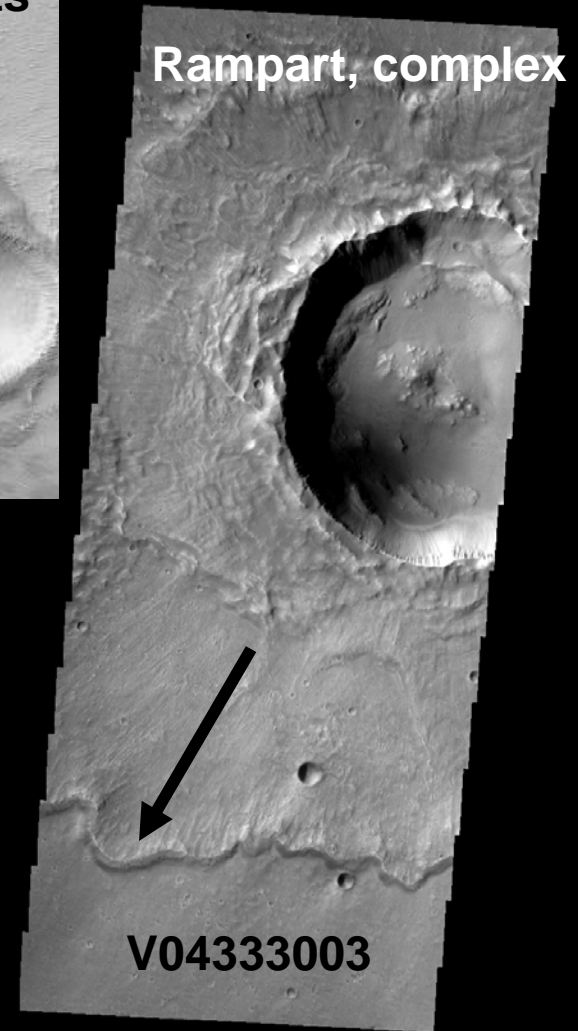
Oblique



Dark,
wind deposits



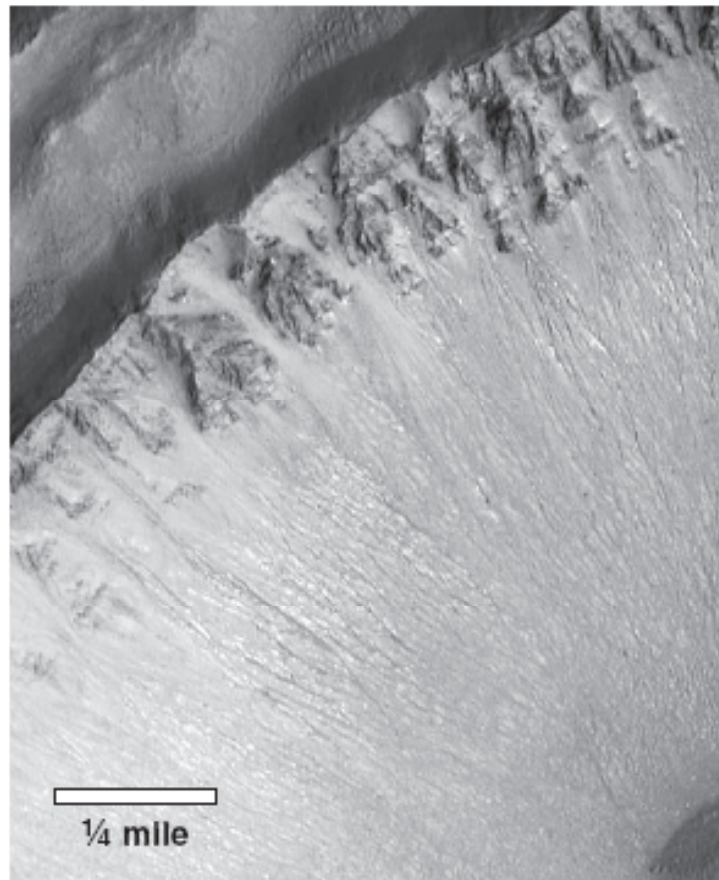
Rampart, complex



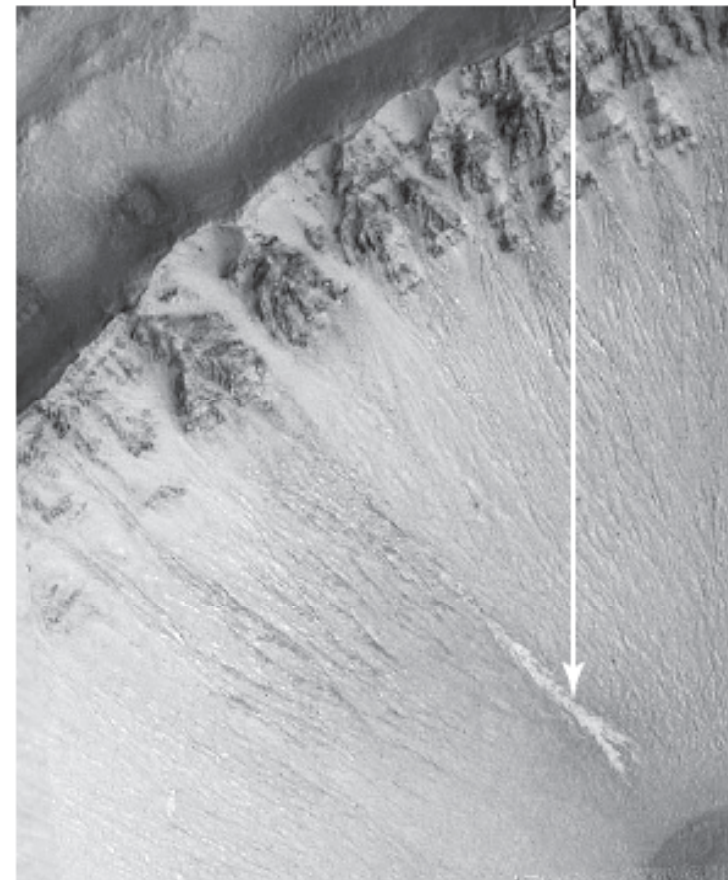
Martian Gully, Familiar Signs

Before-and-after pictures taken by NASA's Mars Global Surveyor spacecraft show what appear to be deposits of materials left by bursts of water flowing down the sides of gullies.

