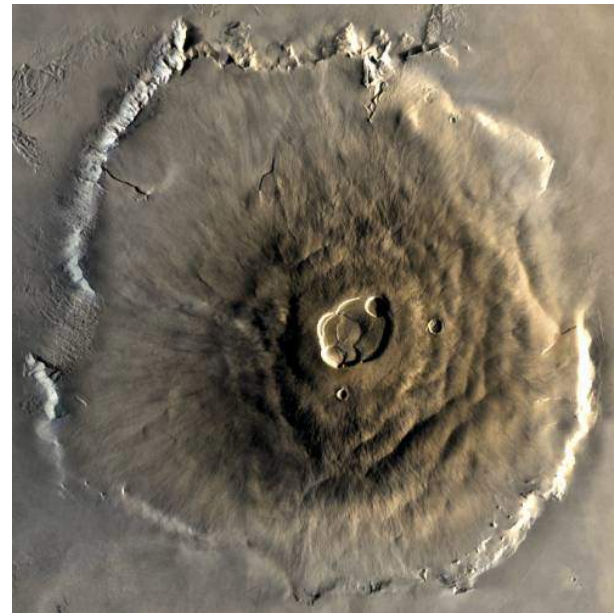
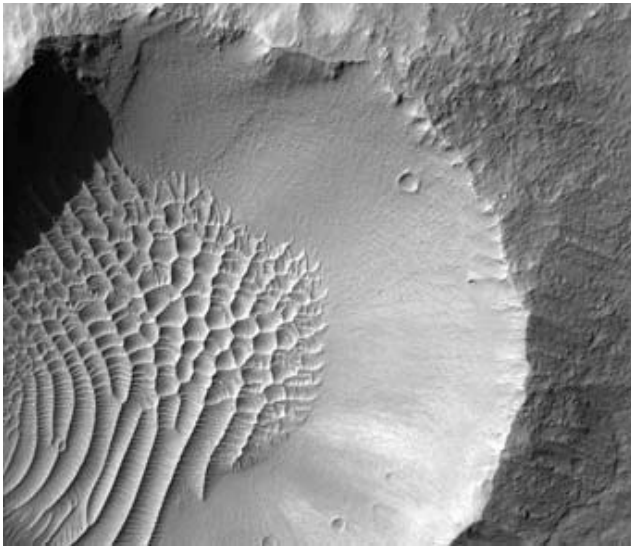
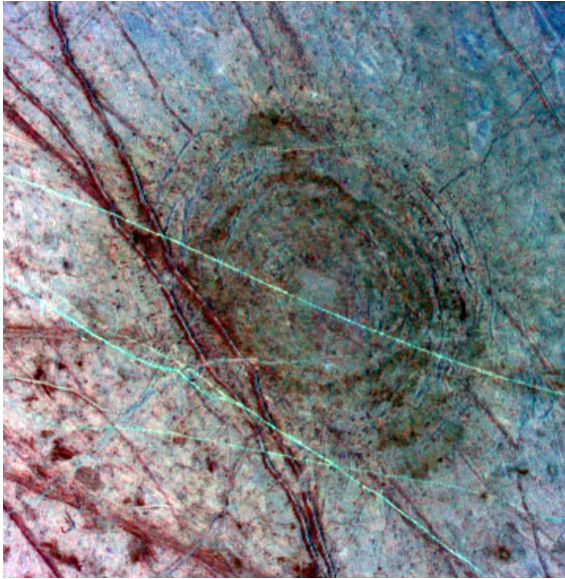
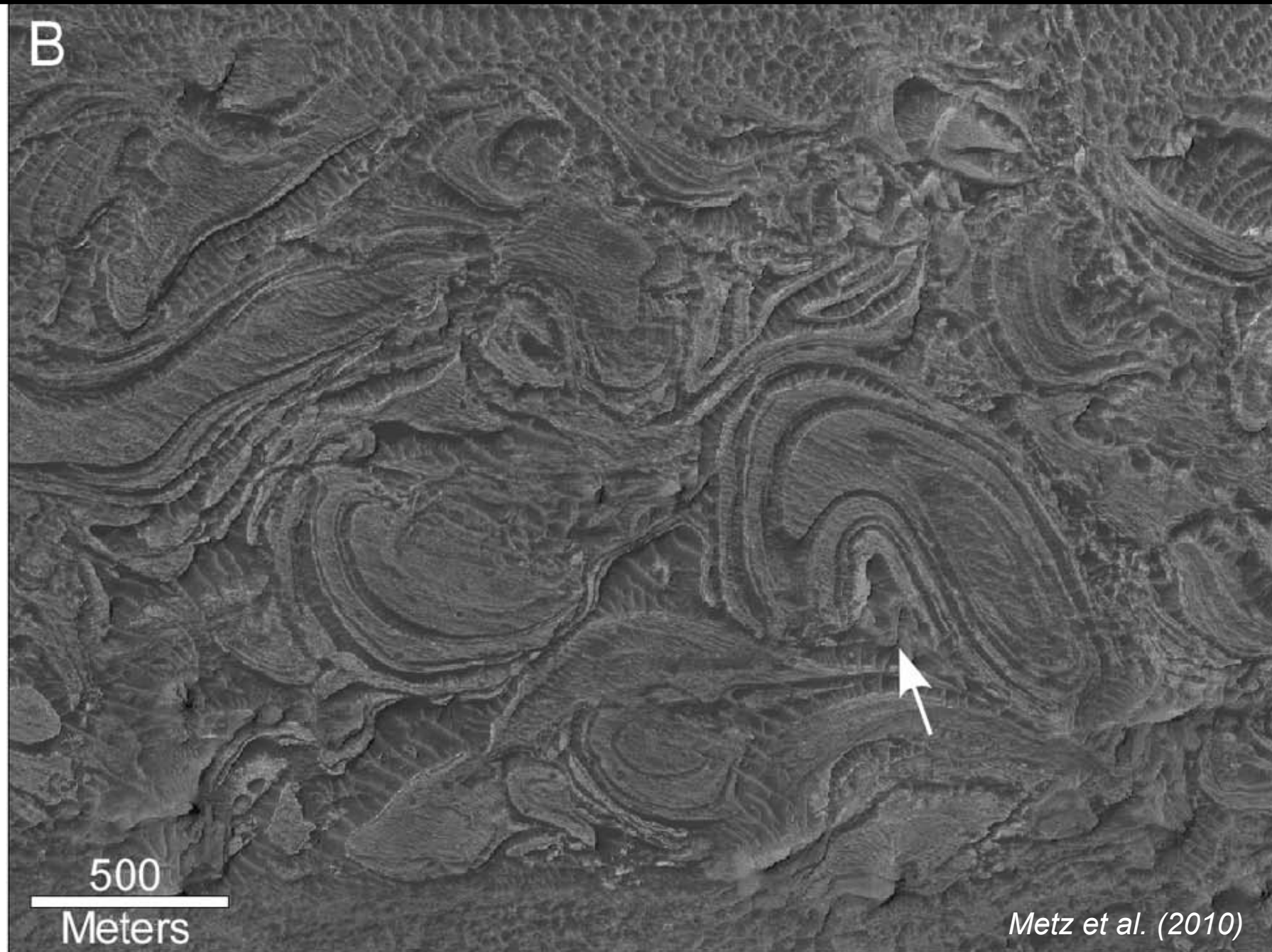


