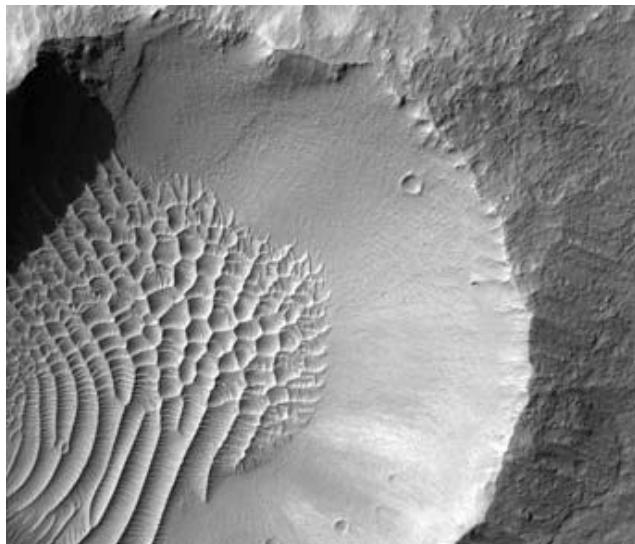
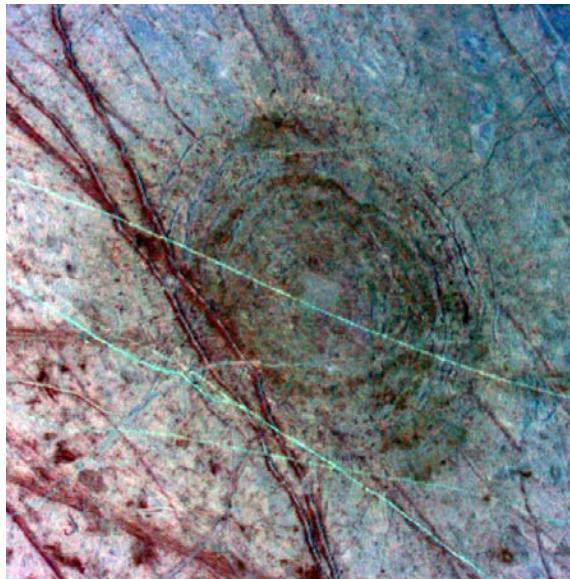
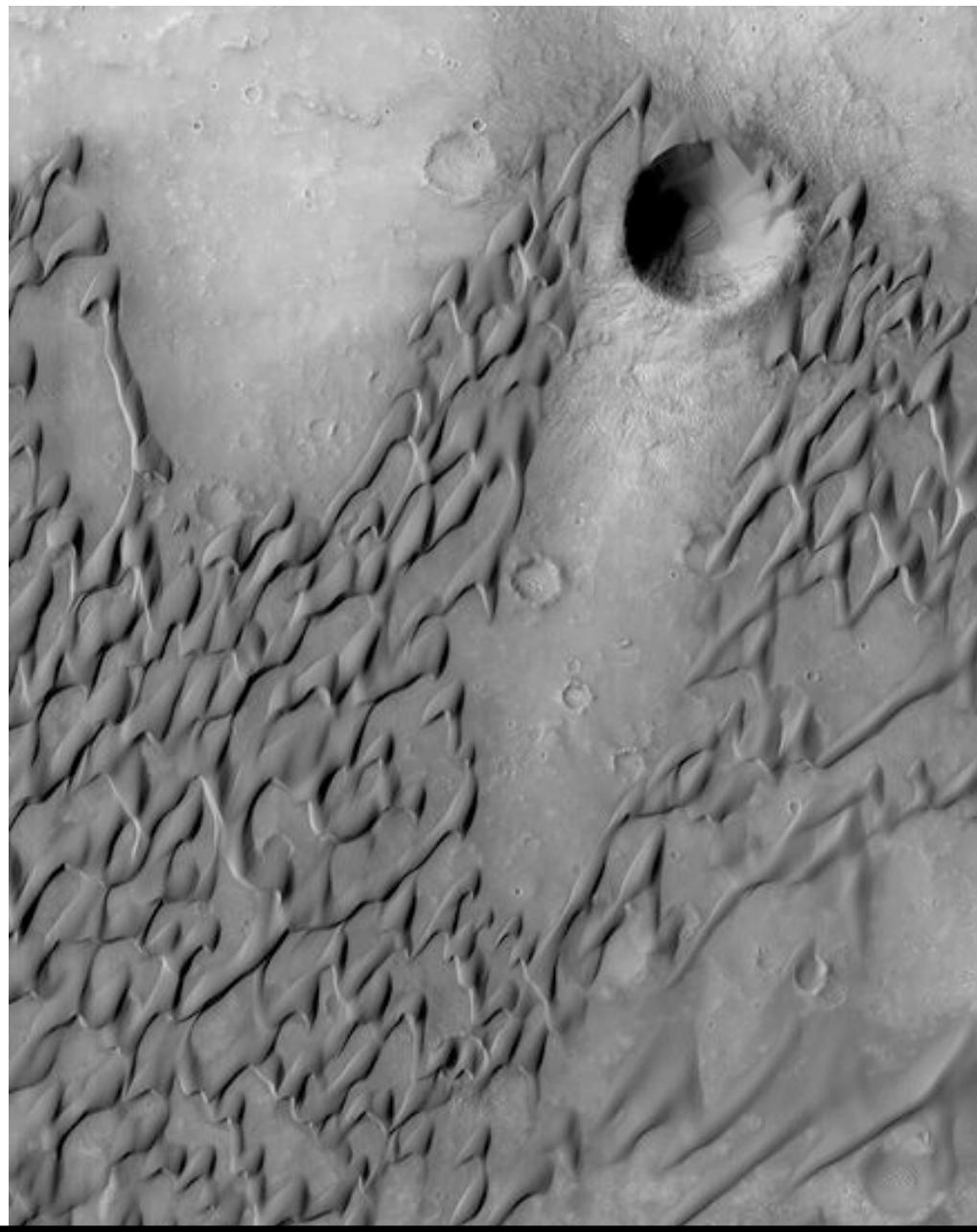