AUG. 1999



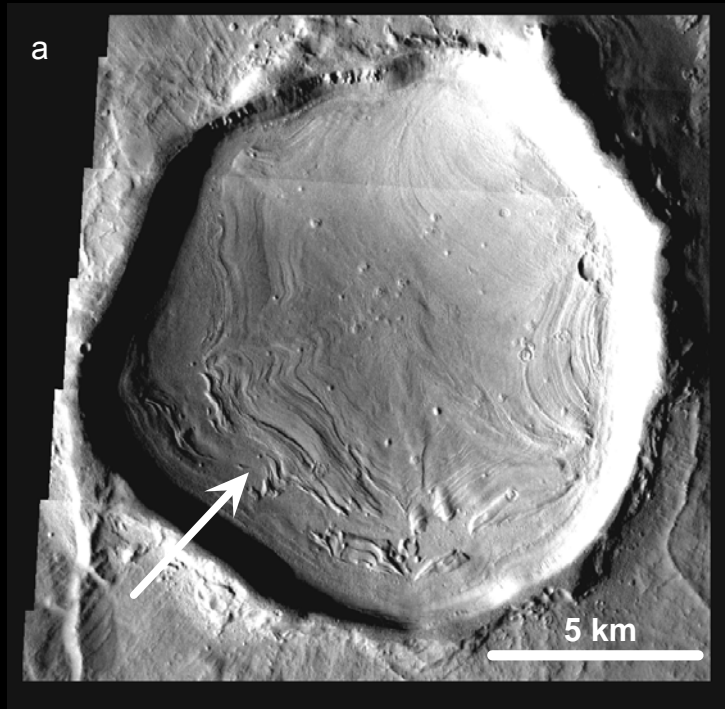
SEPT. 2005



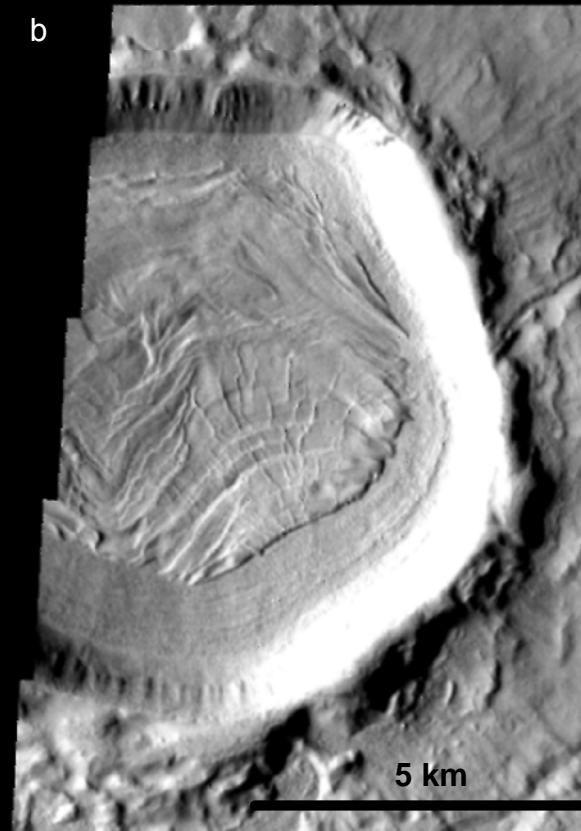
New deposit

The New York Times; photographs from NASA

Craters with Concentric Ridges



~13.2 km crater
at 35.1° N, 84.4° E
(section from V18095023)



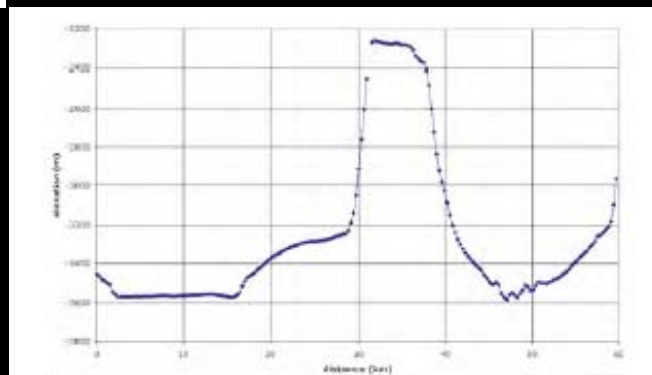
~9.2 km crater
at 33.1° N, 81.1° E
(section from V1908101)

Craters with Concentric Ridges

Tempe Fossae, Mareotis Fossae, Phlegra Montes, & Utopia Planitia - lack of craters in Equatorial Region ($\pm 30^\circ$)

Squyres 1979; Squyres and Carr 1986

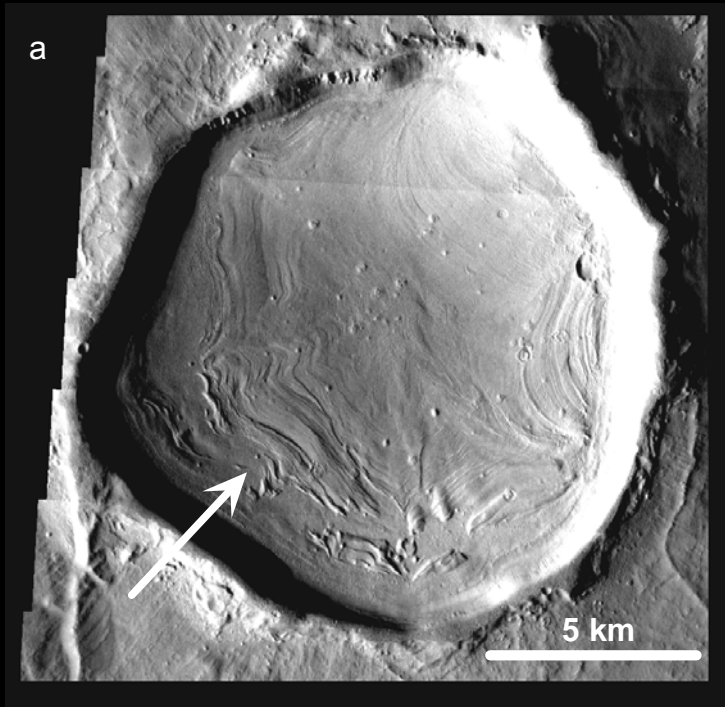
- Ice-rich mass wasting
- Evidence: occurrence and similarity to debris aprons; sharp break in slope between the rim and floor.



