

Earth Timeline

Moon Forms
4.5 BYA

Violent collisions continue until
3.8 BYA. Moon was much closer

Active volcanoes,
oldest known rock forms

Continents form, atmosphere is mostly
nitrogen with methane and carbon dioxide

Oceans turned from green to
clear as the iron was removed

Photosynthesis creates an
atmosphere with oxygen

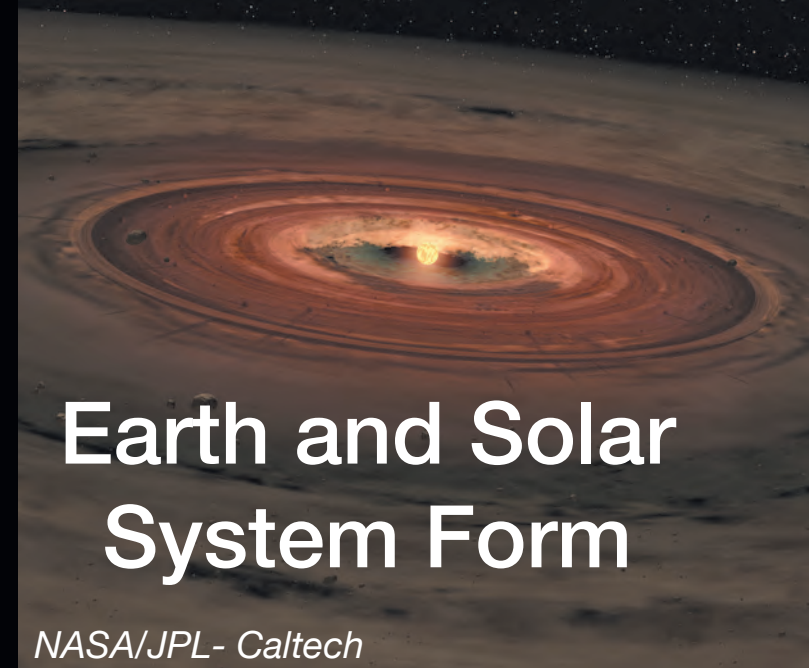
Days were only 20 hours
but years were 450 days

First evidence of
sexual reproduction

Ice ages occur
many times

Warm period with
high sea levels

Pangea forms
250 MYA



Earth and Solar System Form

NASA/JPL - Caltech



David A Aguilar (CFA)