Planetary Surface Processes



B

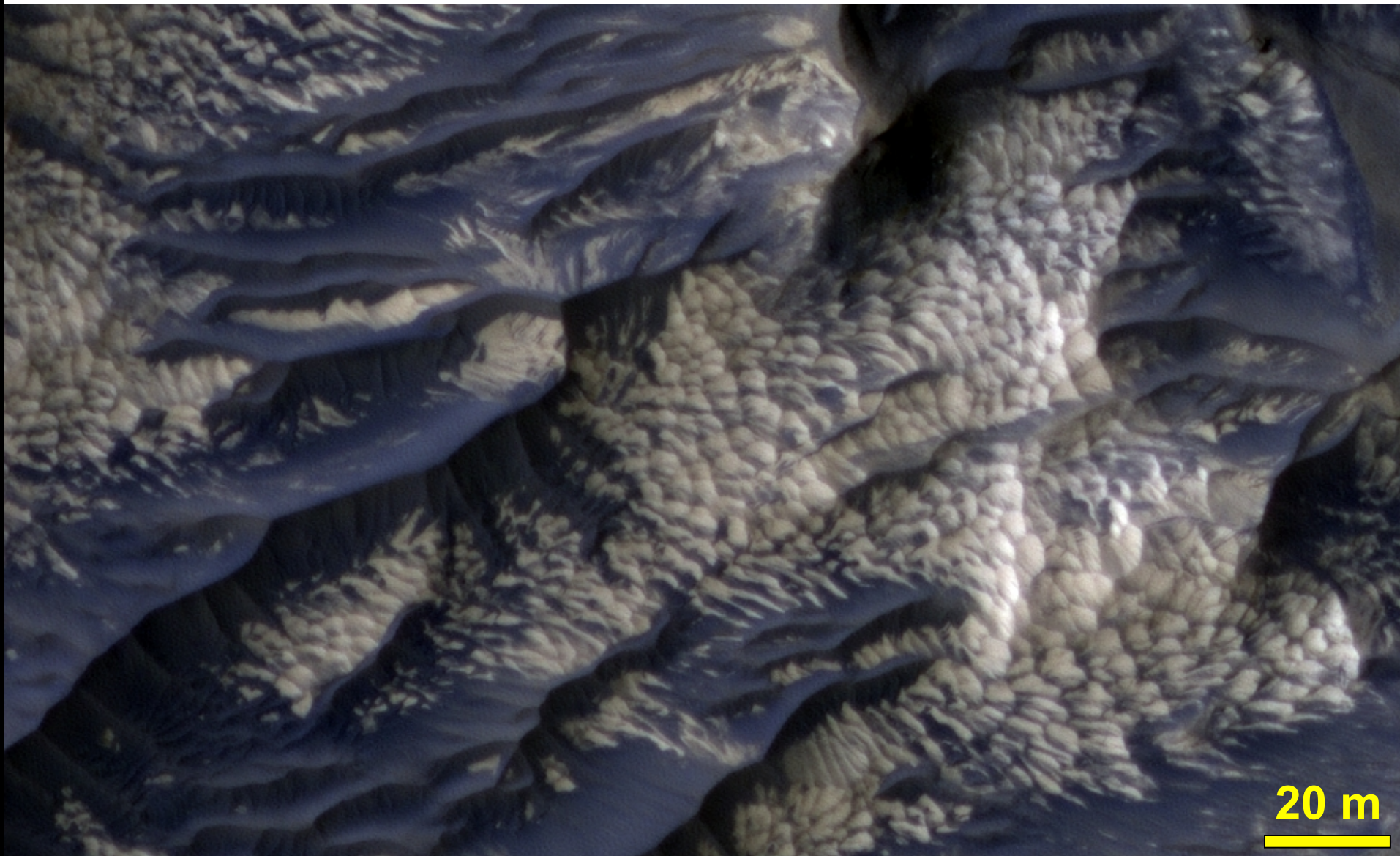