Zimbelmann et al. 1988

- Aeolian depositional model
- Evidence against ice-creep model: uniform layering; lack of flow outside of rim and around obstacles; small strain rates needed

Craters with Concentric Ridges

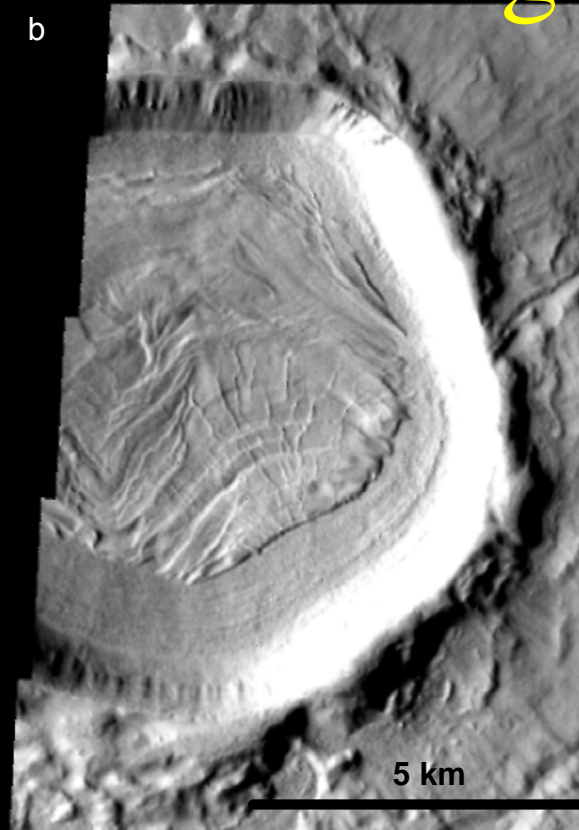


~13.2 km crater

at 35.1° N, 84.4° E

(section from V18095023)

11 separate concentric ridges, ~287 m
circular mounds, ~161-242 m



~9.2 km crater

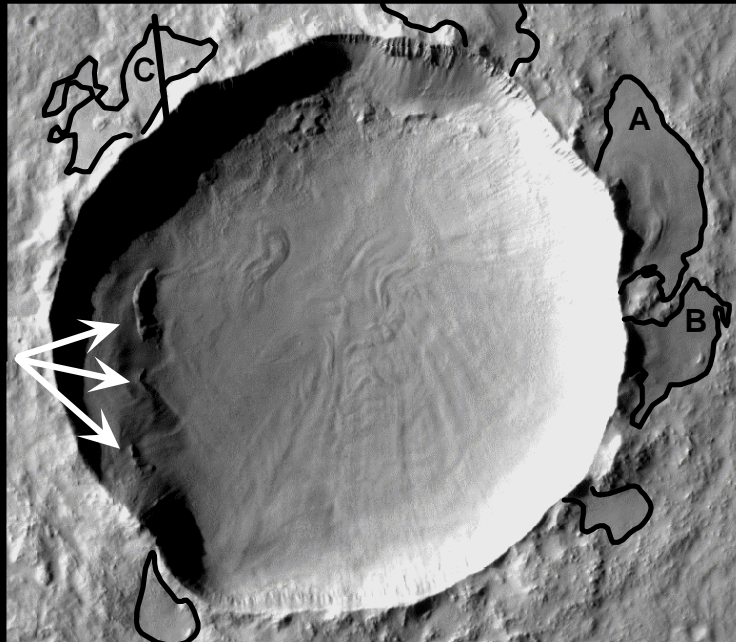
at 33.1° N, 81.1° E

(section from V1908101)

Web-like pattern perpendicular

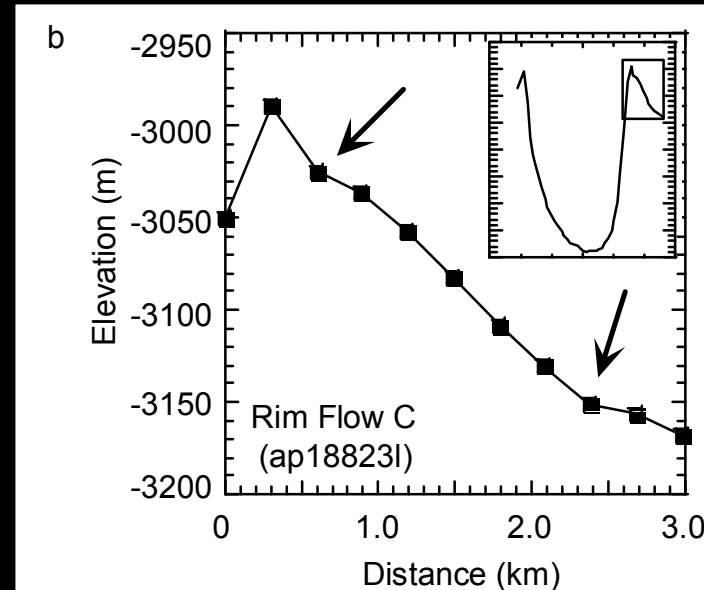
Wall slope for these craters typically ranges from ~4°-1°

Ice-Enhanced Mass Wasting?

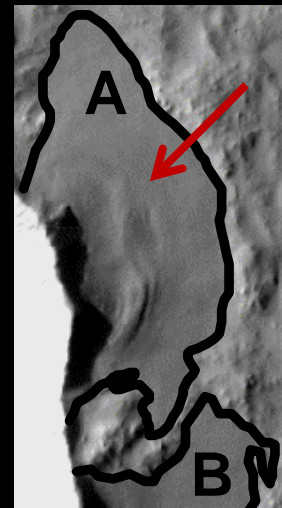


~12 km crater
at 36.0° N, 80.5° E
(section from V20354002)