Planetary Surface Processes

Cratering
Gravity
Tectonics
Volcanism
Winds
Fluvial
Glacial
Chemical
weathering

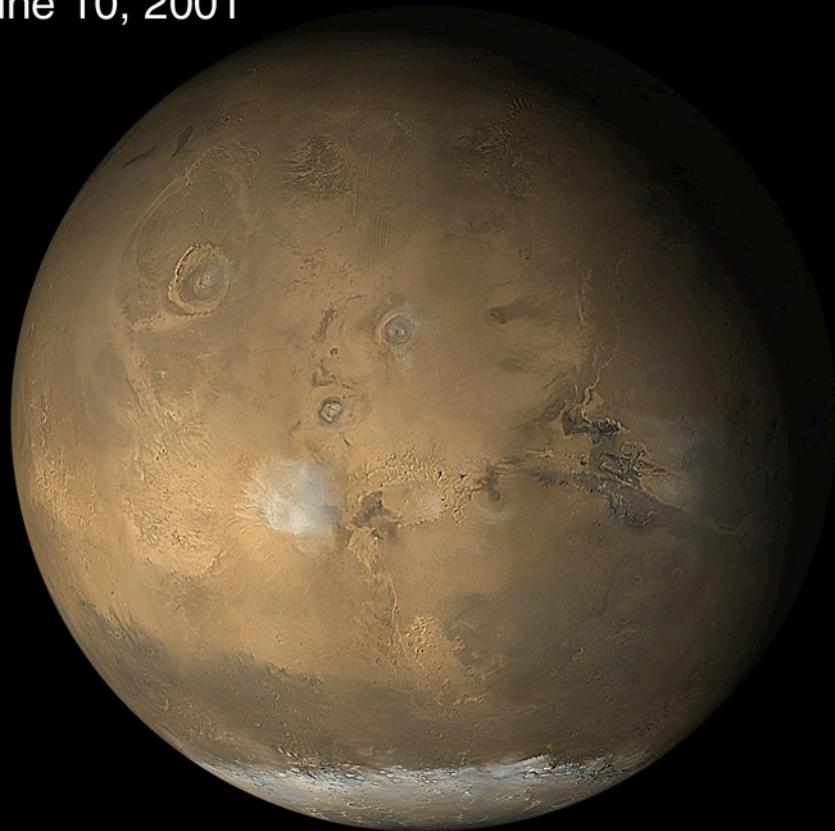


Aeolian Processes

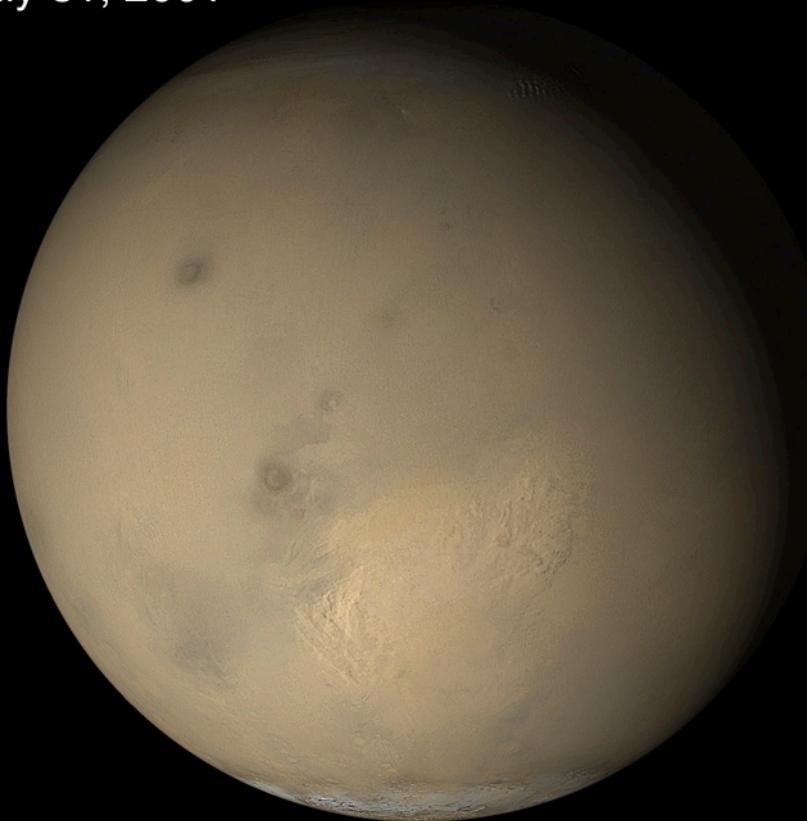


Mars: Global dust storms

June 10, 2001



July 31, 2001



Mars: dust storm viewed from the surface

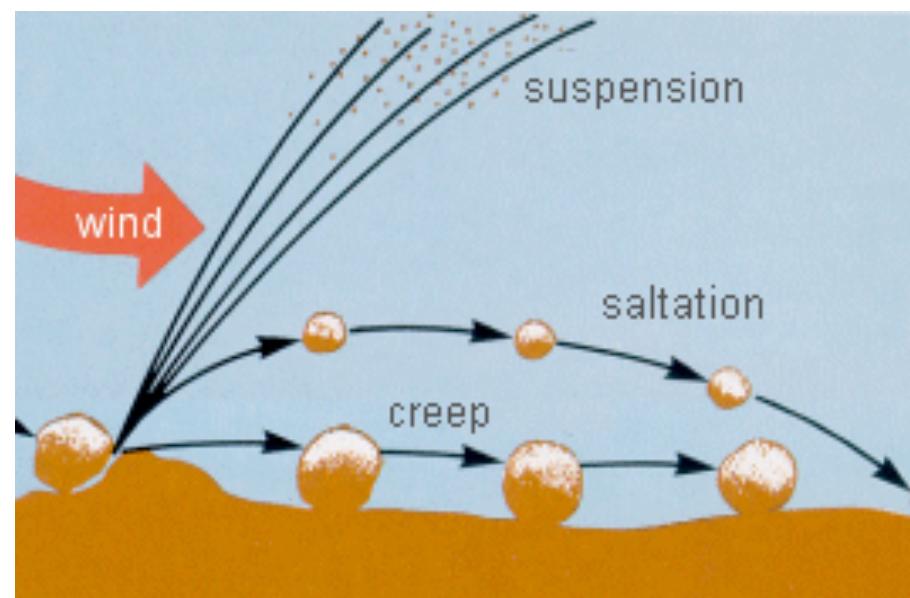


Aeolian Processes: Size-dependent

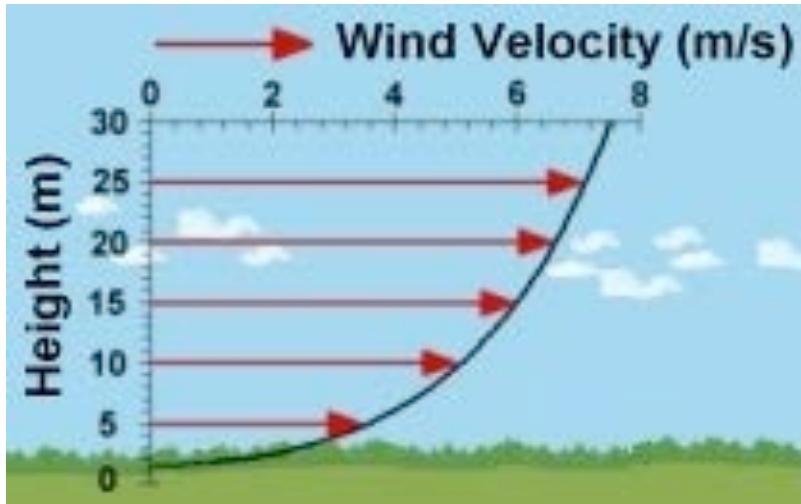
Size Wentworth Size Class Sediment/Rock Name

256 mm	Boulders	Sediment: GRAVEL
64 mm	Cobbles	Rock RUDITES: (conglomerates, breccias)
4 mm	Pebbles	
2 mm	Granules	
1 mm	Very Coarse Sand	Sediment: SAND
1/2 mm	Coarse Sand	Rocks: SANDSTONES (arenites, wackes)
1/4 mm	Medium Sand	
1/8 mm	Fine Sand	
1/16 mm	Very Fine Sand	
1/256 mm	Silt	Sediment: MUD
	Clay	Rocks: LUTITES (mudrocks)

- Dust grains via suspension
- Gravel via creep
- Sand grains via saltation



Threshold wind speeds



- Wind varies with height:
 $u \approx 2.5 u_* \ln(z/z_0)$
 u_* wind friction speed, z_0 aerodynamic roughness (\sim mm for sand)
- Threshold speed for saltation:
 $u_{*t} \approx \{.0123(\rho_p gd/\rho + 3 \times 10^{-4}/[\rho d])\}^{0.5}$
 ρ_p particle density, d diameter, ρ atm. density