500
Meters

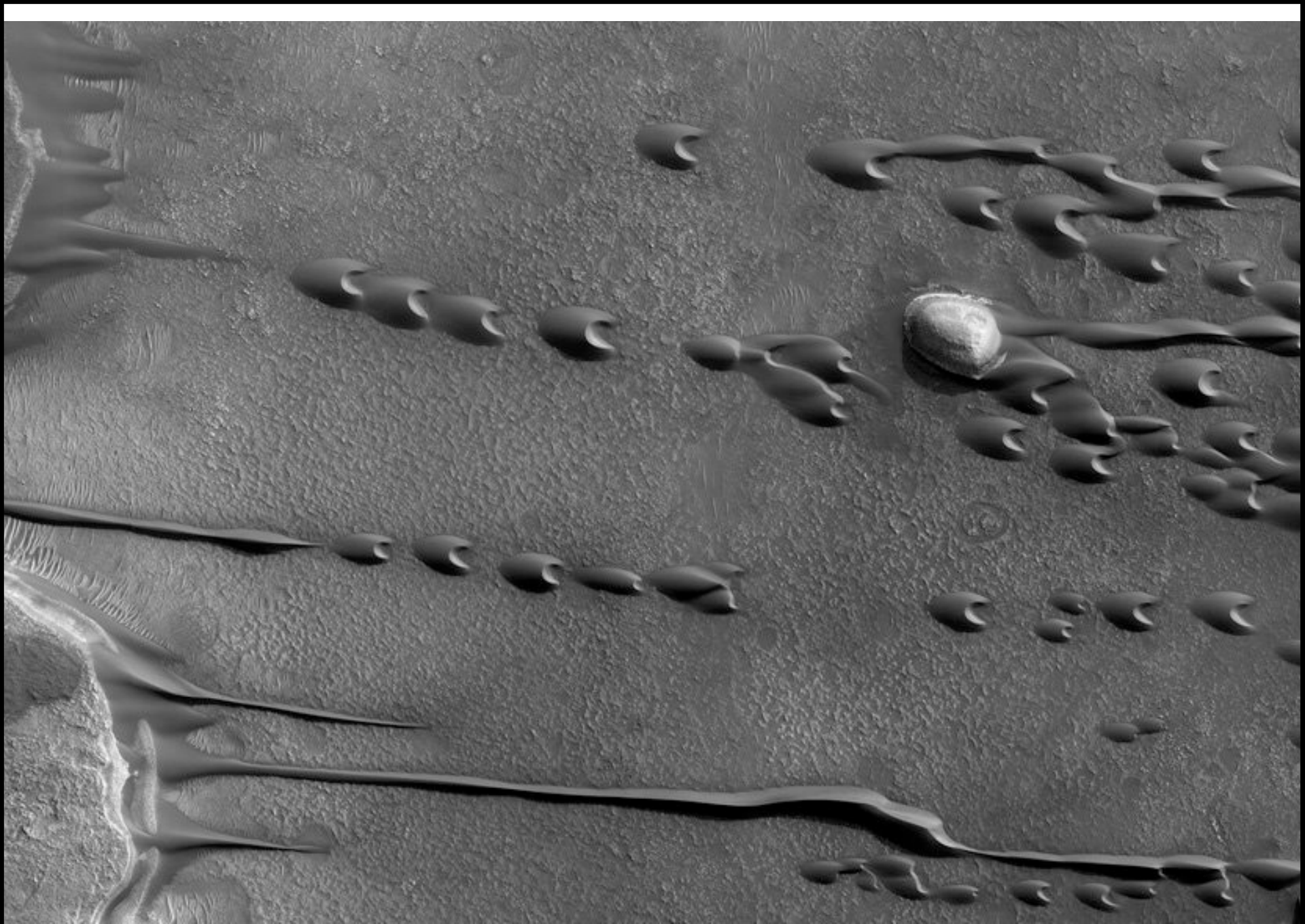
Metz et al. (2010)