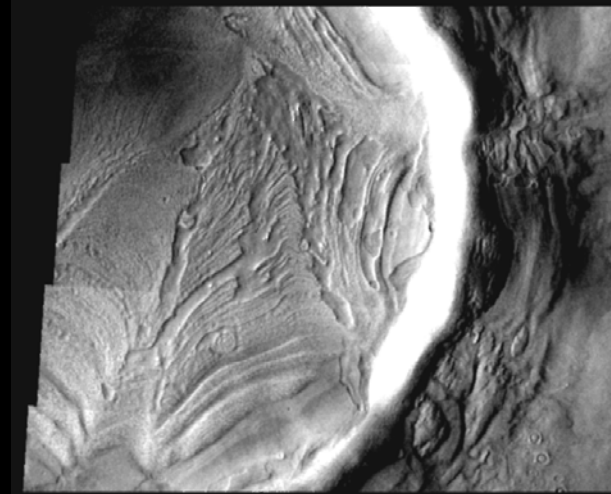
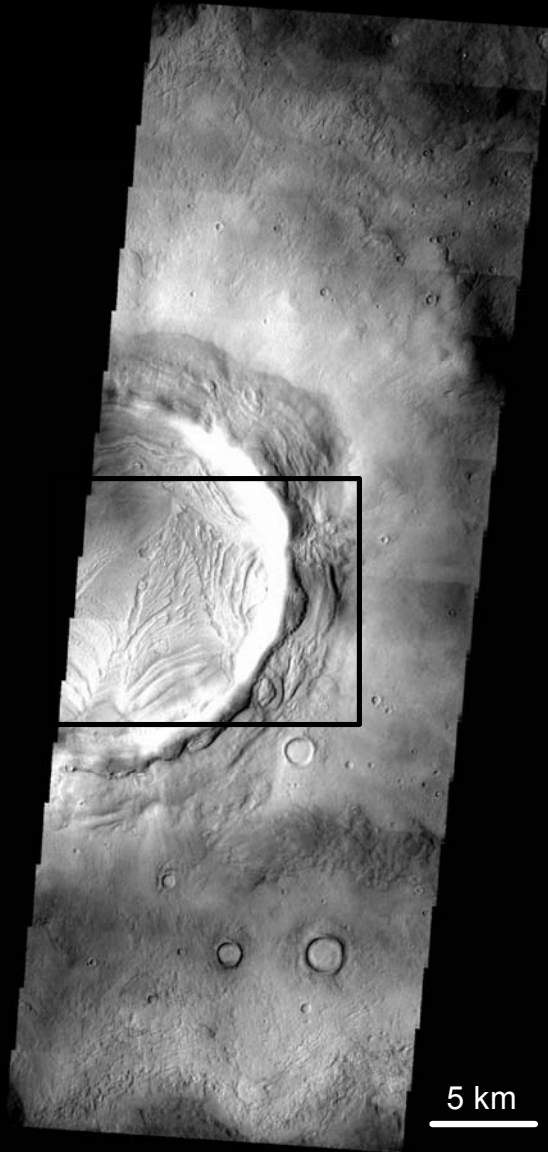
Crater fill material around obstacles
Flows originating at the rim with
compressional ridges around
obstacles - convex



Thickness: 126 m
length: 1.78 km



Craters Pitted-floor Texture



V0328003

~17 km Unnamed Crater
at 41.4° N, 87.7° E

Quasi-linear furrows or grooves
Length: ~2-6 km; Width: ~373 m

Zimbelman et al. 1988

Craters Pitted-floor Texture

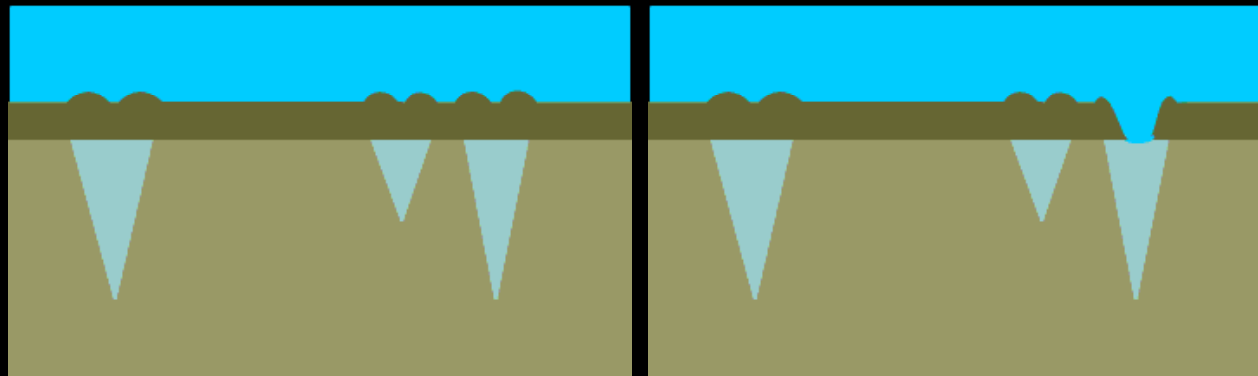
Kortenieniemi et al. (2005)

Soare and colleagues (2005)

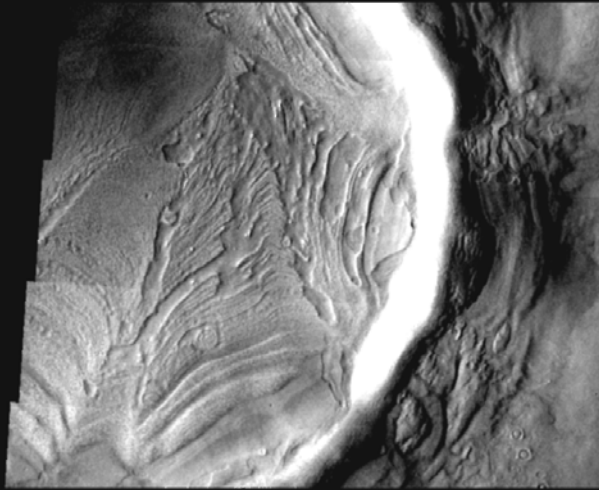
“Thermokarst” - due to obliquity changes

Earth: selective thawing of ground ice or permafrost

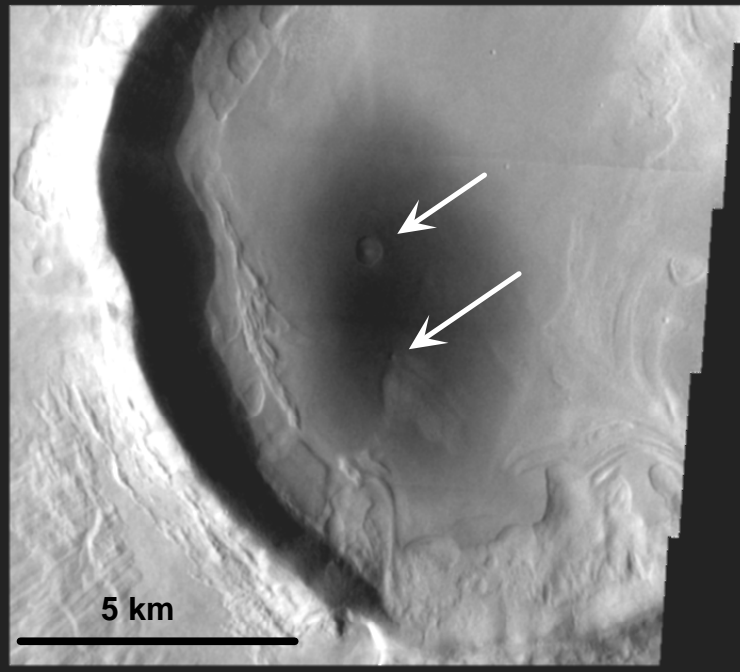
Mars: disturbance of the thermal equilibrium of the near-surface ground ice