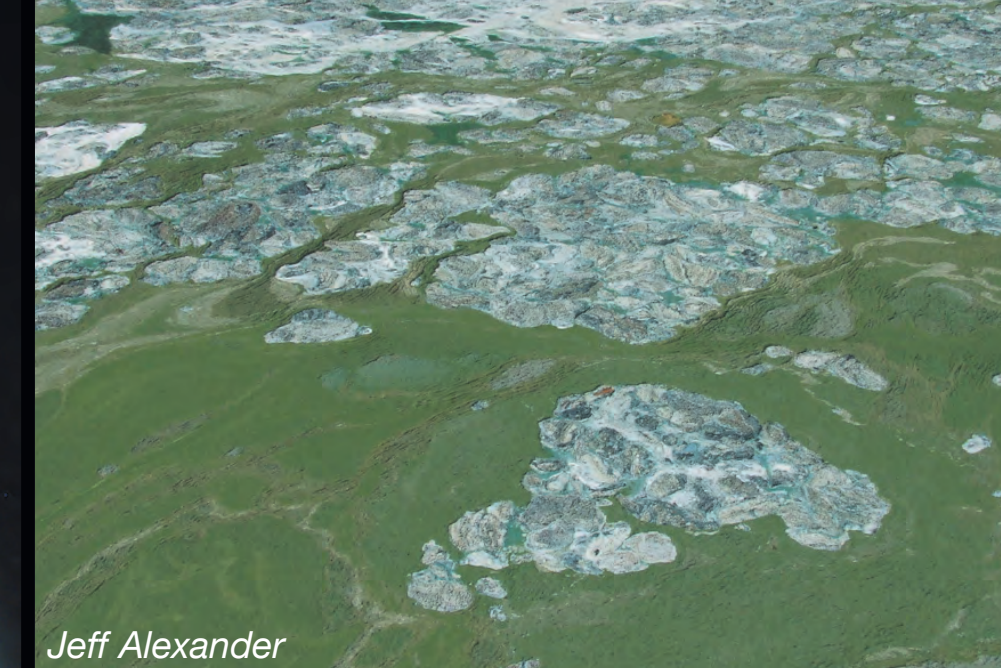
Taro Taylor



Paul Harrison



NASA/JPL/UCSD/JSC



Jeff Alexander



NASA



Seth White



4.6 Billion Years Ago (BYA)

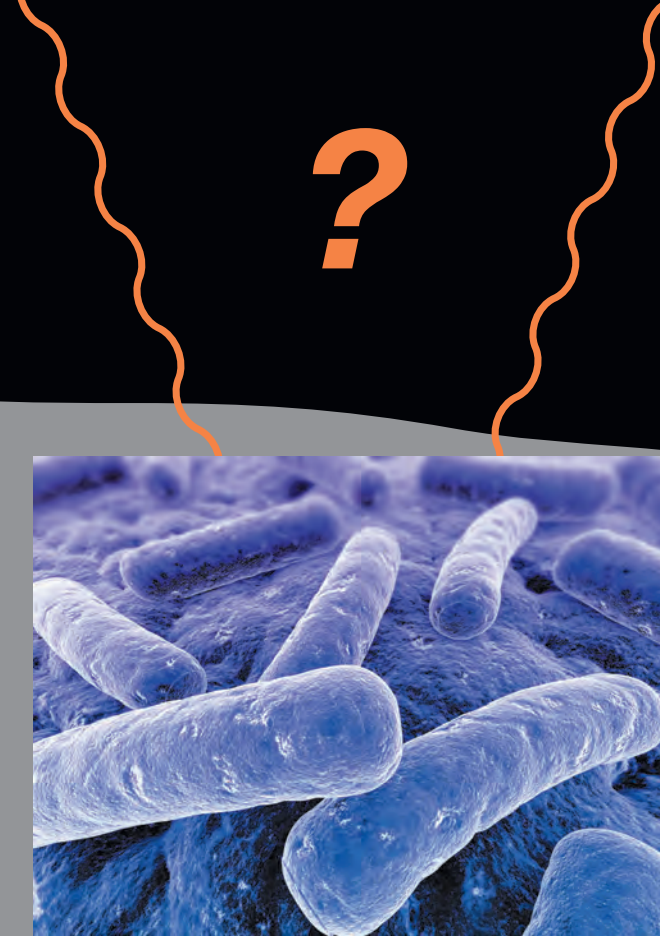
4 BYA

3 BYA

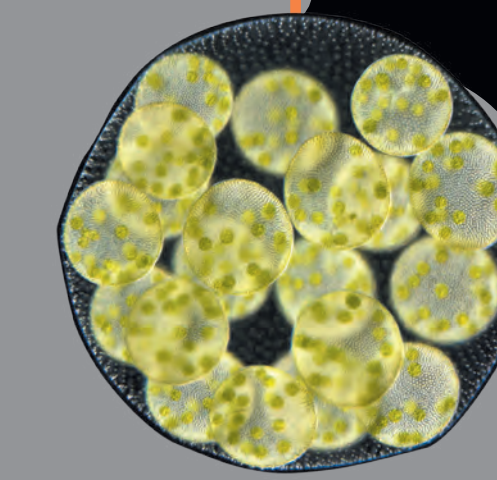
2 BYA

1 BYA = 1,000 Million Years Ago (MYA)

Present



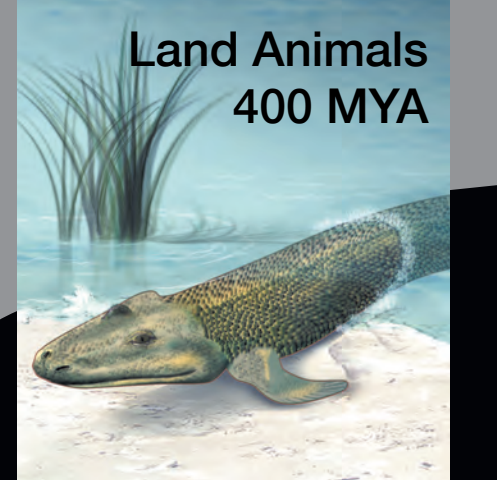
Single-Celled Organisms
3.8?-3.5 BYA



Multicellular Organisms
2.1 BYA



First Animals
600 MYA