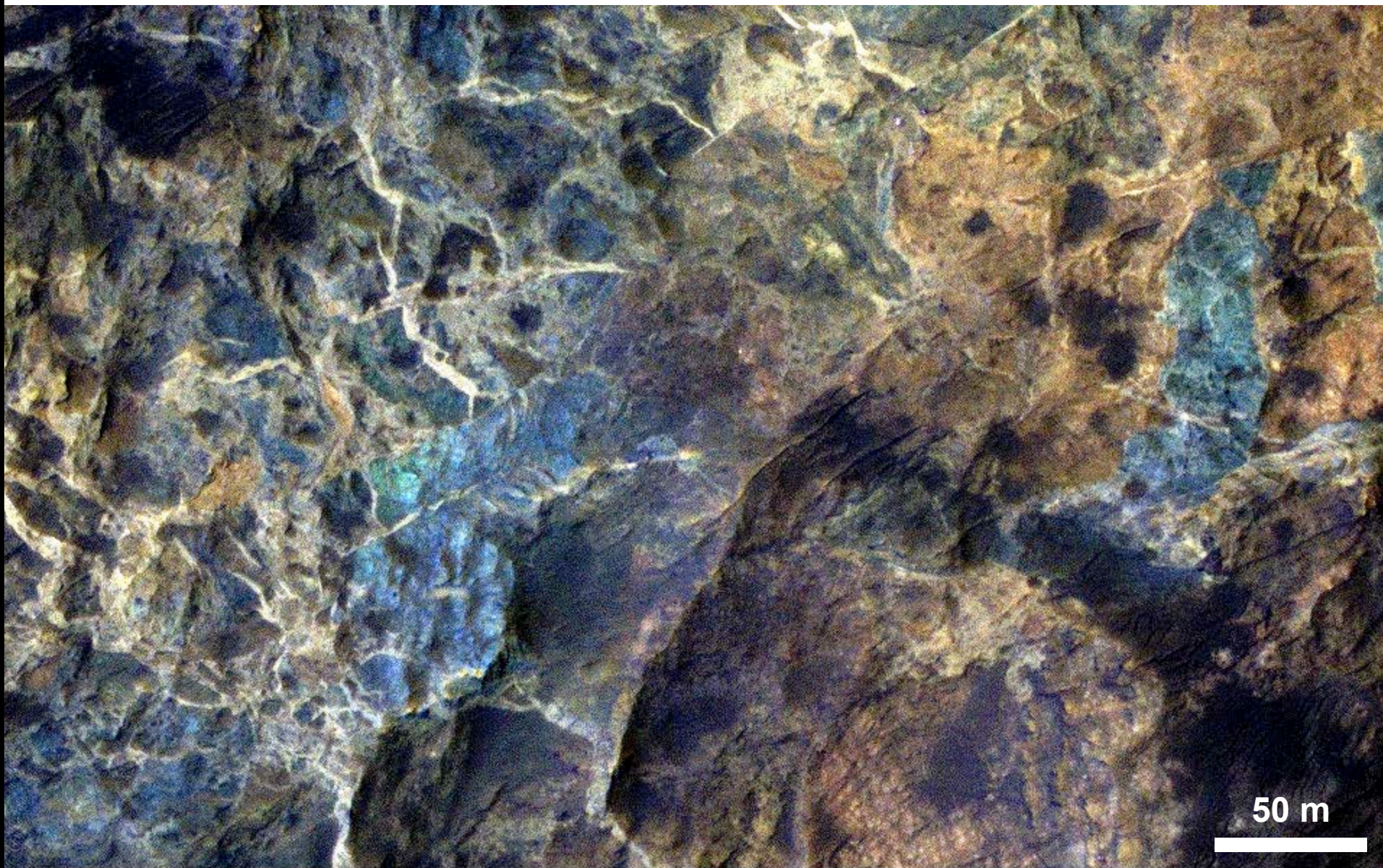




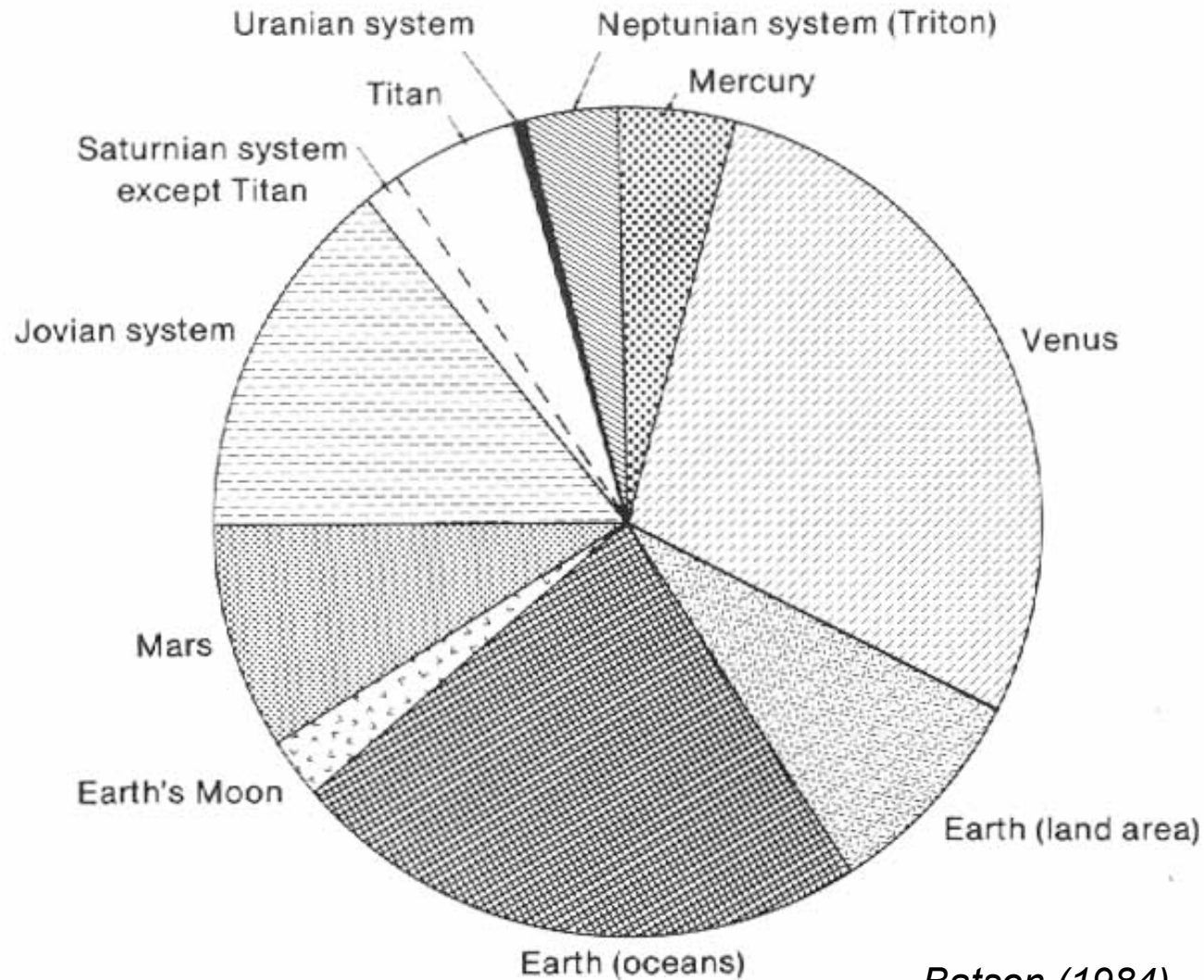


Karunatillake et al. (2009)





Mappable surfaces of the solar system



Batson (1984)