Craters Pitted-floor Texture



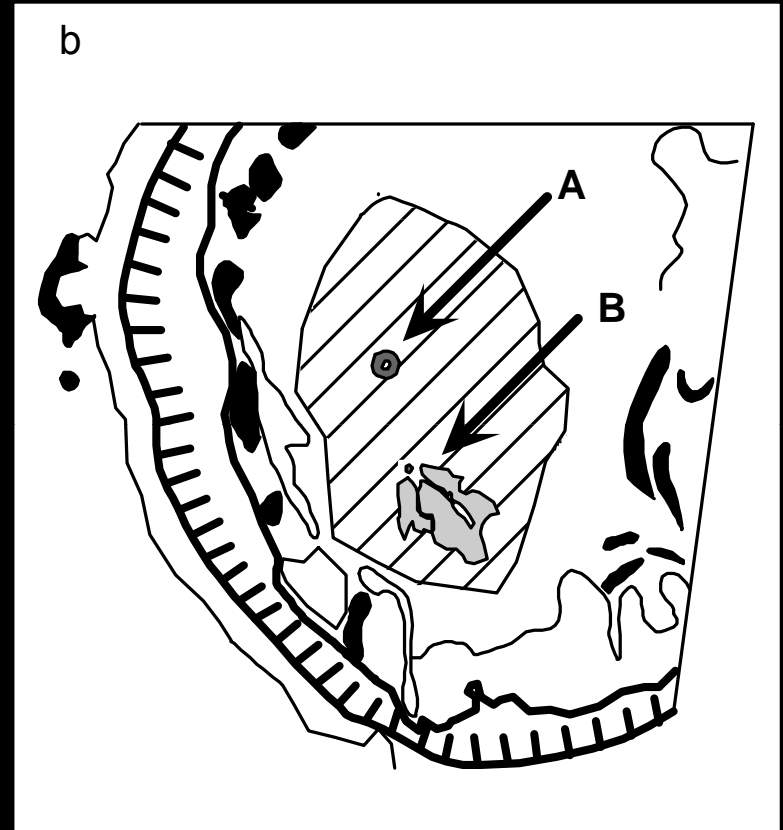
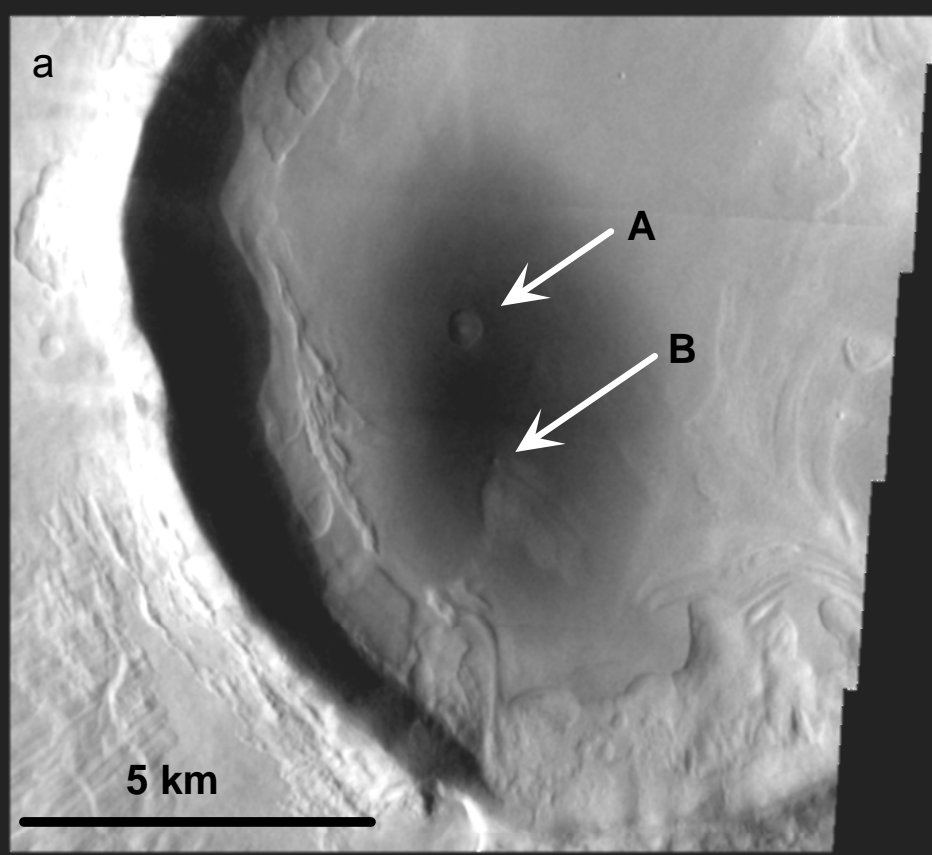
V0328003



V10457016

~15 km crater
at 40.9° N, 98.3° E
Deposits with associated vents

Thermokarst-related?



