



HOW WE MADE REWIND THE RED PLANET

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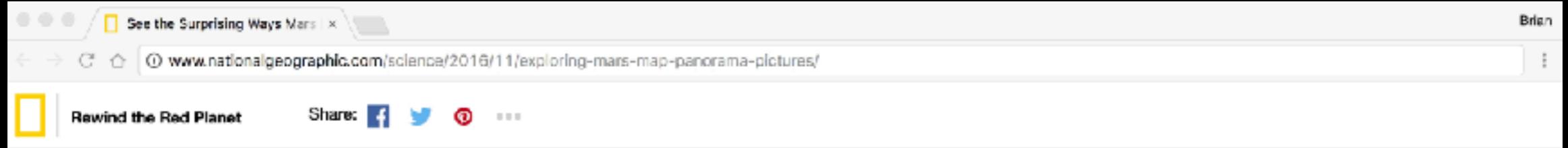
Slides here:
<http://bit.ly/foss4mars>

DESIGN

DEVELOPMENT

EDITORIAL

DATA



REWIND THE RED PLANET

Mars today is a chilly desert. But ancient landscapes reveal a time when water may have flowed freely. Scroll to see how the red planet has evolved.



<http://www.nationalgeographic.com/science/2016/11/exploring-mars-map-panorama-pictures/>

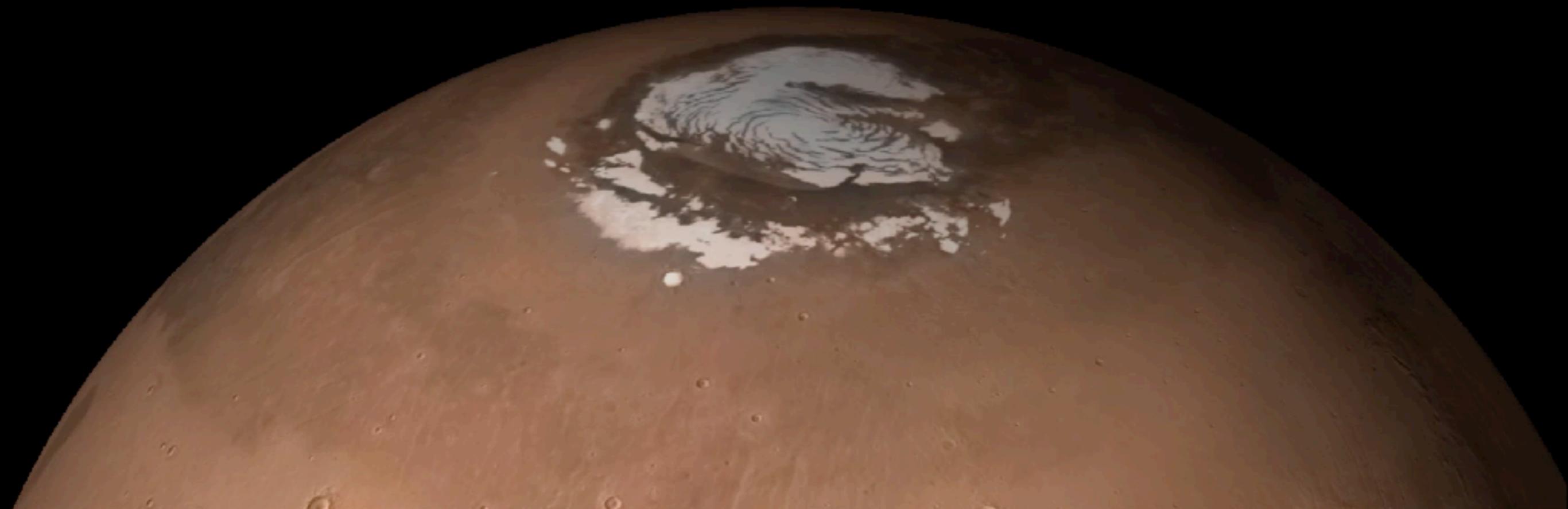


Rewind the Red Planet

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REWIND THE RED PLANET

Mars today is a chilly desert. But ancient landscapes reveal a time when water may have flowed freely. Scroll to see how the red planet has evolved.