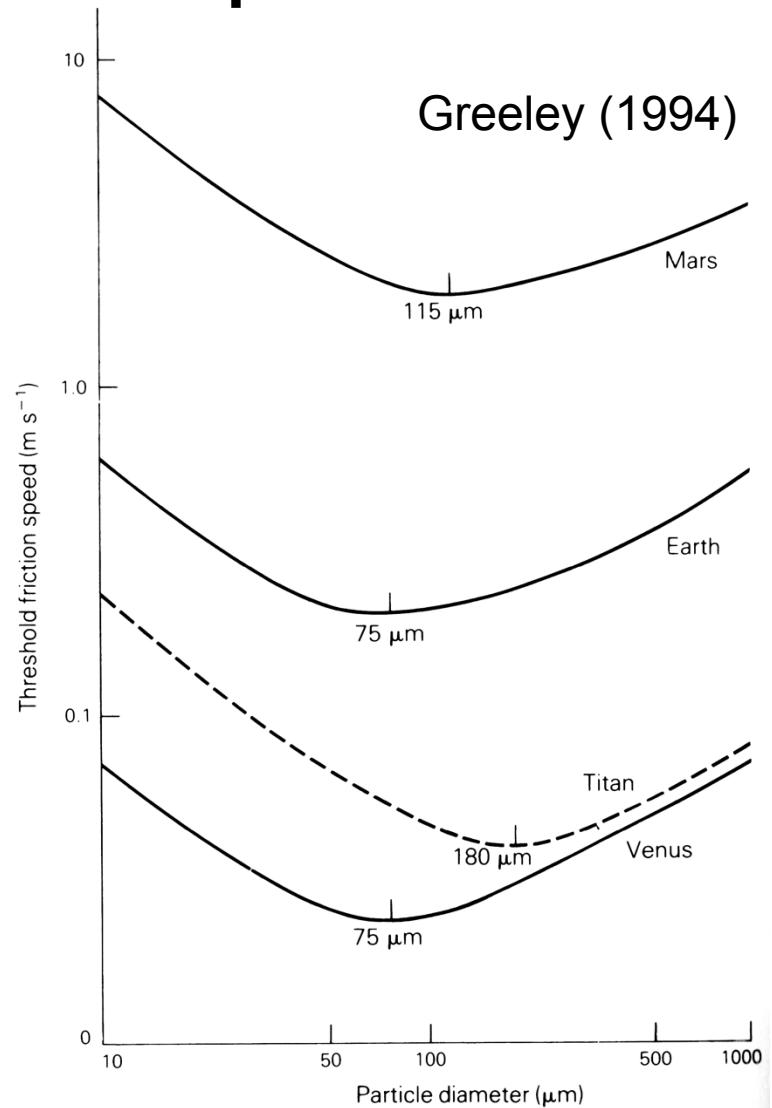
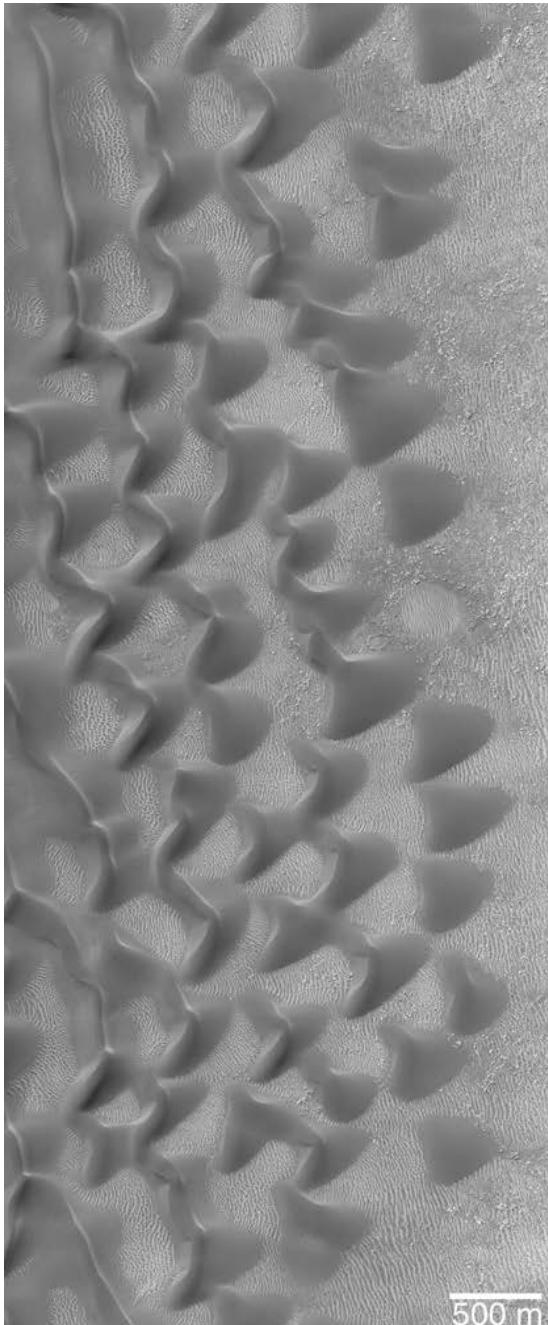
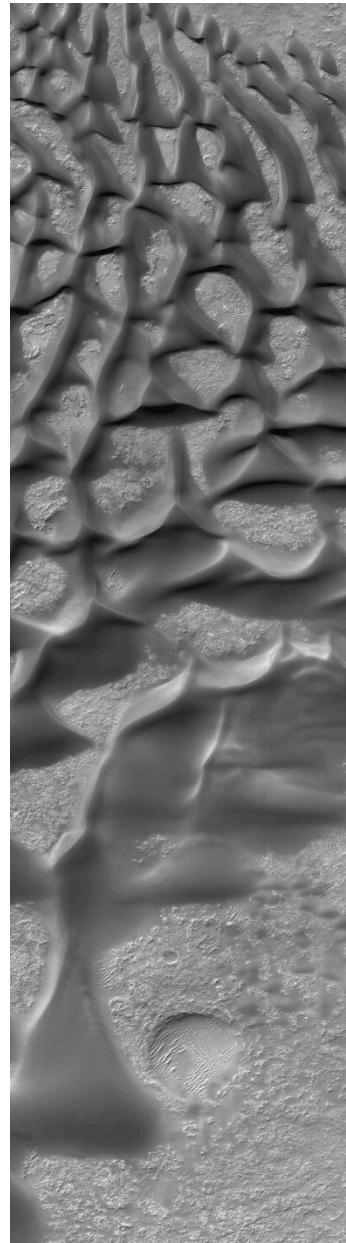
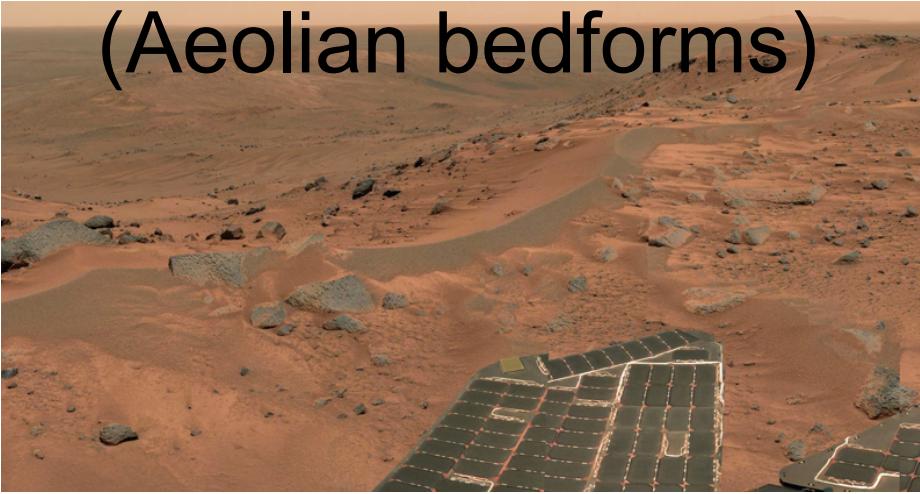


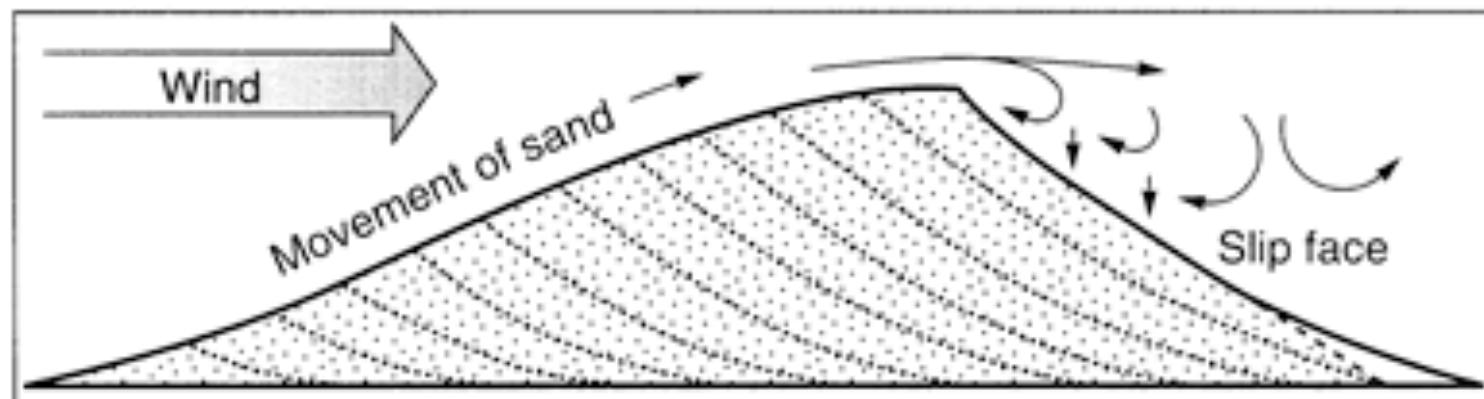
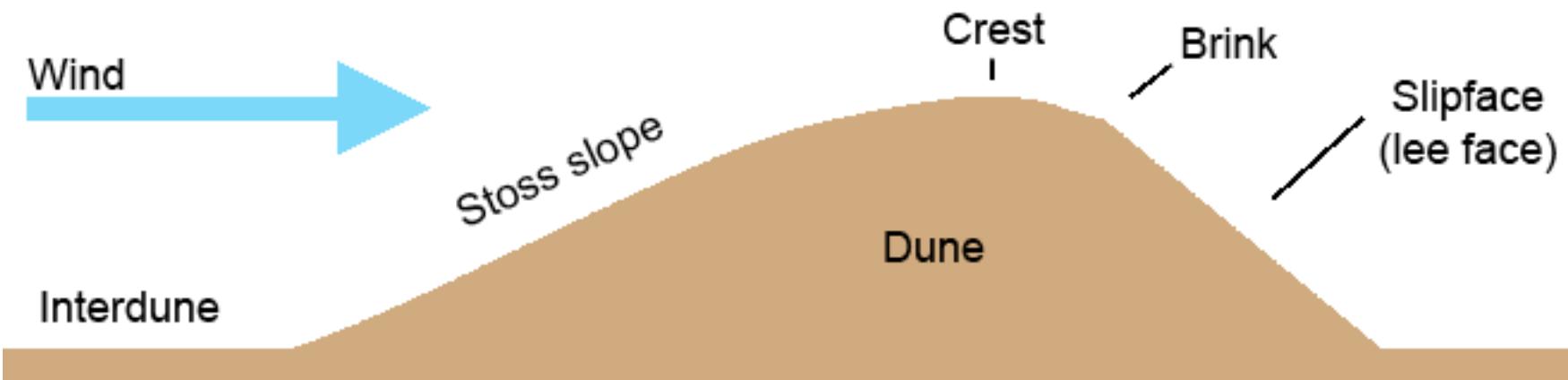
Figure 3.36 Diagram showing the minimum threshold friction speed (a function of wind speed) required to move particles of different sizes on Mars, Earth, Titan and Venus; note that as the atmospheric density decreases from Venus to Mars, minimum winds needed to set particles into motion increases.