Land Animals
400 MYA



Dinosaurs
260-65 MYA



Early Humans
2 MYA years ago

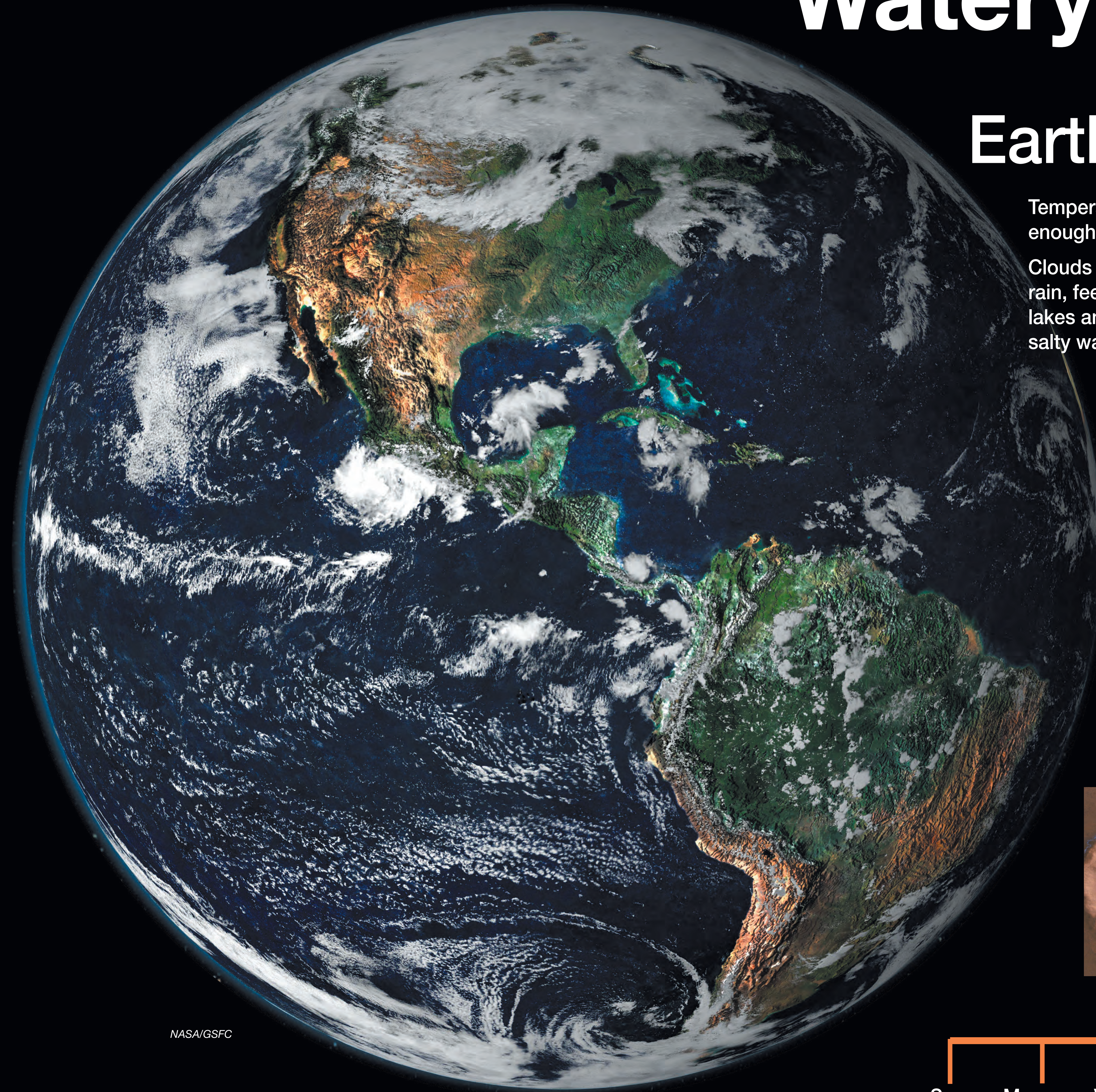


Modern Civilization
10,000 years ago

Watery Worlds of Our Solar System

Note: Saturn and Jupiter orbit too distantly to get much warmth from the Sun. These moons are "tidally heated" or stretched and warmed by the gravity of the large planets they orbit. Saturn and Jupiter both have many other moons that are not tidally heated.