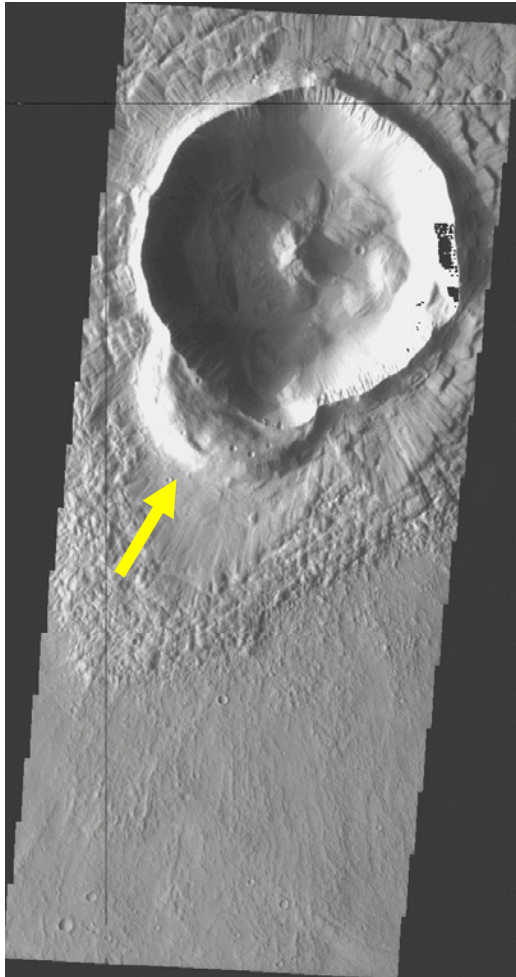
V10457016

Dark deposit: long axis 7.4 km and short axis 4.2 km in length
Light deposit: 3 lobes, extension of ~2.1 km South

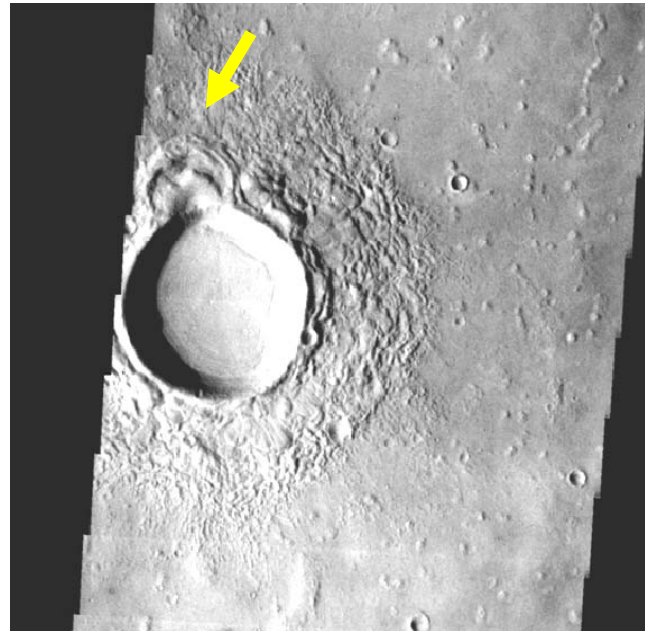
Aeolian Deflation Exposing Near-Surface Ground Ice

- First: removed the surface mixture of regolith and volatiles forming the dark deposit
 - possibly in a similar manner to that of the gas jets on the south polar cap (Hansen et al. 2007).
- Second: emanation of meltwater produced by thawing of the previously uncovered ground ice.
- Recent