Dunes and ripples

(Aeolian bedforms)

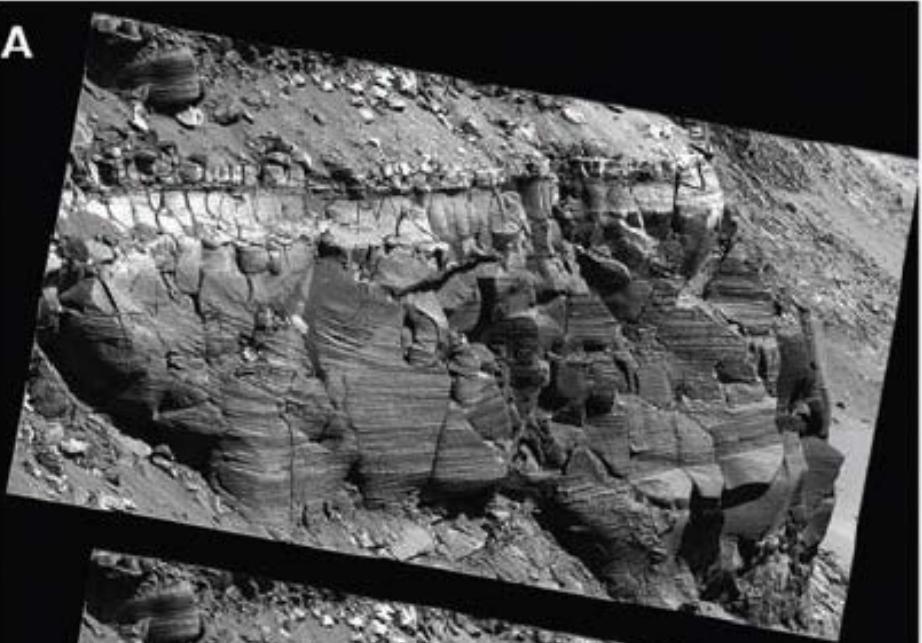


Anatomy of a dune

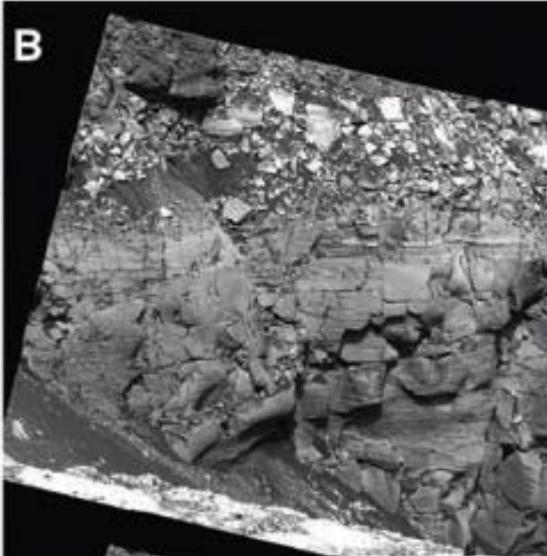


Ancient dunes on Mars

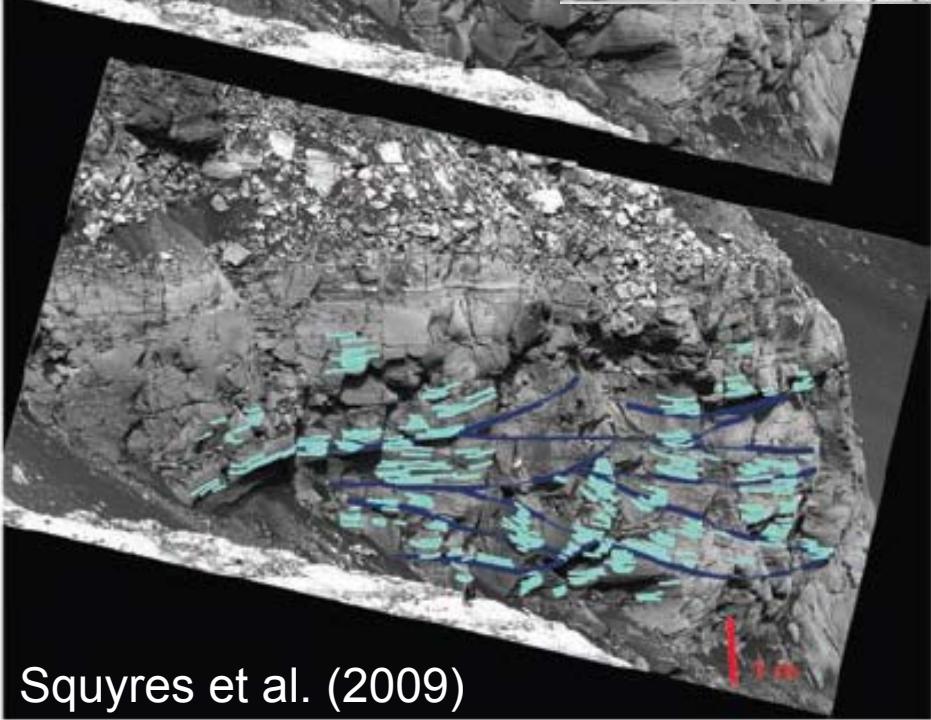
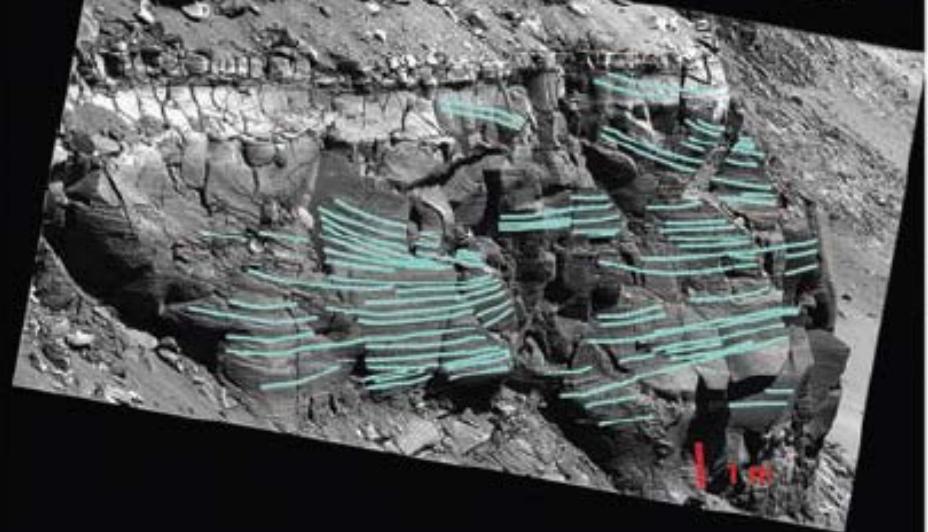
A