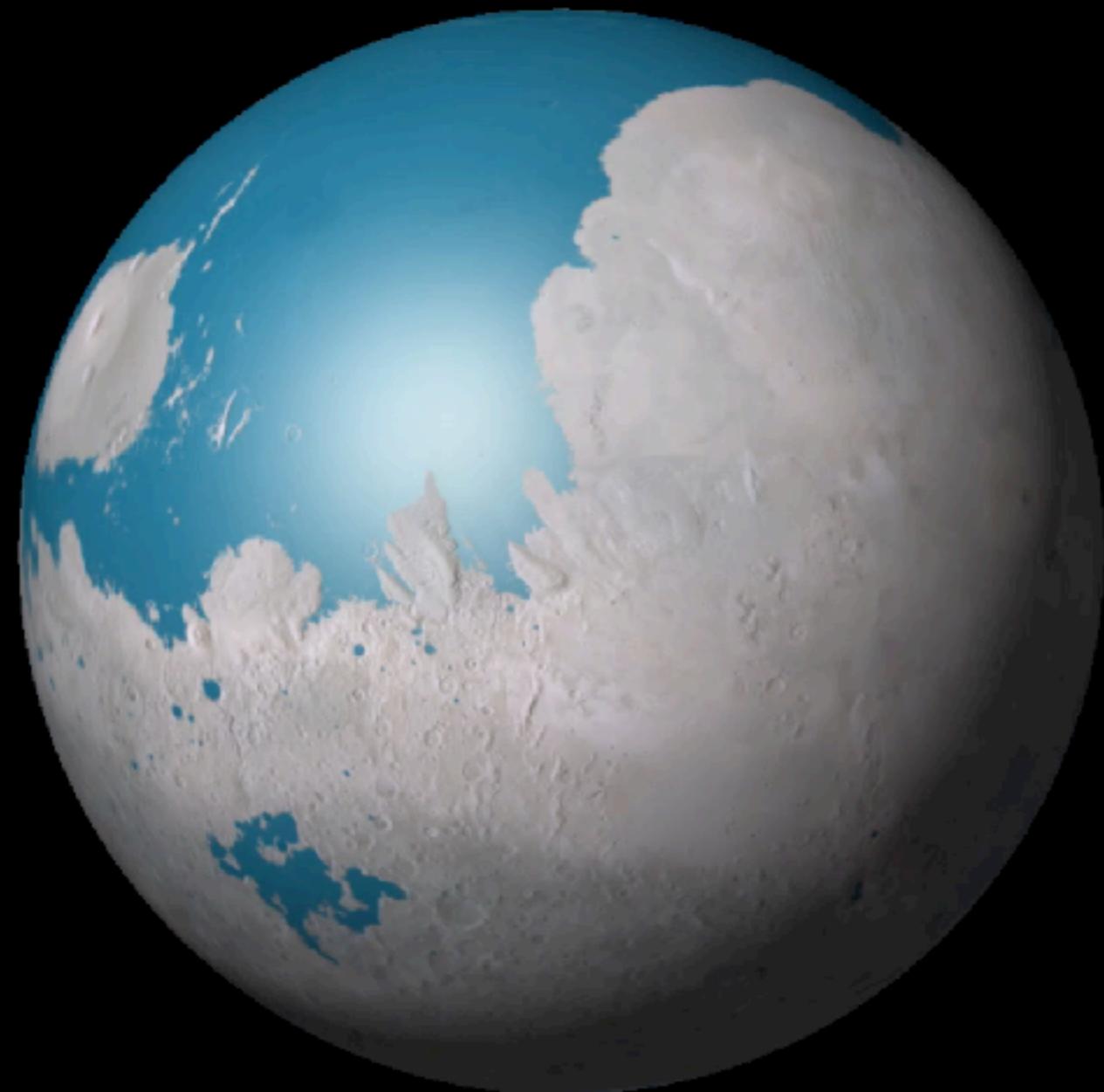




Rewind the Red Planet

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A YOUNG WATER WORLD 3.8 BILLION YEARS AGO