Planetary Surface Processes

Cratering

Gravity

Tectonics

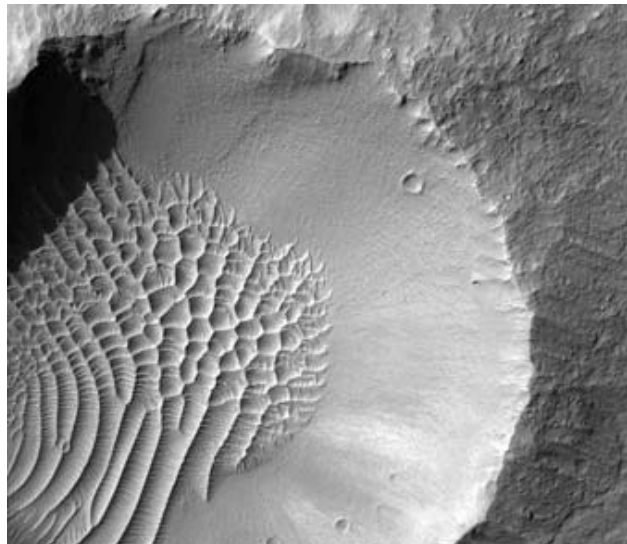
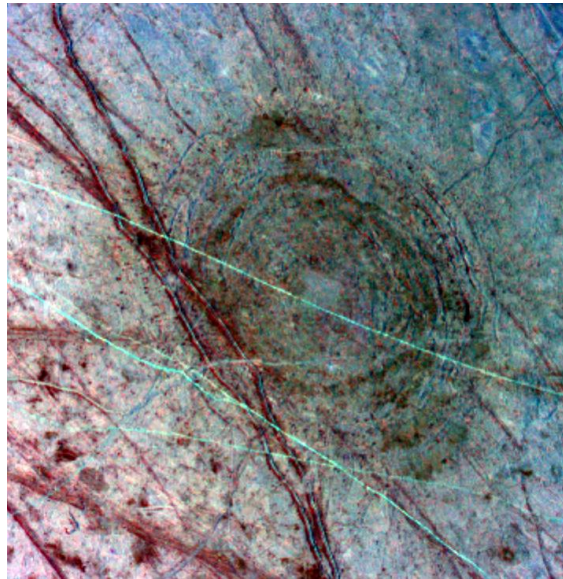
Volcanism

Winds

Fluvial

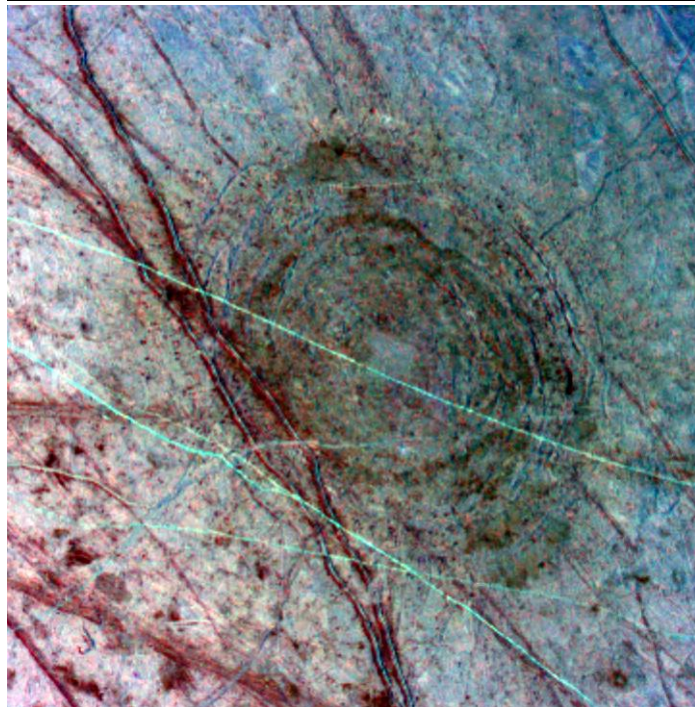
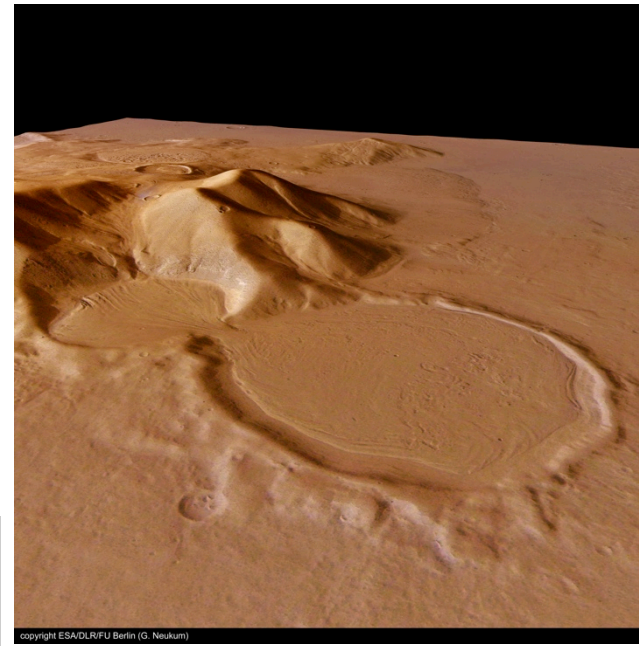
Glacial