B

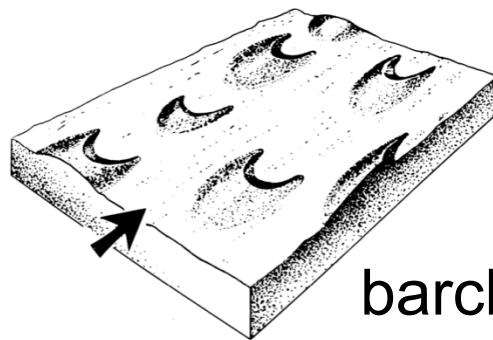


Cross beds

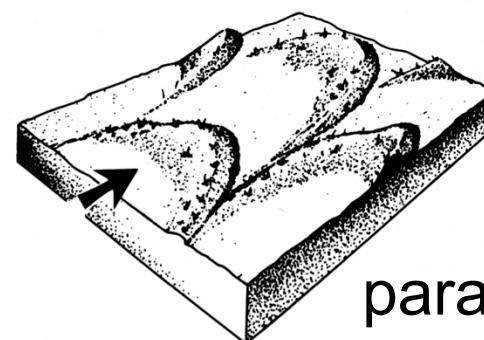


Squyres et al. (2009)

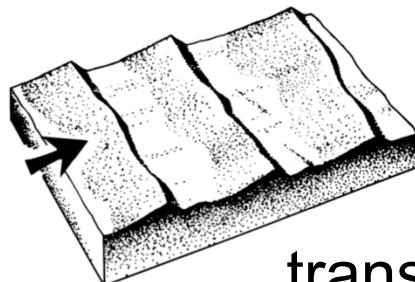
Dunes take many forms



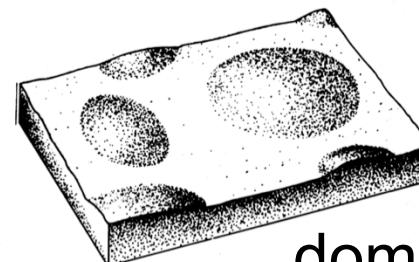
barchan



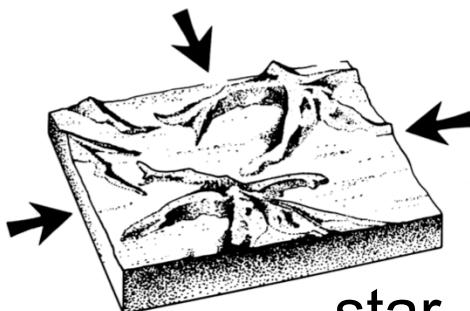
parabolic



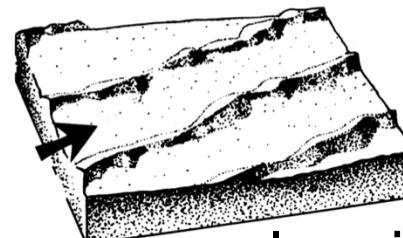
transverse



dome



star



longitudinal

Greeley (1994)

Planetary dunes

Mars



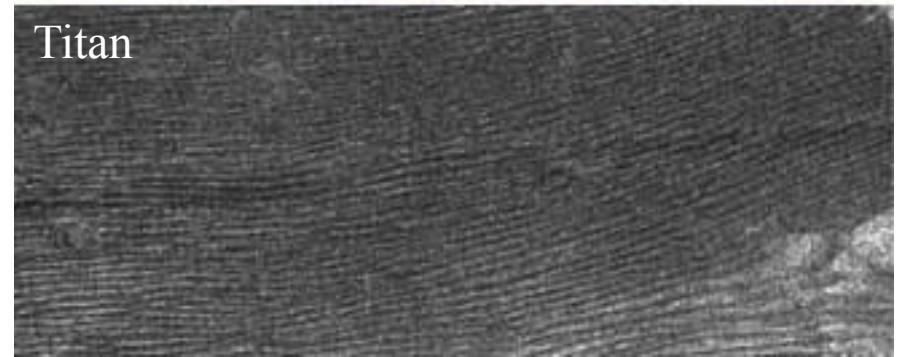
Mars



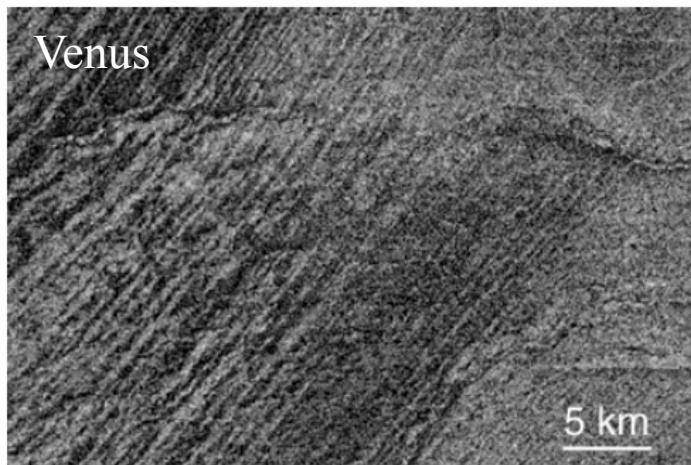
Longitudinal dunes (Earth)



Titan



Venus



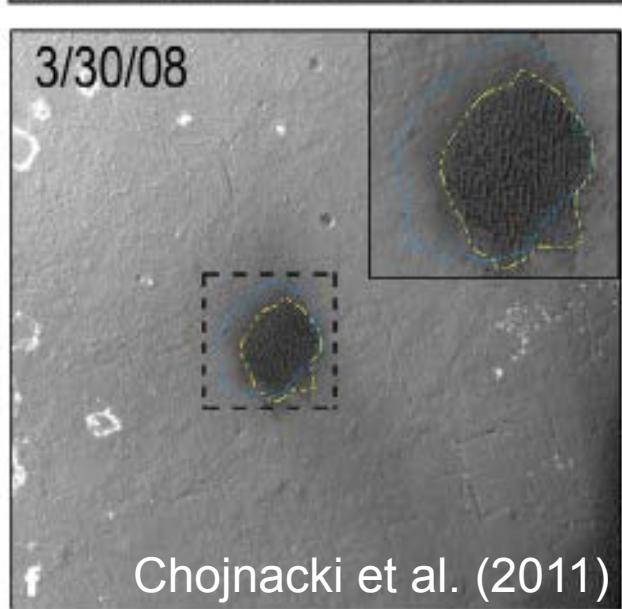
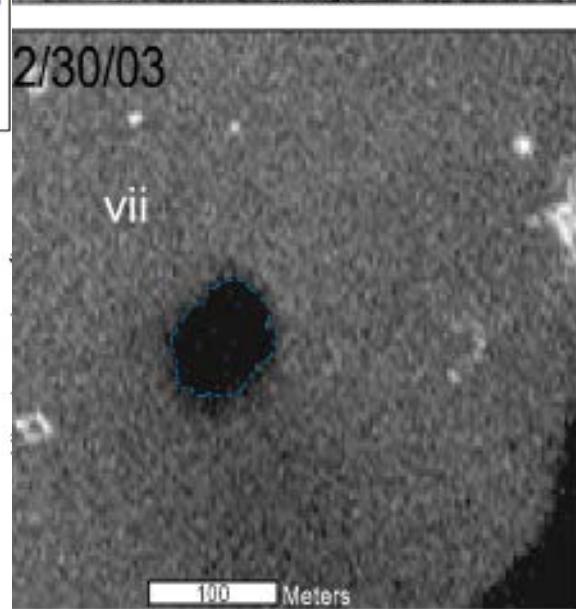
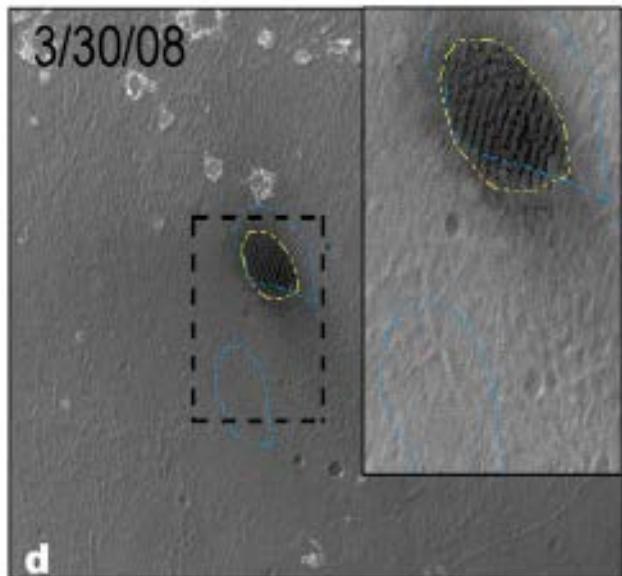
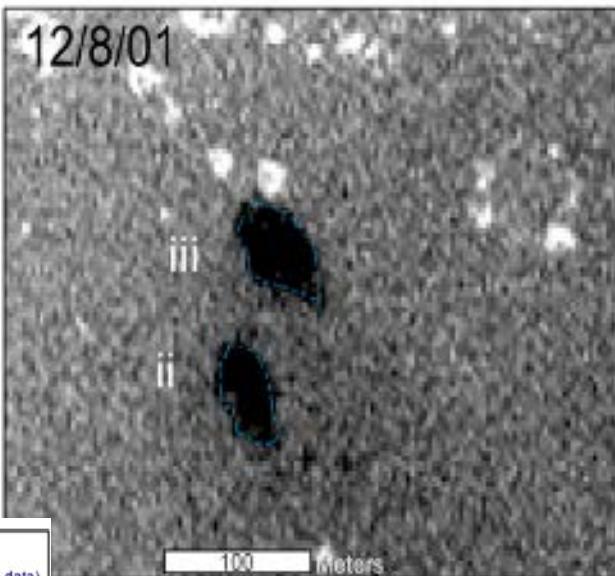
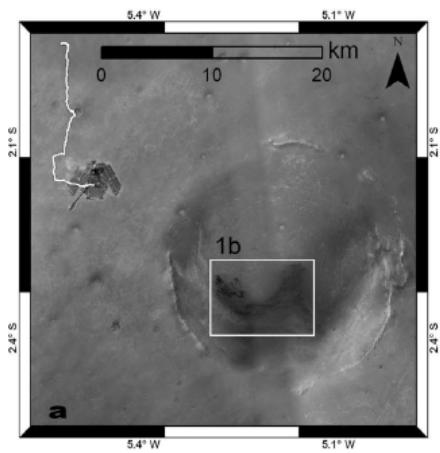
5 km