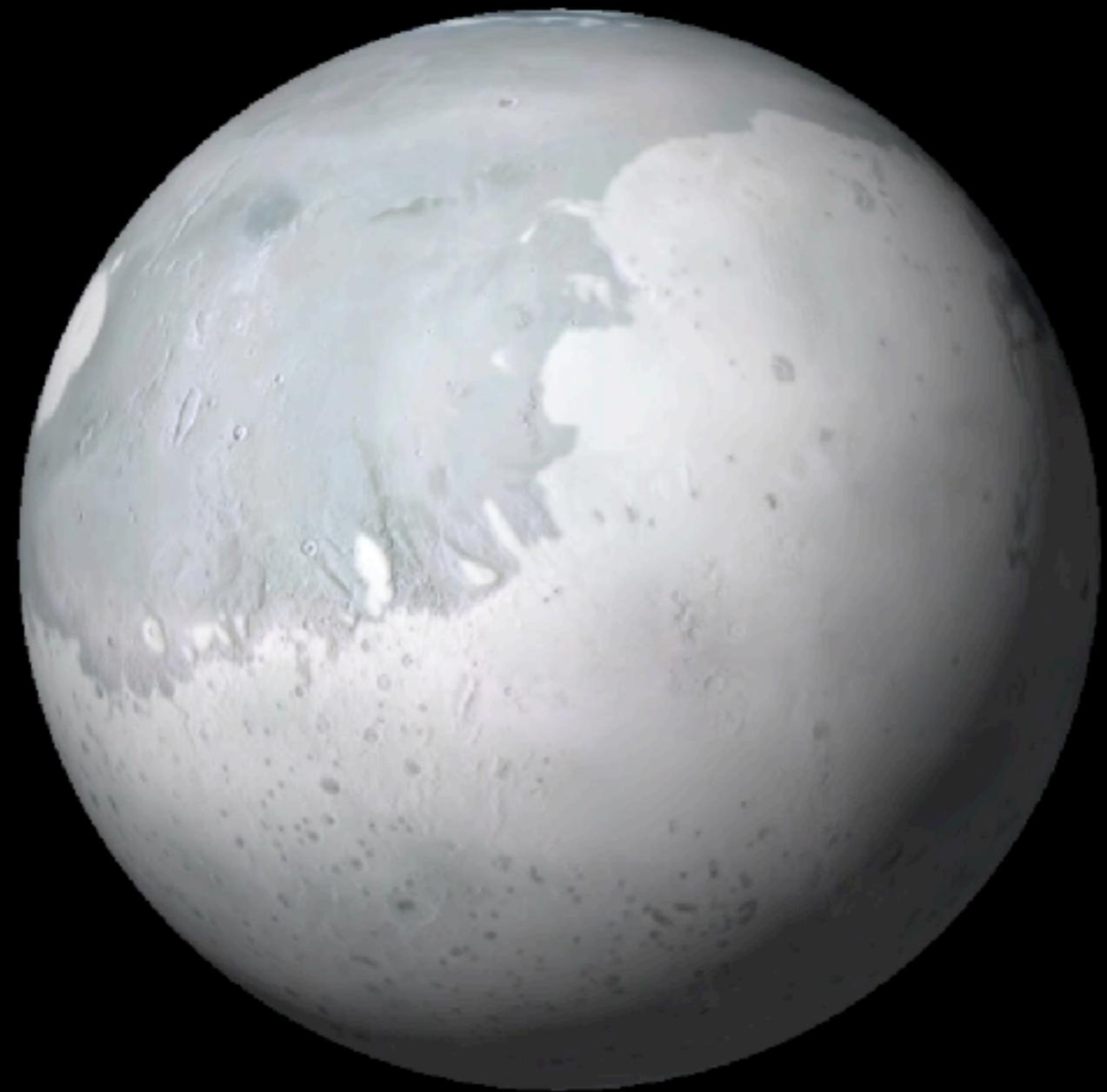




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SNOW GLOBE HYPOTHESIS 3.8 BILLION YEARS AGO





Rewind the Red Planet

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BECOMING A RUSTED REALM

3.5 BILLION YEARS AGO



GALE CRATER



Rewind the Red Planet

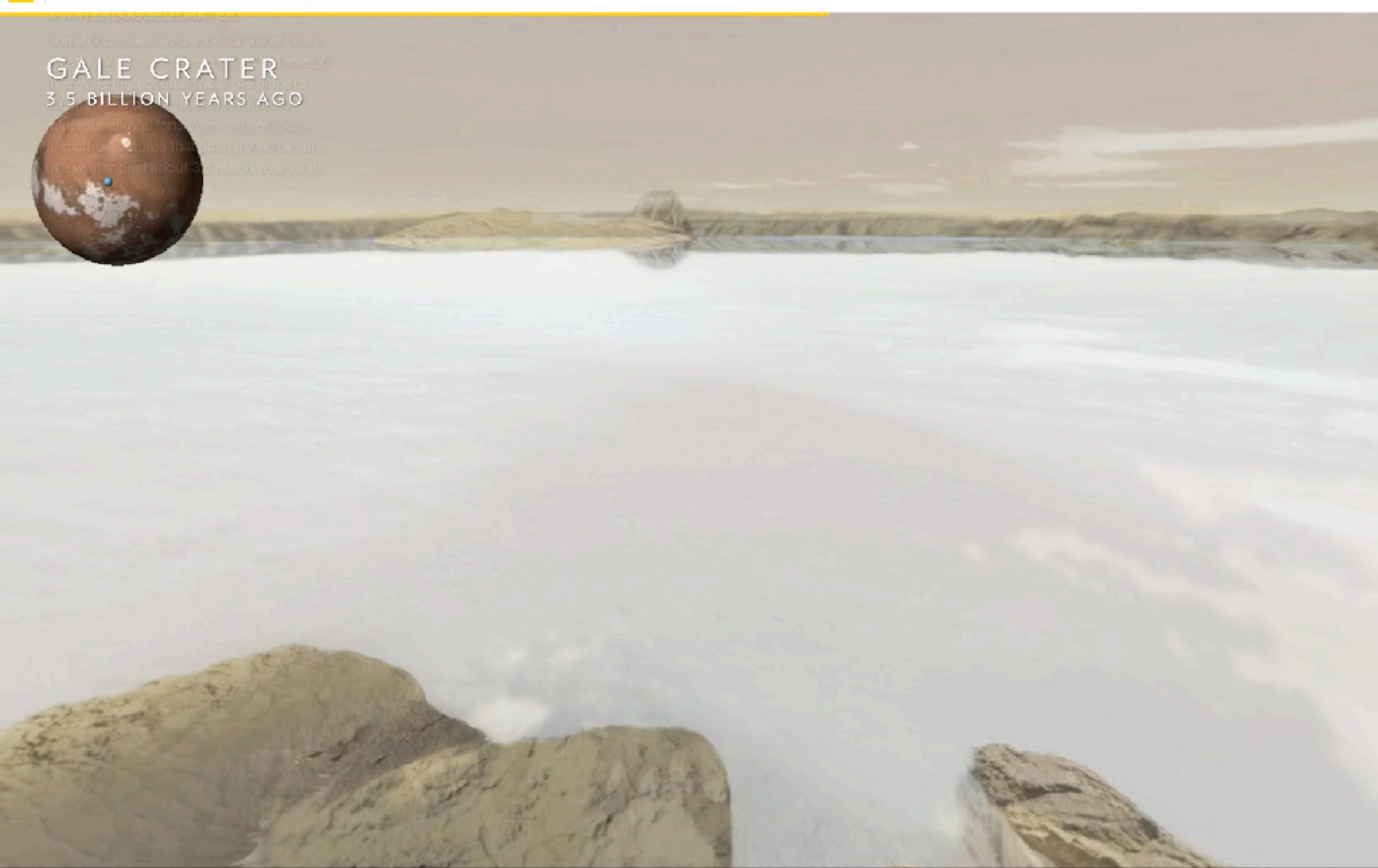
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Some of our best evidence of water flows