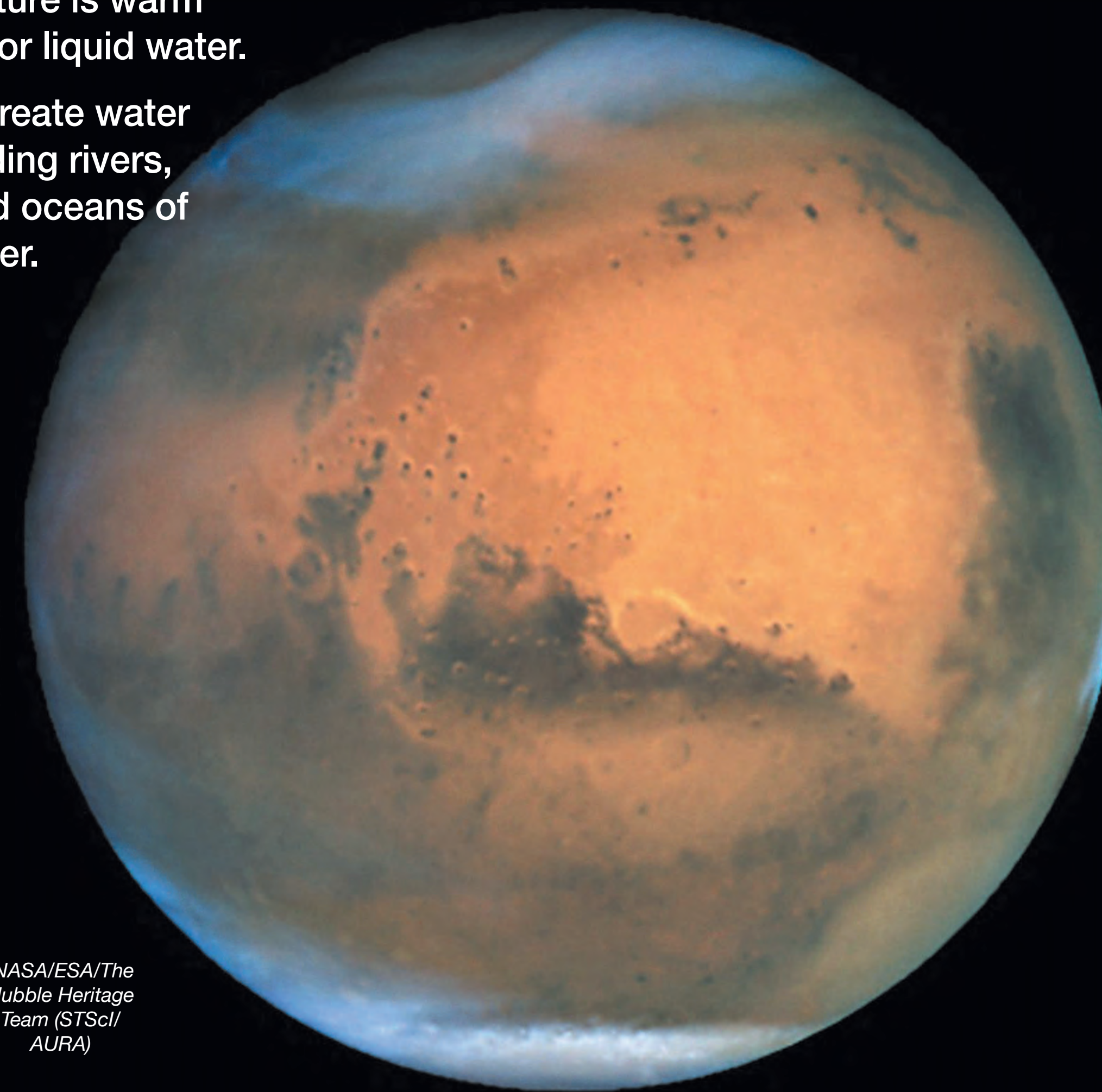
To scale size with the 1/2 meter (19 inch) Earth, left



Earth

Temperature is warm enough for liquid water.
Clouds create water rain, feeding rivers, lakes and oceans of salty water.

Mars?



NASA/ESA/The Hubble Heritage Team (STScI/AURA)



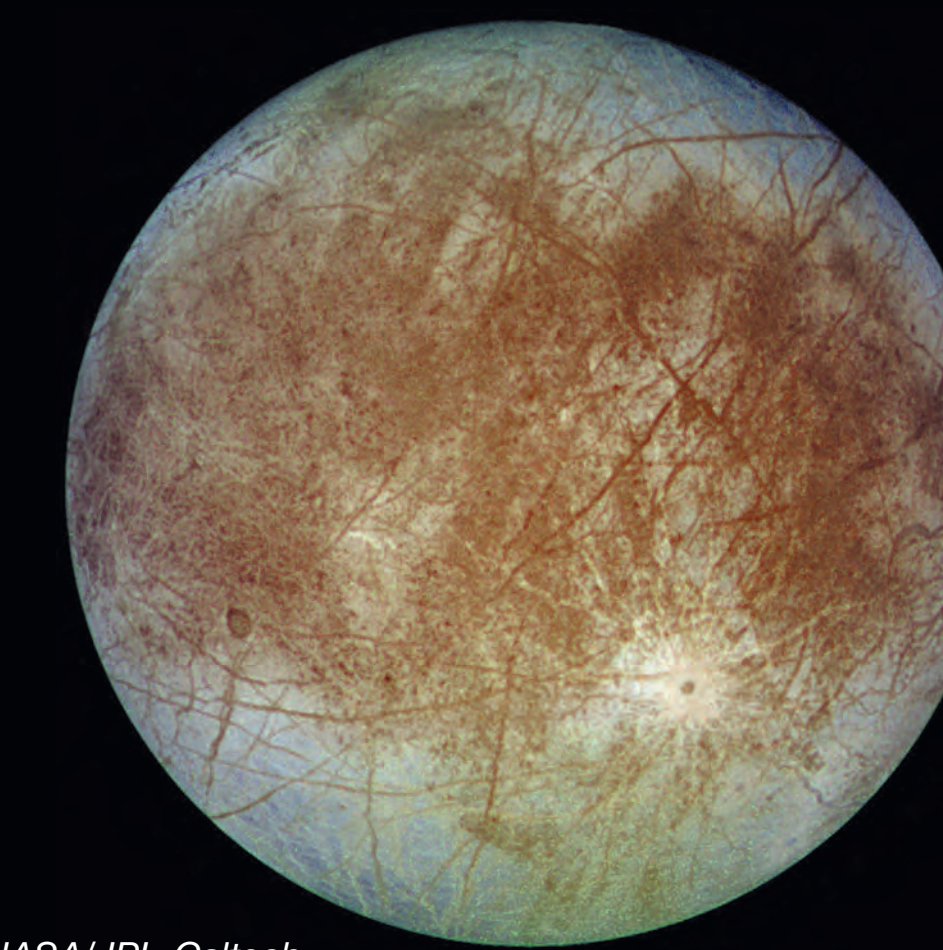
ESA/DLR/FU

Water ice exists on the poles and surface features show a history of liquid water.