Sand movement on Mars

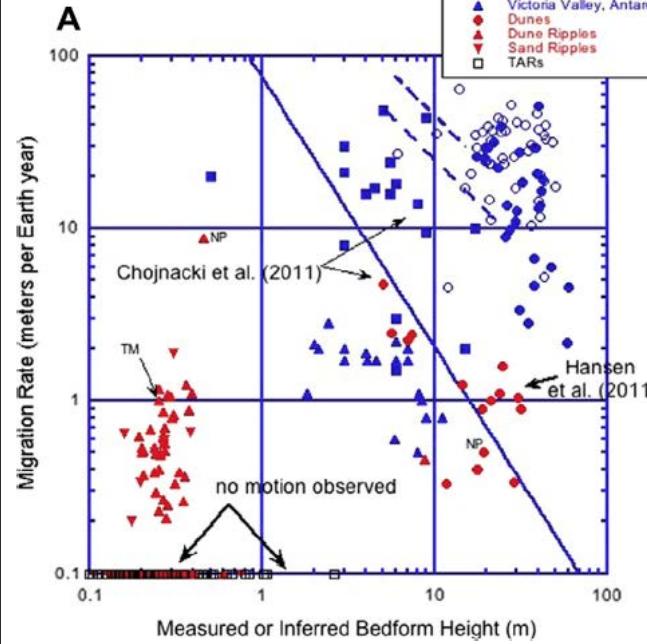


Sullivan et al. (2008)

Sand movement at Endeavour crater



Bridges et al. (2013)