on Mars comes from Gale Crater, or Aeolis

GALE CRATER
3.5 BILLION YEARS AGO

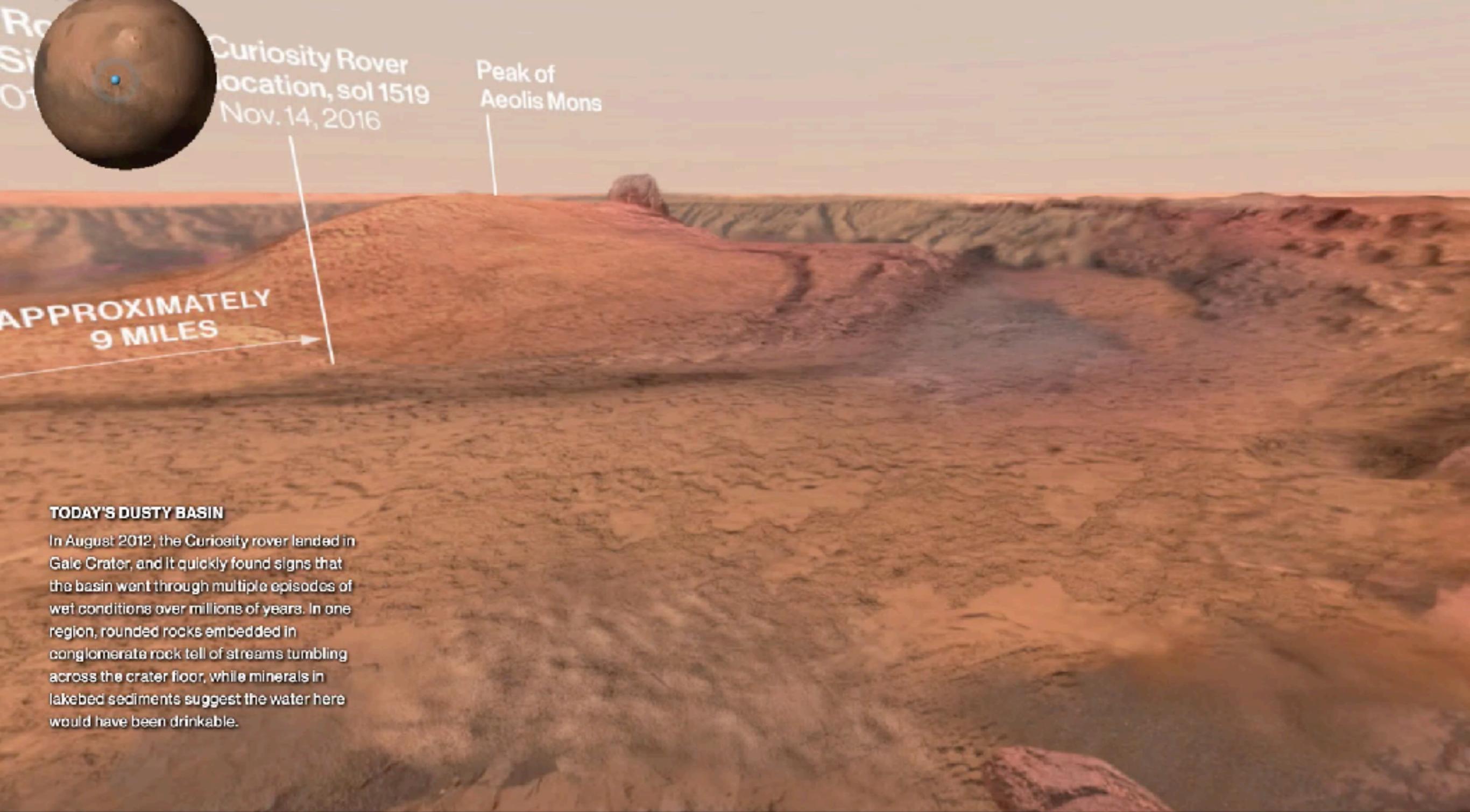
Large-scale alluvial fans, remnants of lakes,
and other features that paint a vivid picture
of a wetter past about 3.5 billion years ago.