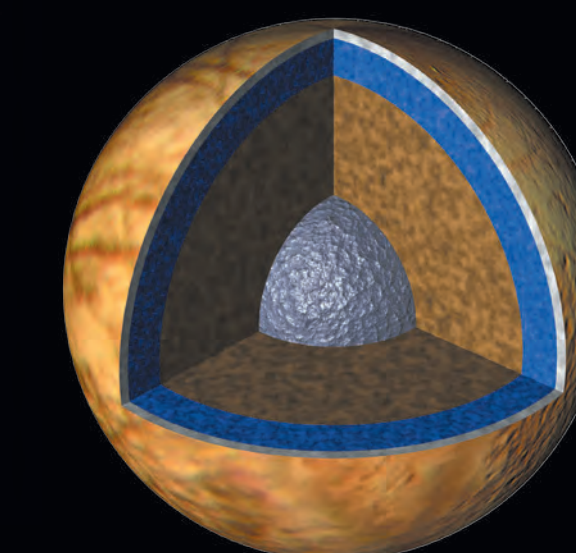
There could be underground lakes below the cold, dry surface.

Moons of Jupiter

Europa

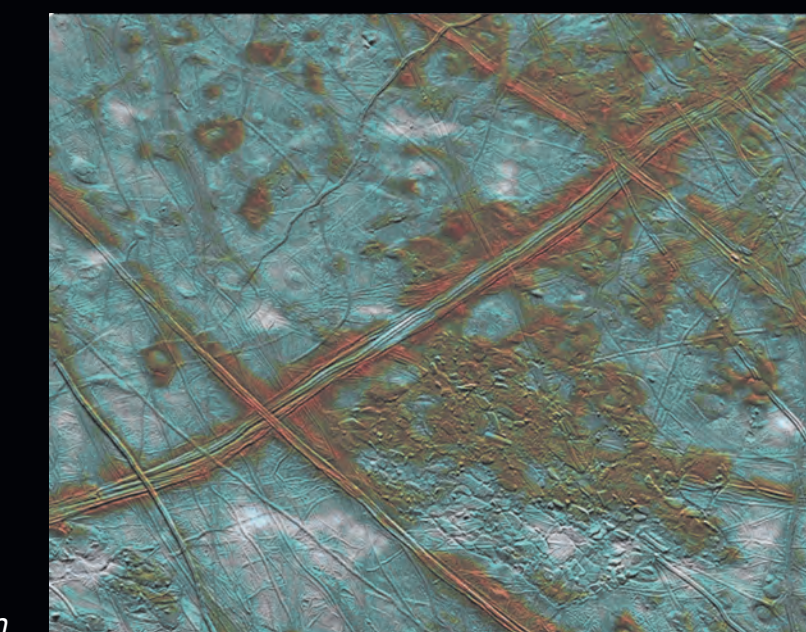


NASA/JPL-Caltech



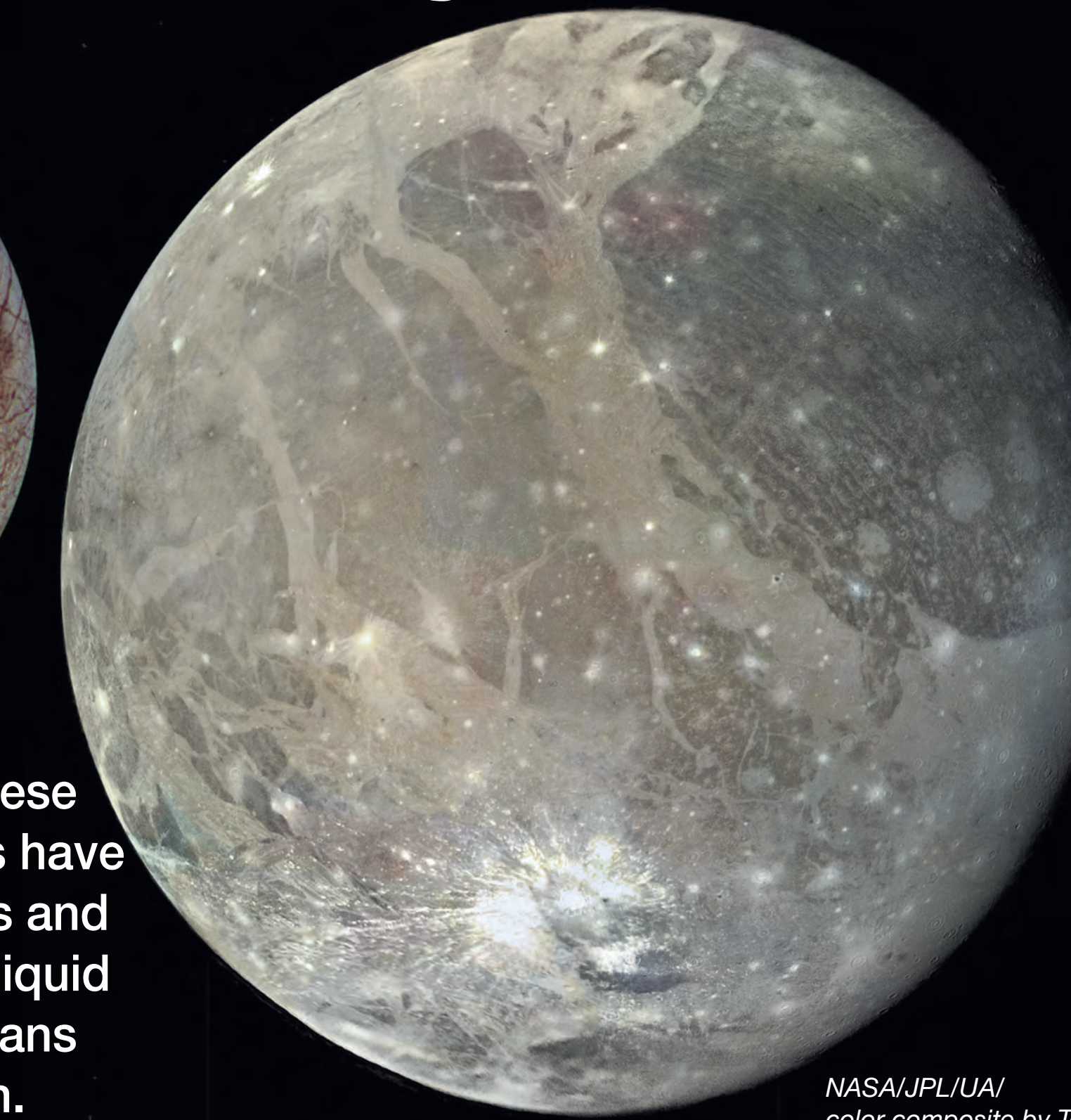
NASA/JPL

Both of these large moons have icy surfaces and likely have liquid water oceans beneath.