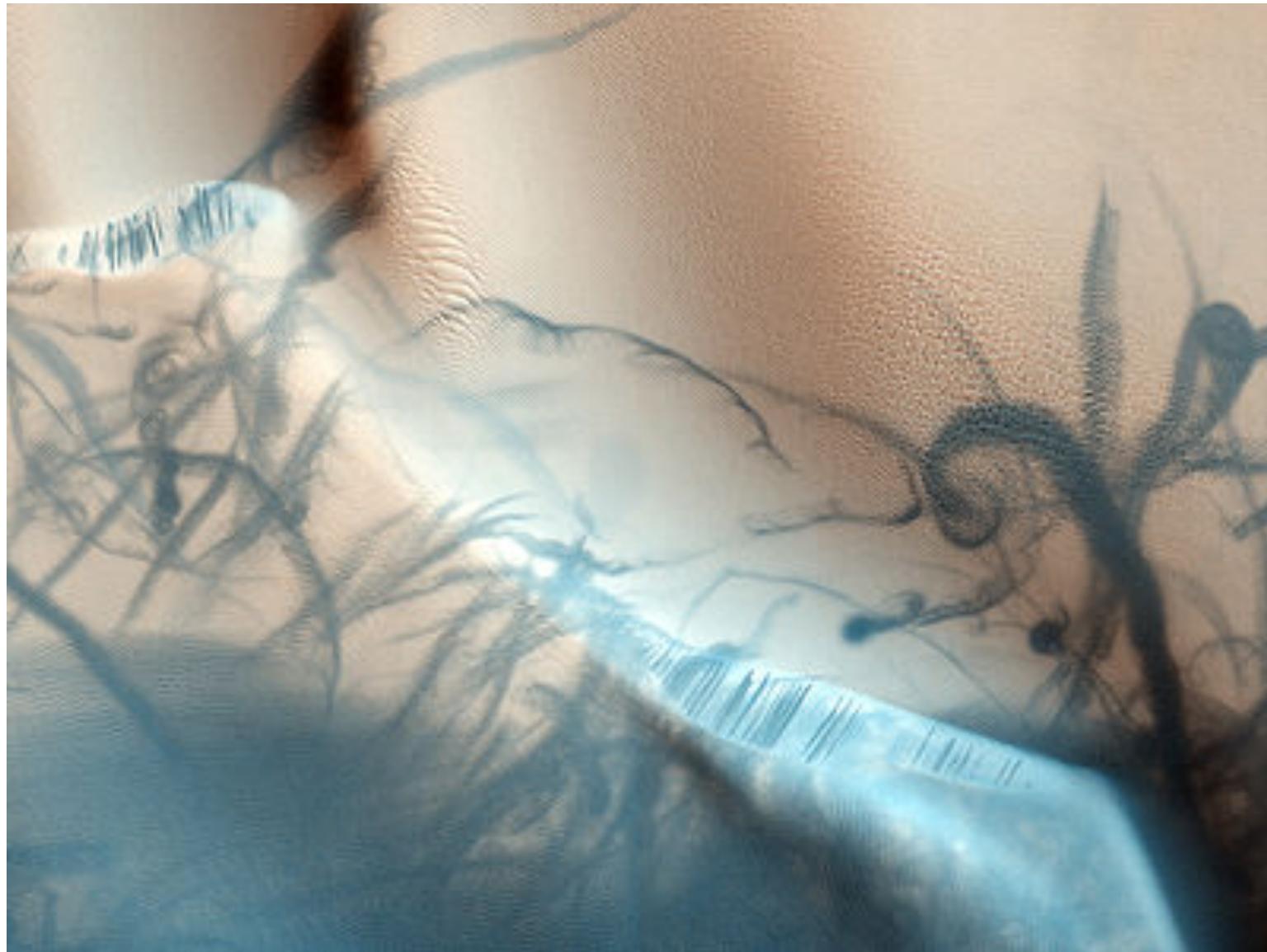


Phoenix Public Release Image

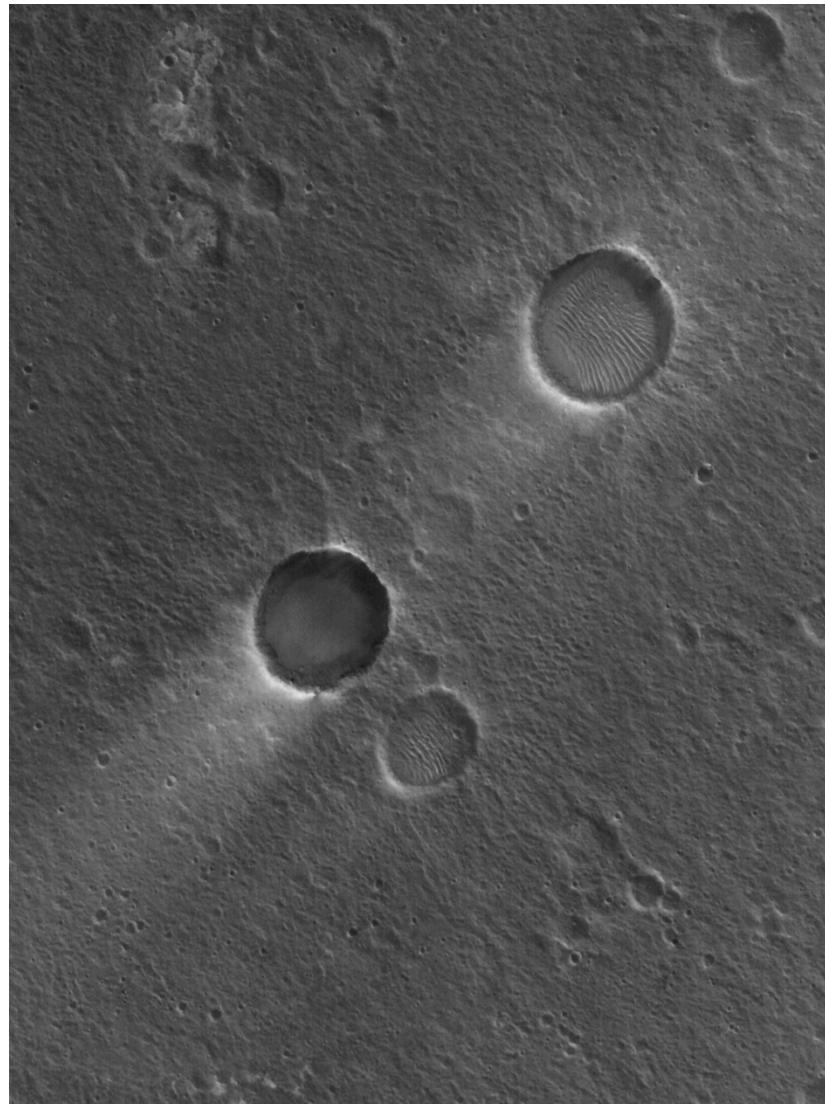
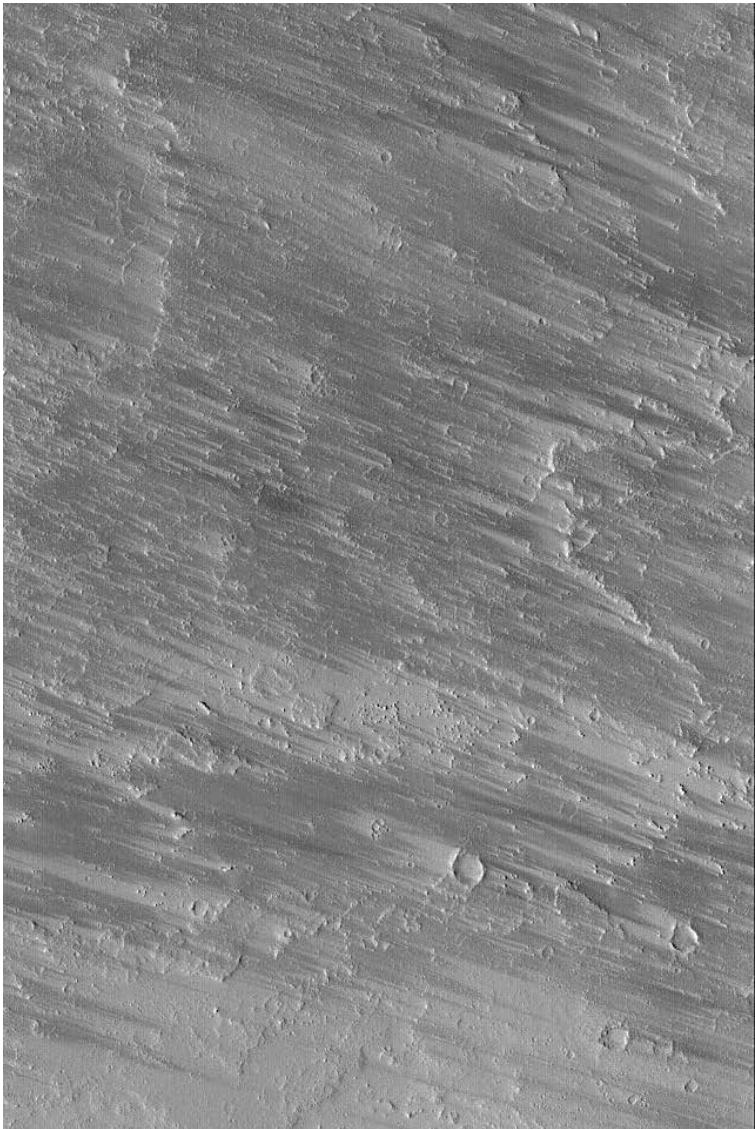