GALE CRATER

TODAY

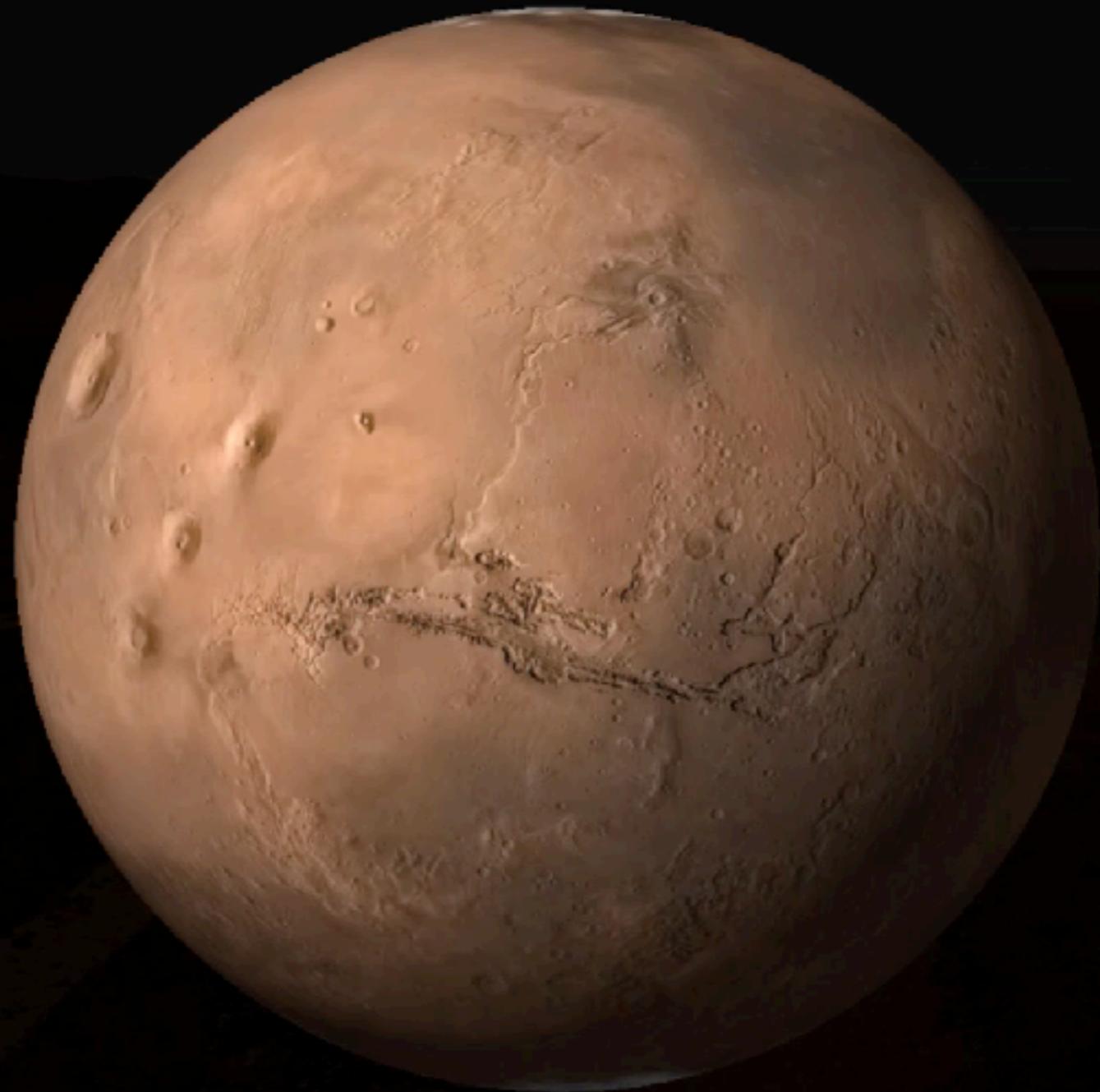




Rewind the Red Planet

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THE RED PLANET TODAY



ACQUIRE KNOWLEDGE/DATA

READING, REPORTING, RESEARCH

Bethany Ehlmann, NASA JPL California Institute of Technology

Robin Wordsworth, Harvard University

Caleb Fassett, NASA Marshall Space Flight Center

Tim Goudge, The University of Texas at Austin

CREATE A NARRATIVE

LOFI/HIFI DESIGNS

COMMISSION ILLUSTRATIONS

RESEARCH TECHNOLOGY

PROTOTYPE

TOOLS

SCRAWLER

<https://github.com/cy-park/Scrawler>

GREENSOCK ANIMATION PLATFORM

<https://greensock.com/gsap>

THREE.JS

<https://threejs.org/>

1

Scrawler tracks box

40%

100%

0%

2

GSAP

TimelineLite
tweens values

0%

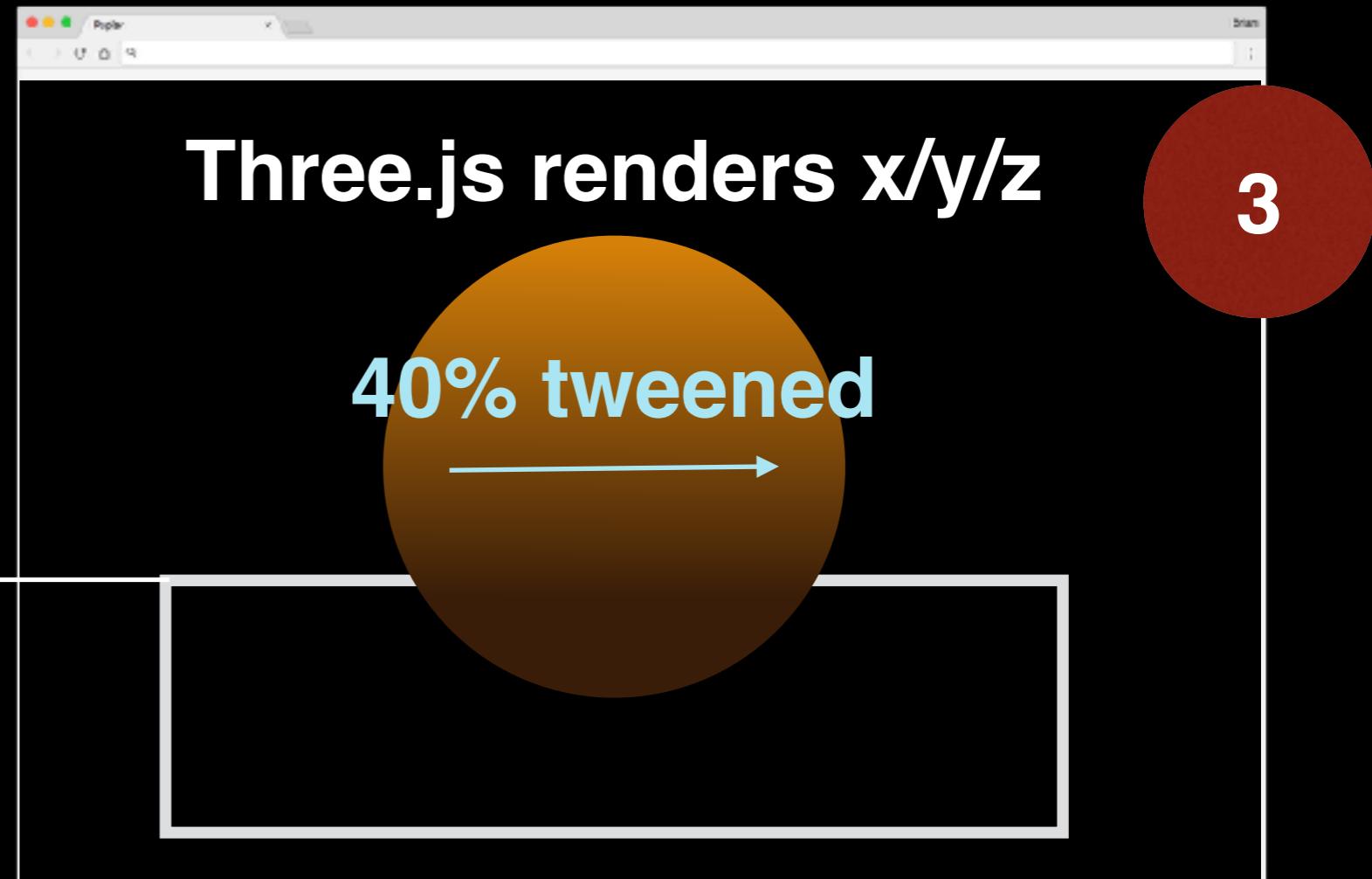
x: 0
y: 0
z: 0

40%

x: 0
y: 40
z: 40

100%

x: 0
y: 100
z: 100



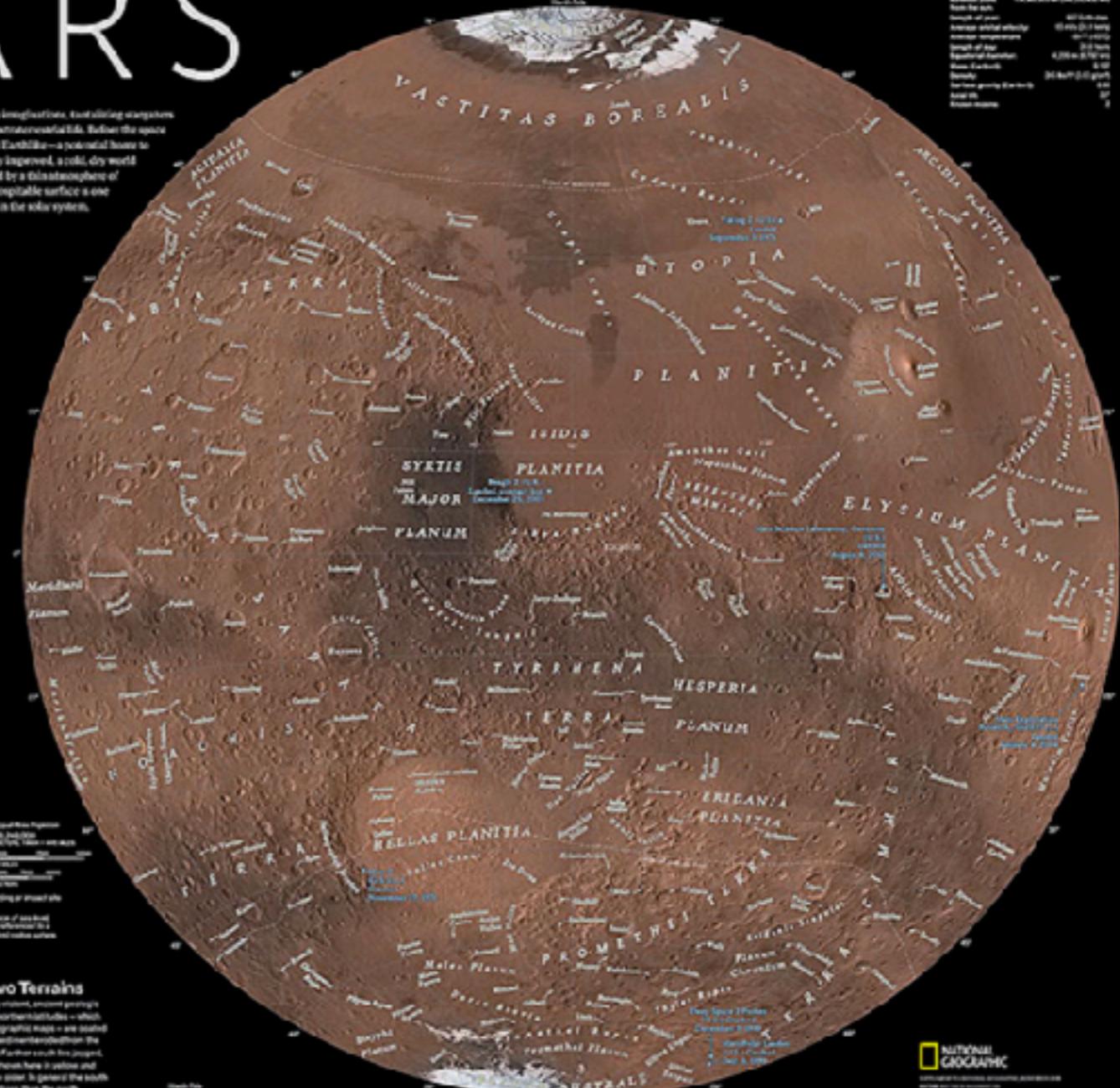
MARS

This view of Mars is a mosaic comprising thousands of photomosaic images from NASA's Mars Global Surveyor. This true-color map shows what scientists conclude about the planet from Earth—including layered valleys, craters, slopes on hills, and polar ice caps. Mars' surface changes constantly. However, as scientists are finding, and naming new features each year,

Western Hemisphere



Eastern Hemisphere



For centuries, Mars has stirred earthly imaginations, tantalizing astronomers and scientists with the prospect of extraterrestrial life. Before the space age, the planet was thought to be Earthlike—a potential home to civilization. But as technology improved, a cold, dry world came into focus. Shrouded by a thin atmosphere of carbon dioxide, the inhospitable surface is one of the most rugged in the solar system.