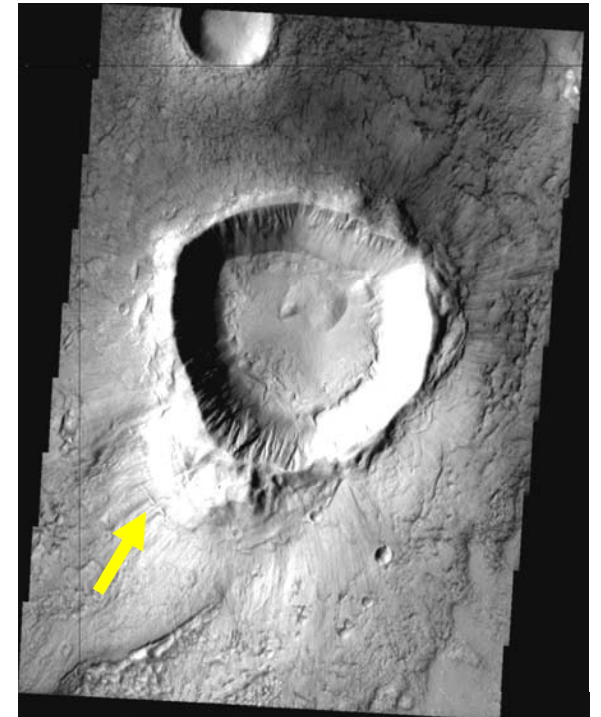
28.3 N, 116.7 E
14.9 km



31.2 N, 88.7 E
7.3 km



38.0 N, 338.8 E
11.6 km



Distance 4.5 km

2.9 km

4.6 km

Bulge R 4.5 km

1.8 km

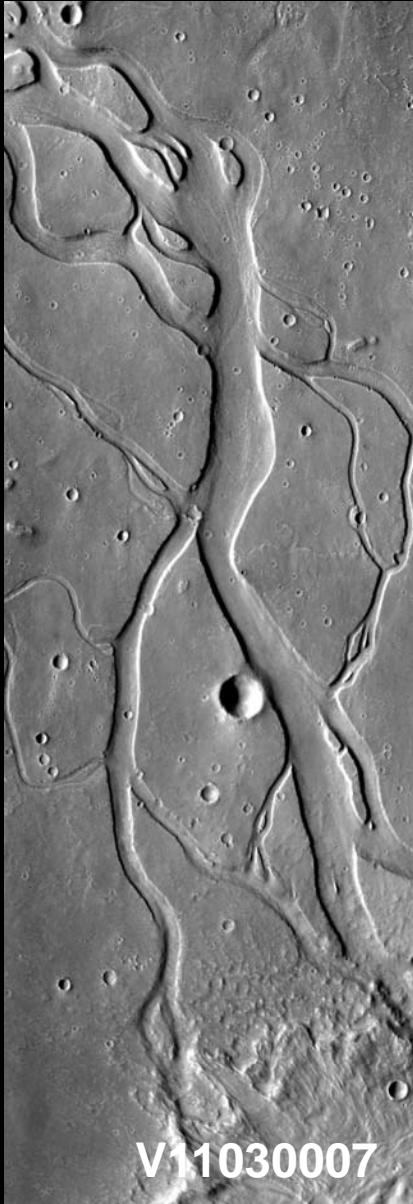
4.6 km

Ratio 0.6 R

0.8 R

0.6 R

Discoveries from Mars



Hebrus Vallis

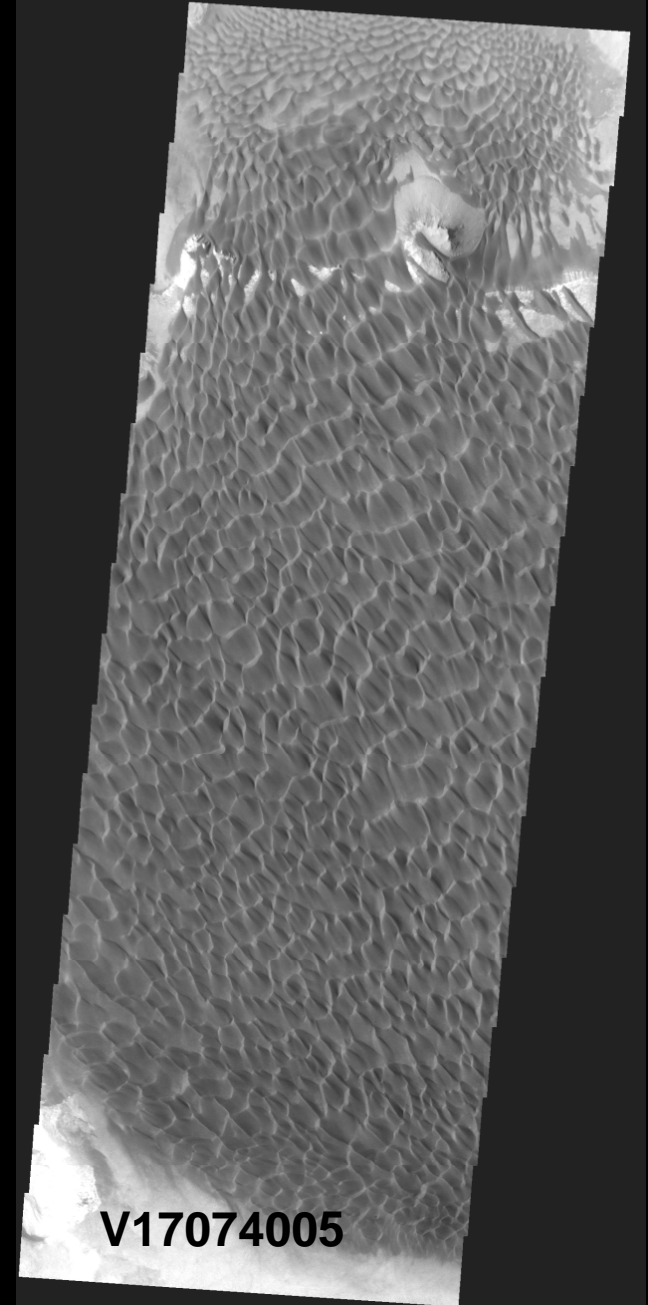
- Channel system
- Originates close to the base of the Elysium volcanic complex
- Criss-crossing of channels not typical for fluvial systems

**THEMIS Visible Images
~19 m/pixel**

Discoveries from Mars

Noachis Terra

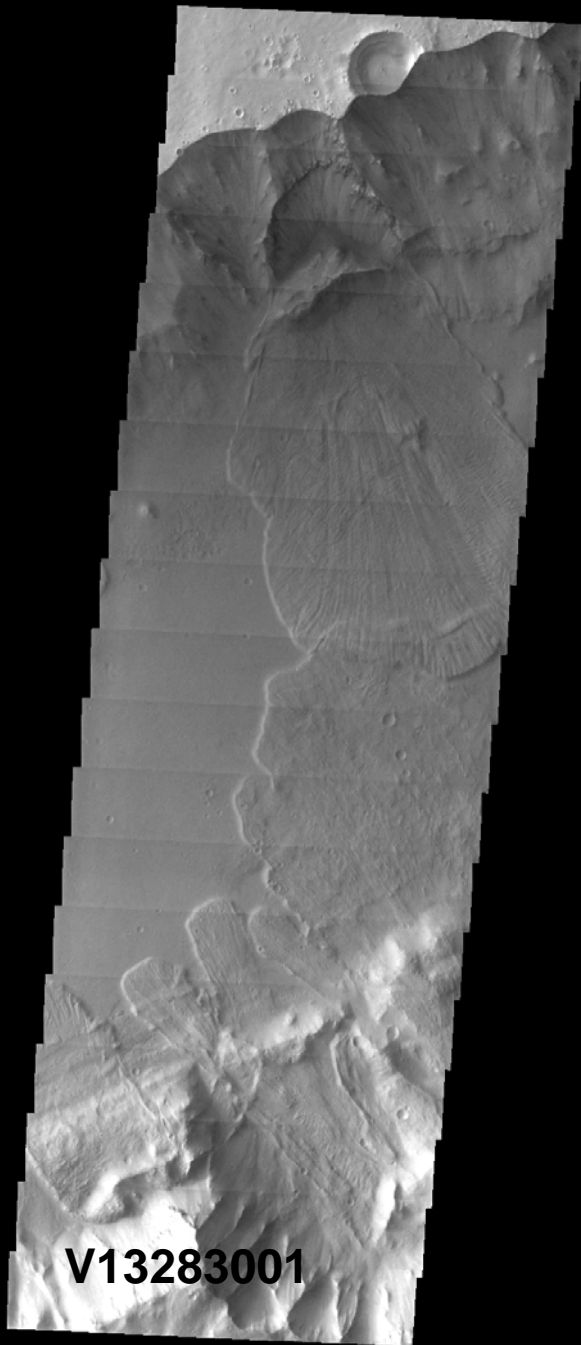
- Dune field is located on the floor of Rabe Crater.
- Dunes' height: 150 to 200 meters



Discoveries from Mars

Eos Chasma

- Several landslides
- Northern wall has failed in a upside-down bowl shape



V13283001

Discoveries from Mars

Dalmatian terrain

- Dark spots are dark dunes in depressions where the ice has defrosted to reveal underlying material