Dust Devils

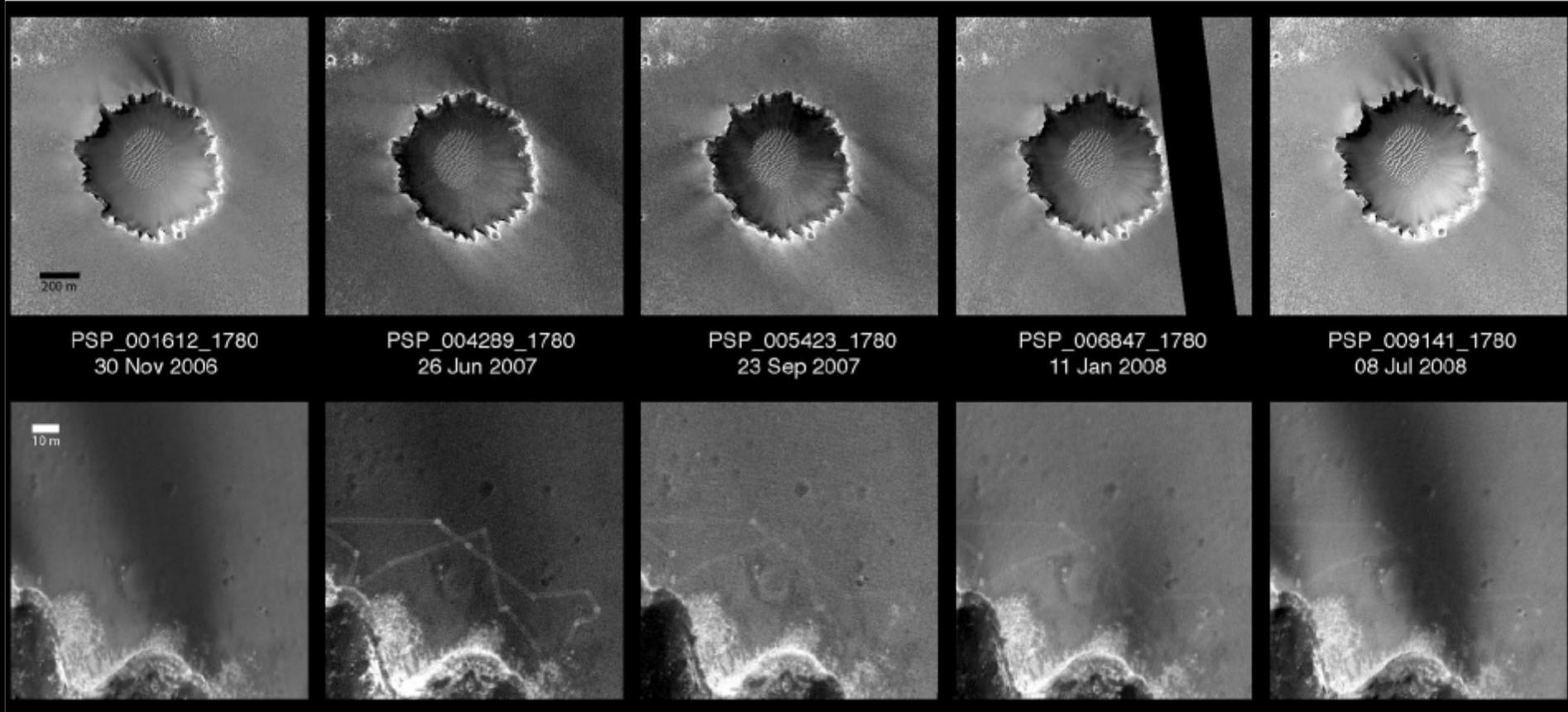
Mars dust devil tracks



Wind streaks

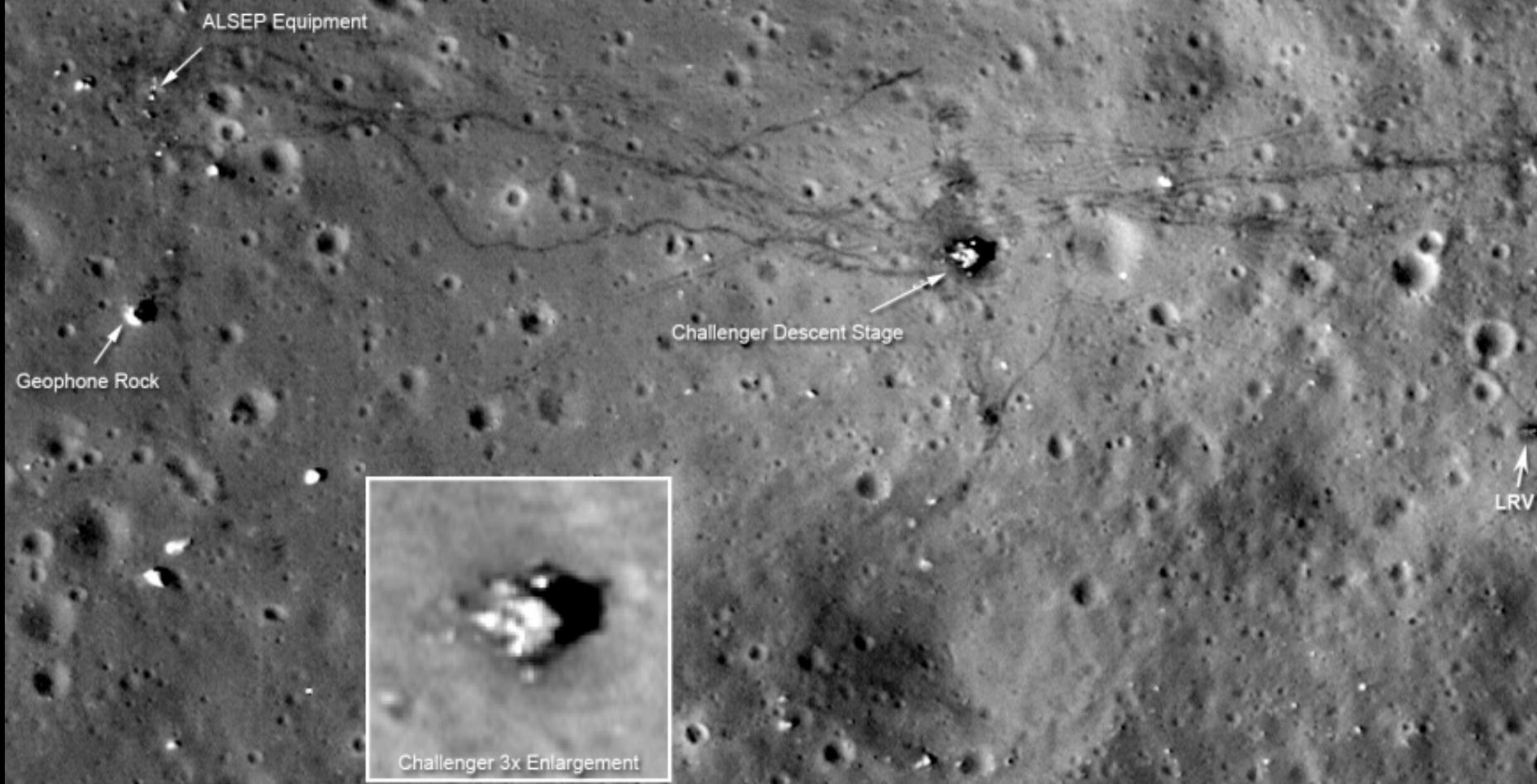


Mars: rover track erasure



Geissler et al. (2010)

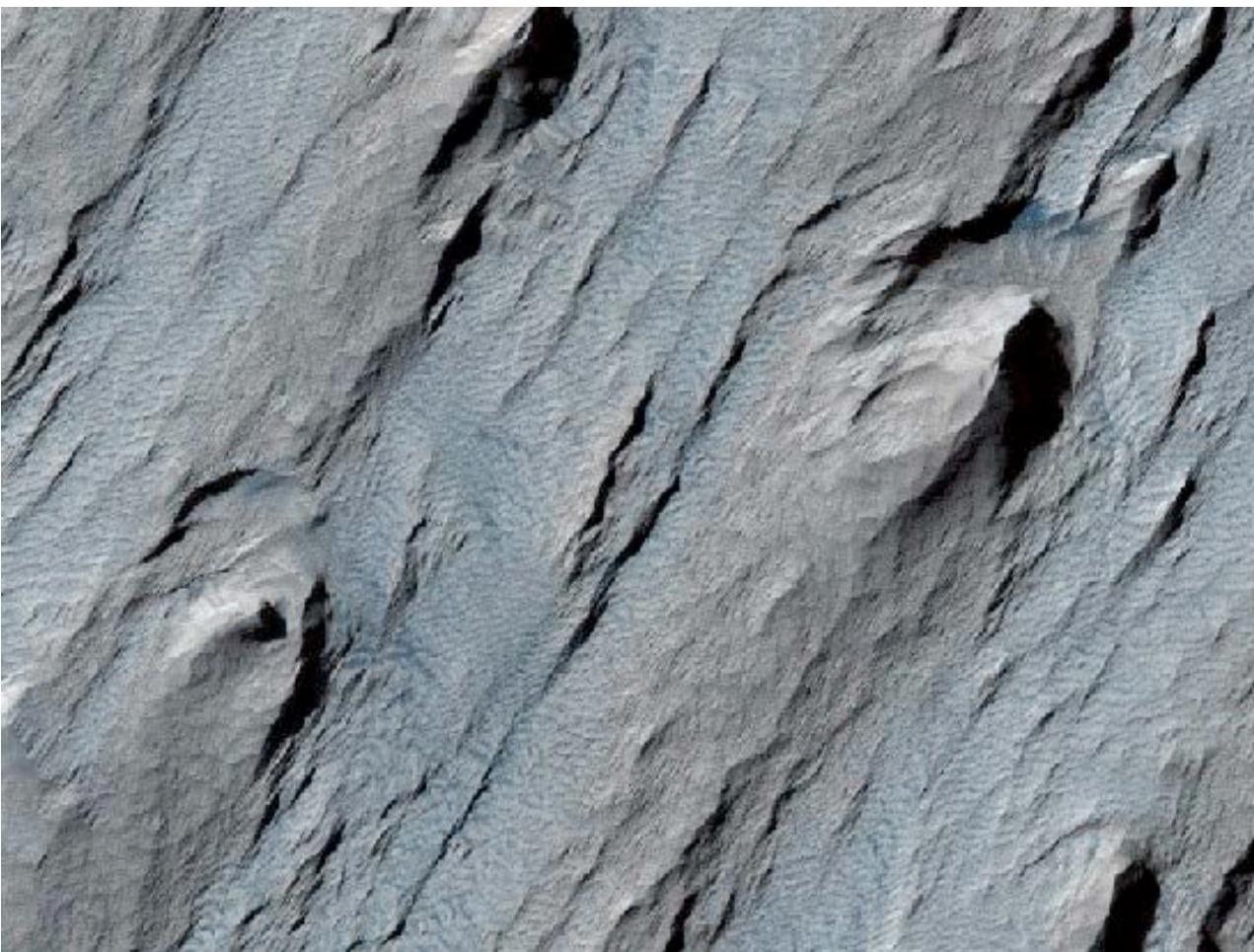
Moon: rover track erasure (not)



Wind also erodes: Martian yardangs



SCIENCEPHOTOLIBRARY



Wind also erodes: ventifacts