Diameter: 7,000 mi (11,270 km)
Distant sun: 134.2 million mi (215,700,000 km)
Distance from Earth: 140 million mi (225,000,000 km)
Surface area: 14.7 million sq mi (38.0 million sq km)
Volume: 1.06 billion cu mi (4.46 billion cu km)
Mass: 6.416 x 10²³ kg
American orbital velocity: 10.4 mi/s (16.7 km/s)
Minimum temperature: -204°F (-97°C)
Length of day: 24.6 hours
Year (Earth): 687 days
Diameter: 3,396 mi (5,460 km)
Surface gravity: 0.38 g (38% of Earth's)
Axial tilt: 25°

Glossary

Atmosphere: Gases, other than water vapor, that surround a celestial body.
Cassini: A probe sent to explore the ringed planet Saturn.
Chasma: A long, narrow valley.
Chasma Borealis: A canyon system in the northern hemisphere of Mars.
Crater: A depression in the surface of a celestial body.
Dwarf planet: A celestial body that orbits the Sun, is roughly spherical in shape, and has cleared its neighborhood of other objects.
Eccentricity: The degree of deviation of an orbit from a perfect circle.
Elevation: Height above sea level.
Equator: An imaginary line around a celestial body, halfway between the North and South Poles.
Exobiology: The study of life outside Earth.
Exoplanet: A planet located outside our solar system.
Galaxy: A collection of billions of stars held together by their mutual gravitational pull.