Chemical
weathering

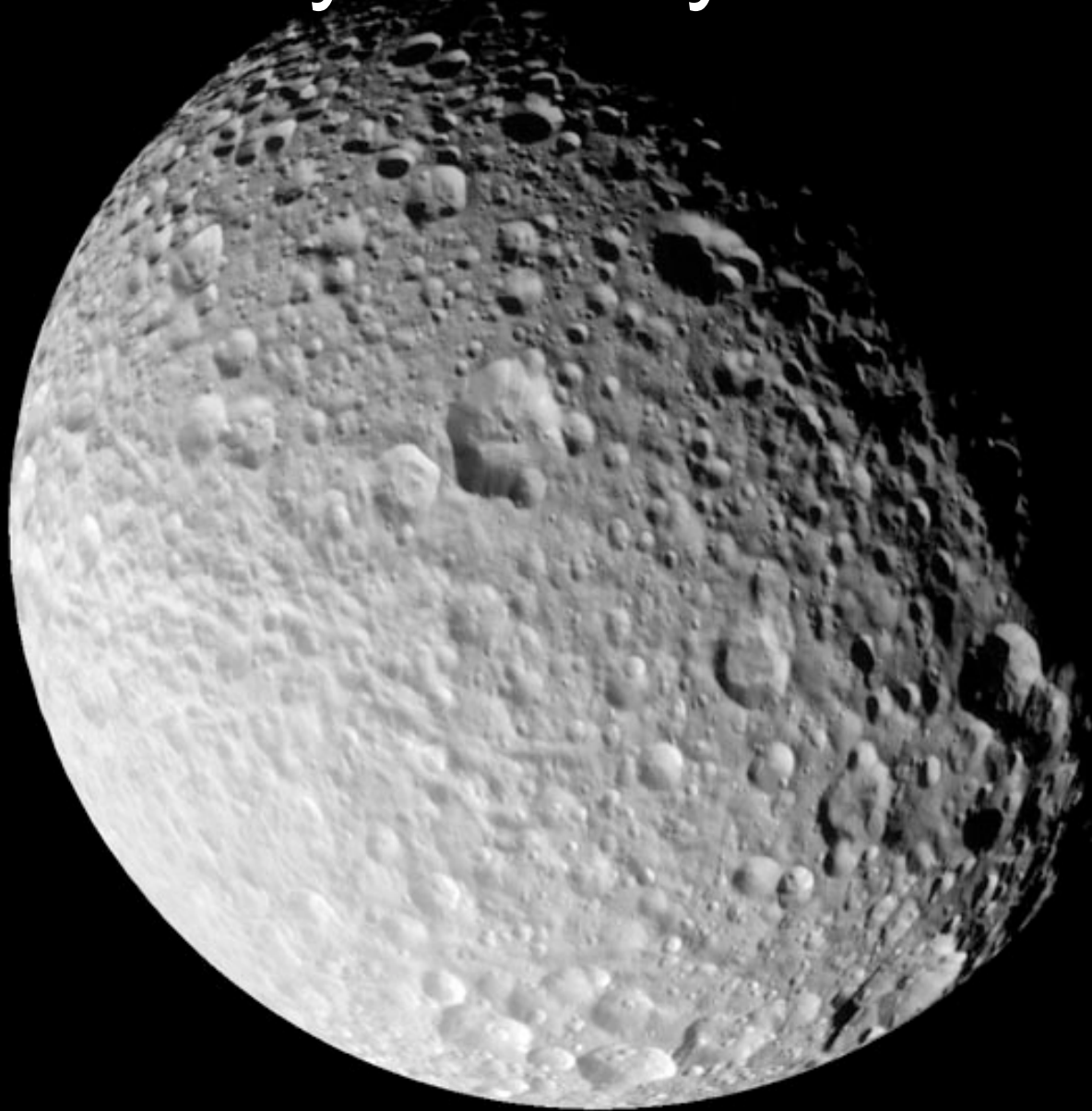




Craters



They're everywhere!