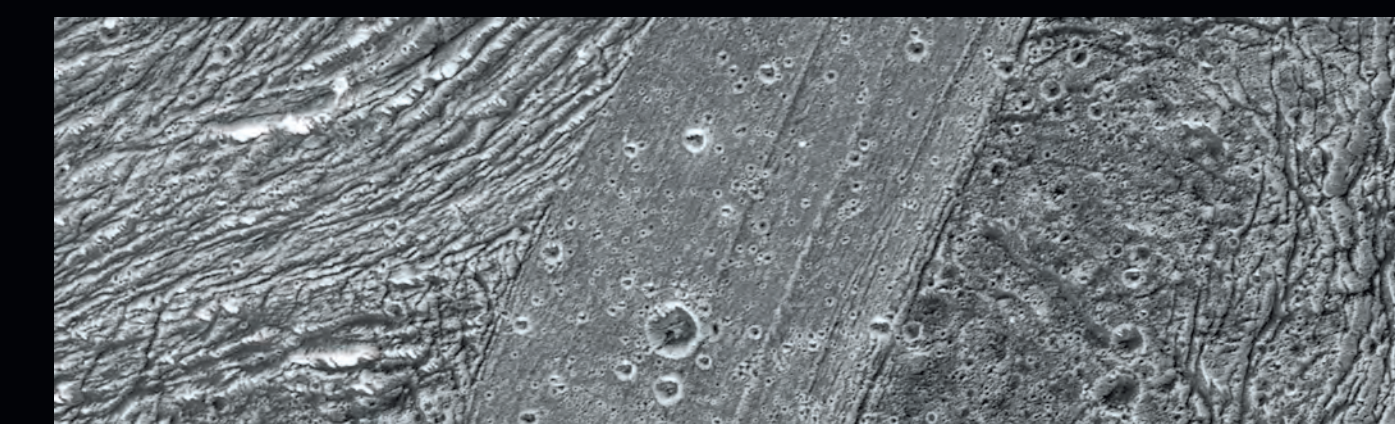


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Ganymede

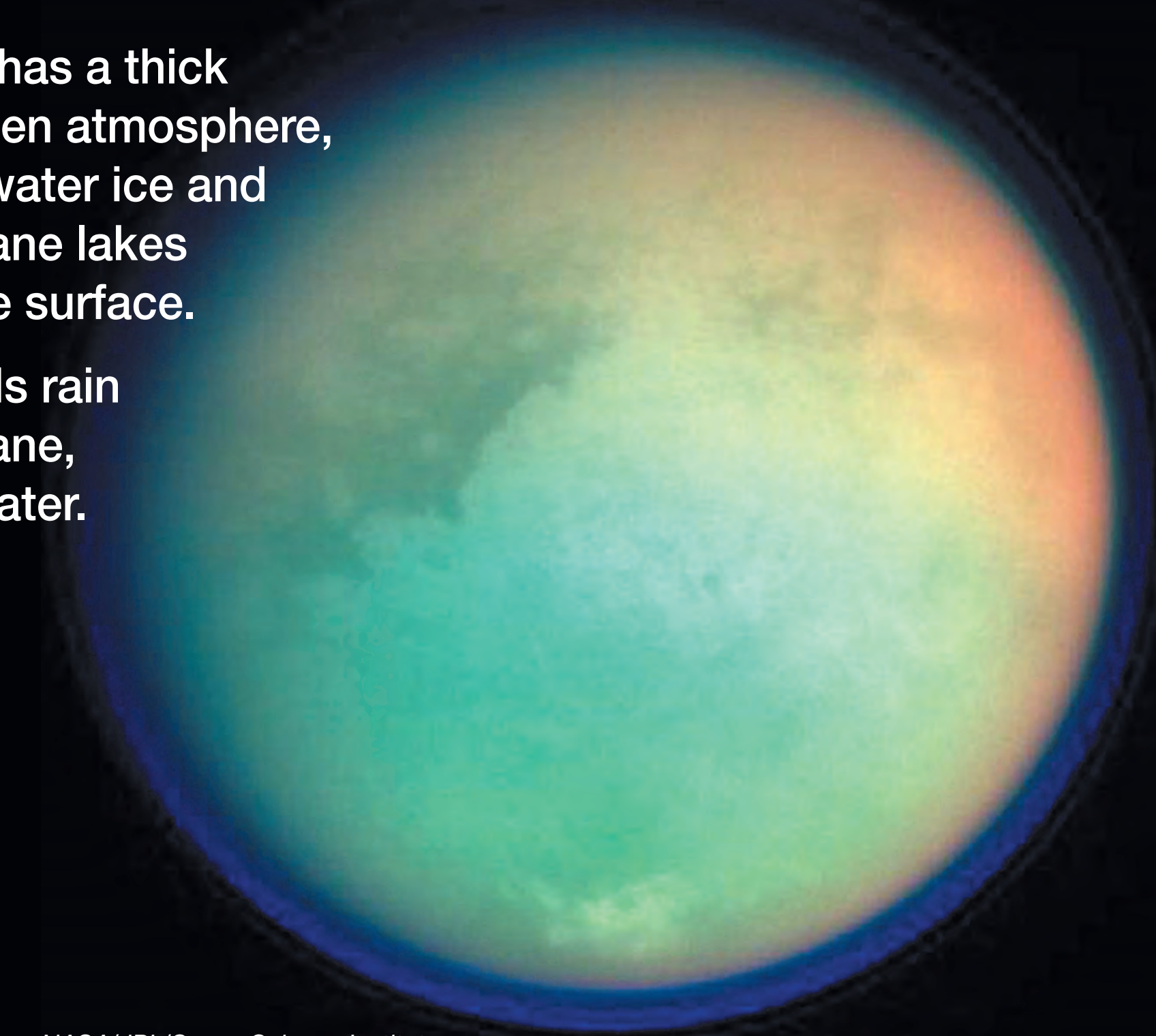


NASA/JPL/JAI color composite by Ted Stryk



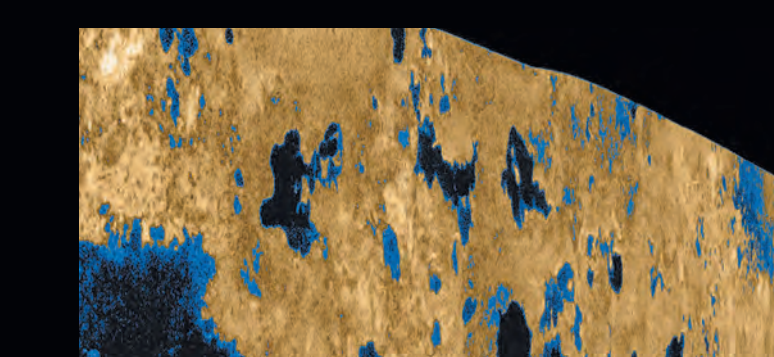
Moons of Saturn

Titan

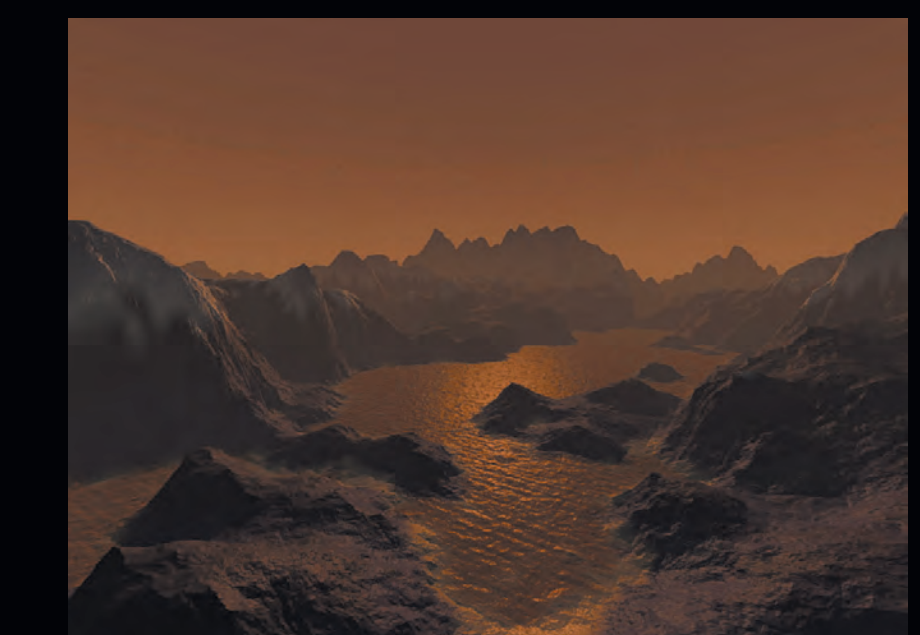