Gullies: Small, narrow depressions on the surface of Mars.
Hemisphere: One half of a celestial body, such as Earth or Mars.
Latitude: The angular distance of a point on Earth or another celestial body from the equator, measured in degrees.
Longitude: The angular distance of a point on Earth or another celestial body from the prime meridian, measured in degrees.
Mars Reconnaissance Orbiter: A robotic probe sent to Mars to study the planet's surface and atmosphere.
Meridian: A vertical line of longitude.
Missions: Spacecraft sent to explore other celestial bodies.
Noctilucent clouds: High-altitude clouds that appear at night.
Oasis: A small area of vegetation in a desert.
Orbit: The path of a celestial body as it moves around another celestial body.
Orbiter: A spacecraft that orbits a celestial body without landing on it.
Planetary ring: A ring of small celestial bodies, such as rocks and dust, that orbits a celestial body.
Plains: A flat, relatively featureless area of the surface of a celestial body.
Polar ice cap: A large area of ice at the North or South Pole of a celestial body.
Protoplanet: A celestial body that has not yet formed into a planet.
Red planet: A nickname for Mars because of its reddish color.
Satellite: A celestial body that orbits another celestial body.
Sputnik: The first artificial satellite ever launched into space.
Terra: A large area of land on the surface of a celestial body.
Volcano: A vent through which molten rock, ash, and gases erupt from beneath the surface of a celestial body.