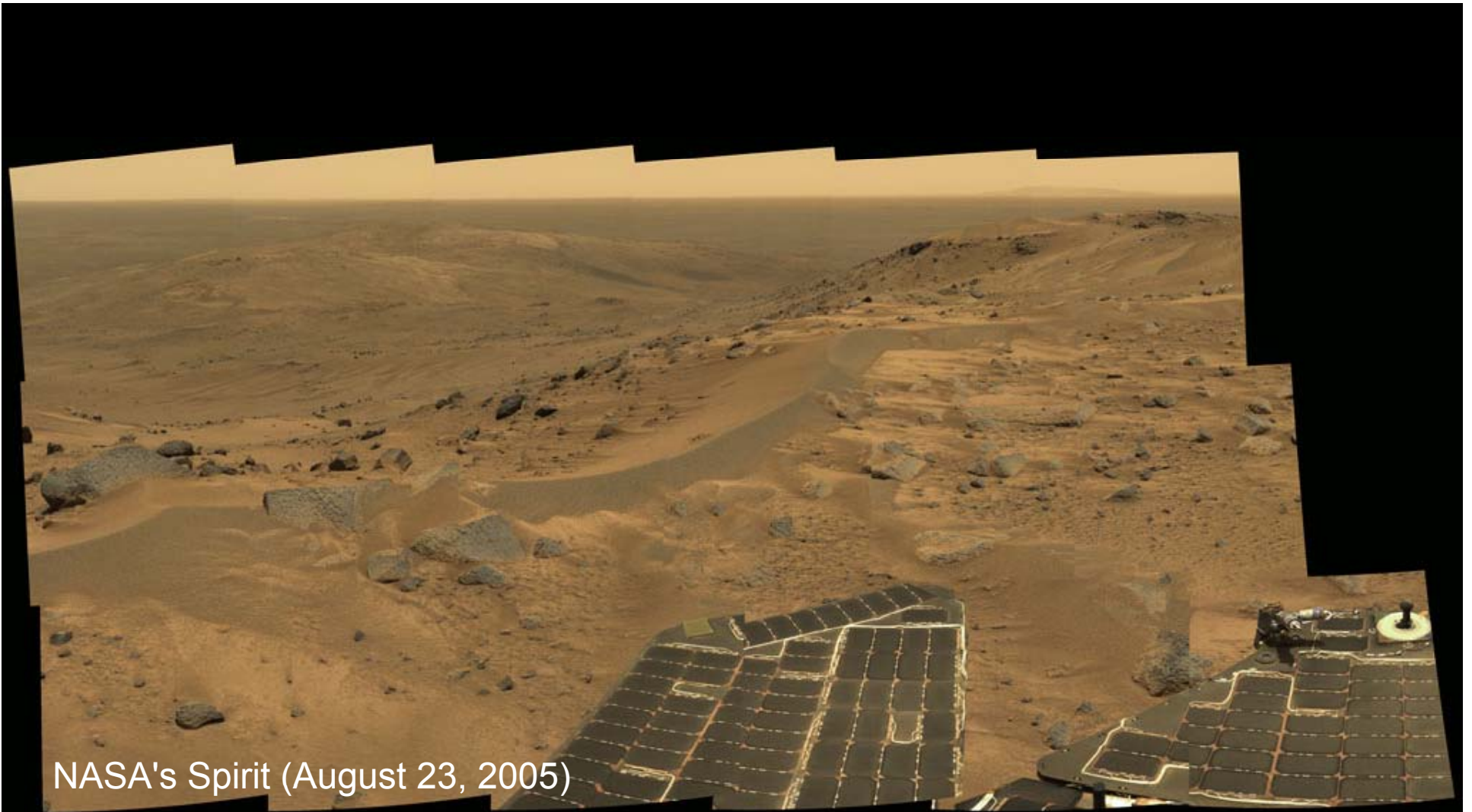


V06403009

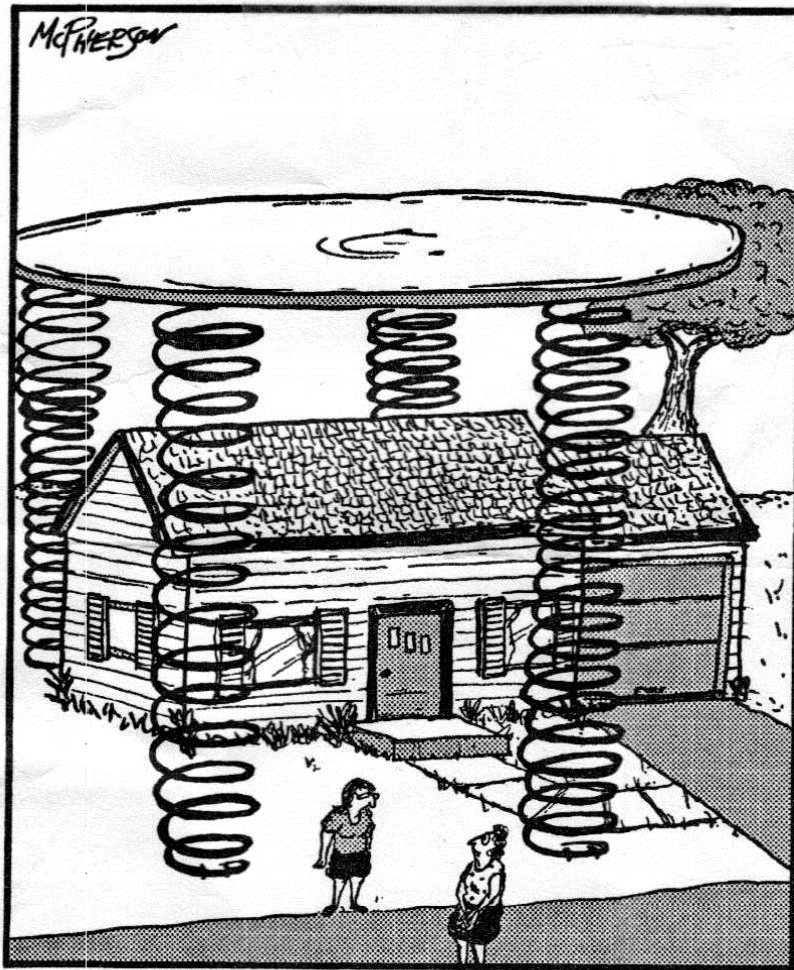
Summary & Conclusions

- Evidence for ice-enhanced mass-wasting origin for concentric fill material: flows coming from the rim crest, convex shape of the outflows, and flow around obstacles.
- Dark deposits Pitted-Floor Craters: formation of deposits in recent times suggests they are related to aeolian processes rather than a period of high obliquity.
- THEMIS images favor an ice-enhanced origin for the features
- The vast majority of craters displaying anomalous landforms studied are located within Utopia Planitia.





NASA's Spirit (August 23, 2005)



"My husband has a morbid fear of asteroids."

**Close
to
Home**

Thursday

7

JUNE