The sky *is* falling!

“I would rather believe that two Yankee professors would lie than believe that stones fall from heaven.”

—*Thomas Jefferson*

The sky *is* falling!

TABLE 3 Chances of dying from selected causes (USA)

Cause of death	Chances
Motor vehicle accident	1 in 100
Murder	1 in 300
Fire	1 in 800
Firearms accident	1 in 2,500
Asteroid/comet impact (lower limit)	1 in 3,000
Electrocution	1 in 5,000
ASTEROID/COMET IMPACT	1 in 20,000
Passenger aircraft crash	1 in 20,000
Flood	1 in 30,000
Tornado	1 in 60,000
Venomous bite or sting	1 in 100,000
Asteroid/comet impact (upper limit)	1 in 250,000
Fireworks accident	1 in 1 million
Food poisoning by botulism	1 in 3 million
Drinking water with EPA limit of TCE*	1 in 10 million

* EPA, Environmental Protection Agency; TCE, trichloroethylene.

Chapman & Morrison (1994)

Terminology



1) *meteoroid*



2) *meteor*



3) *meteorite*

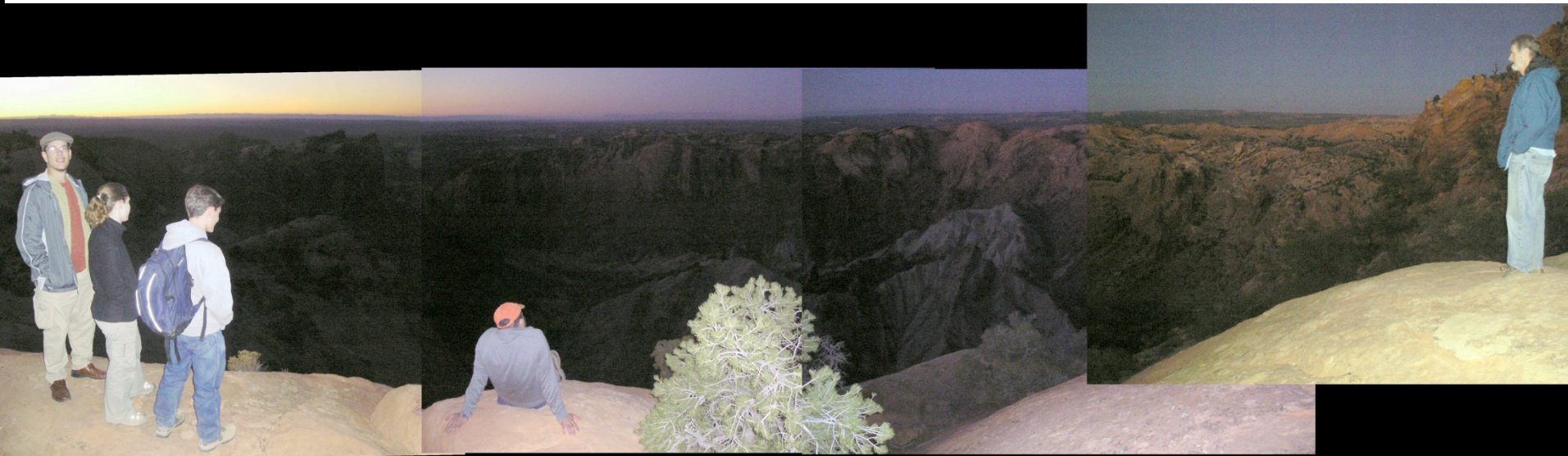
Meteor (Barringer) Crater, AZ



Upheaval Dome, UT



Upheaval Dome, UT



Clearwater Lakes, Quebec



Simple craters



Contact and compression stage

- Most of projectile's energy, momentum transferred to target rocks
- $t_{cc} \approx 2R/v_i$
- Rankine-Hugoniot equations can be solved for pressure
- At few km/s, energy per unit mass \approx that of TNT



Cinder Lake Crater Field, AZ



The Sedan Test -- Plowshare Program

July 6, 1962

A thermonuclear device was lowered into the desert alluvium to a depth of 194m in Yucca Flat, NV.

The fusion-fission blast had a yield equivalent to 104 kilotons of TNT, and lifted a dome of earth 90m above the desert floor before it vented at 3s after detonation.

The explosion displaced more than 11,000,000 tons of soil, and the resulting crater is 100m deep with a diameter of about 390m. A circular area of the desert floor five miles across was obscured by fast-expanding dust clouds moving out horizontally from the base surge, similar to a pyroclastic surge. The blast caused seismic waves equivalent to an earthquake of 4.75 on the Richter scale.

The Sedan Test