Titan has a thick nitrogen atmosphere, with water ice and methane lakes on the surface.
Clouds rain methane, not water.

NASA/JPL/Space Science Institute, image in representational color

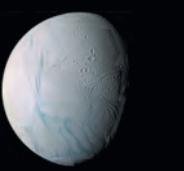


NASA/Cassini



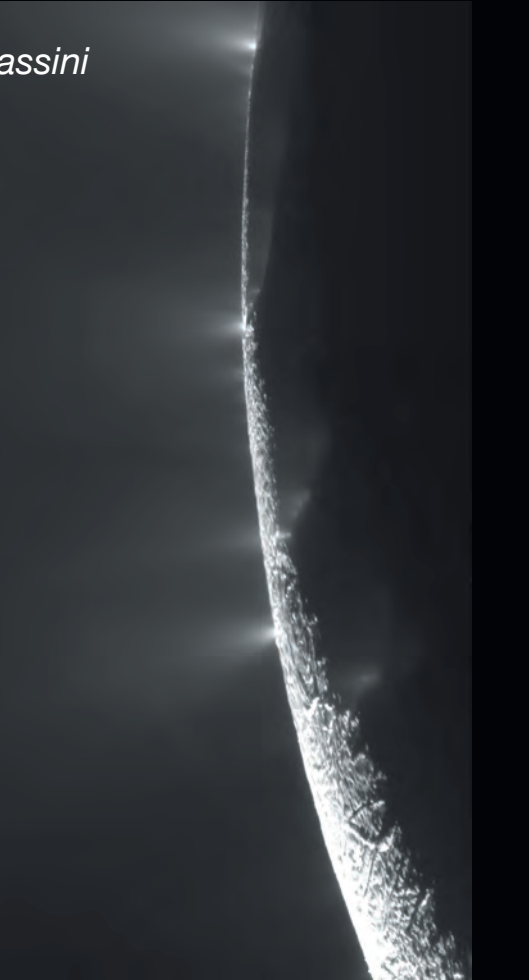
Steve Hobbs

Enceladus

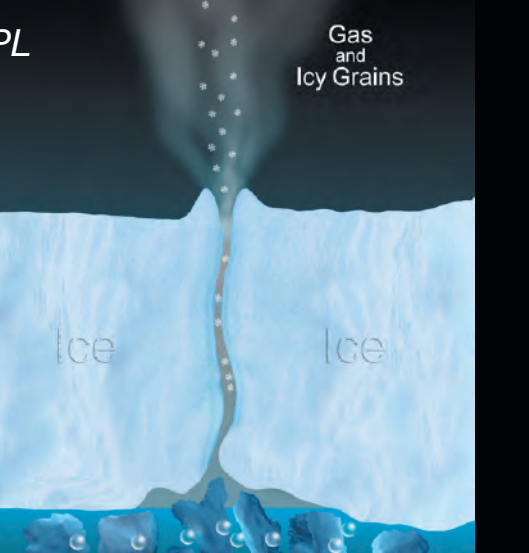


This tiny moon sprays liquid water from many geysers. A liquid ocean may exist below the icy surface.

NASA/Cassini



NASA/JPL



Gas and Ice Grains

Habitable Zone



Jupiter

Scaled distance of the planets' orbits from the Sun

Saturn

NASA/GSFC