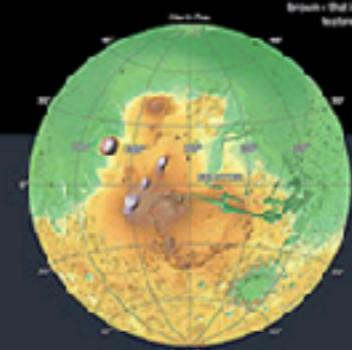
Misshappen Martian Moons



Phobos
This irregularly shaped moon circles Mars' North Polar region, 3,700 miles from the planet's center. It's about 16 miles across.

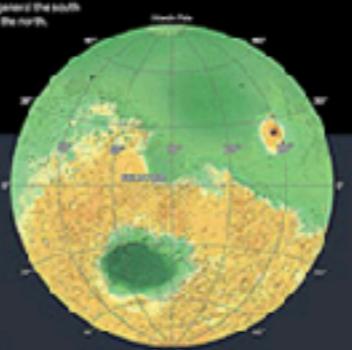


Deimos
This tiny moon orbits Mars at an average distance of 16,000 miles. Scientists say the tiny moon—visible only in a telescope—was captured by the planet's gravity.



Elevation

-10,000 m
-5,000 m
0 m
5,000 m
10,000 m



Fourth Rock From the Sun

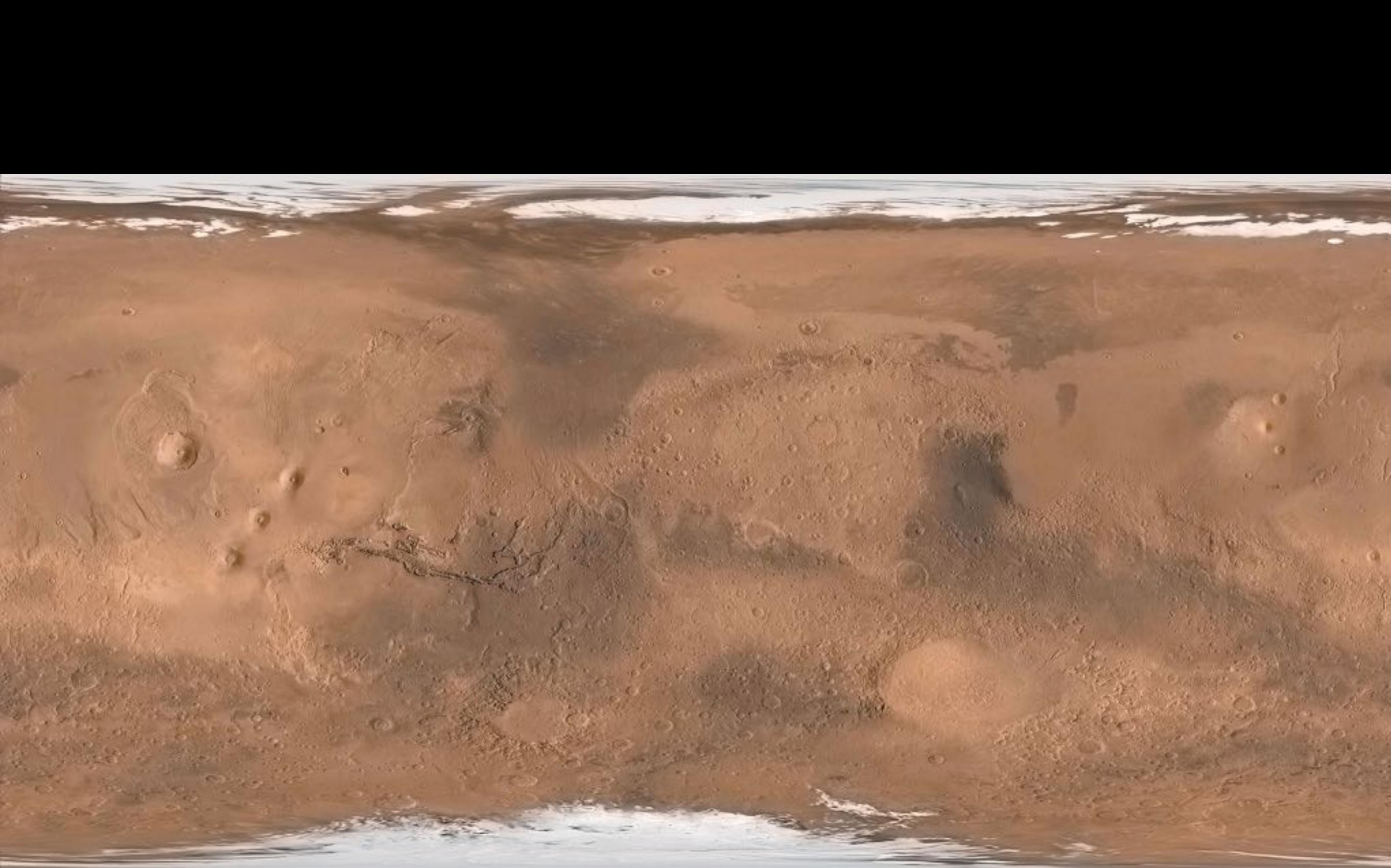
From Mercury to Neptune, here's how the diameters of our solar system's eight planets compare with one another. All these dwarf planets have an orbital diameter smaller than that of Earth's moon, 2,160 miles.

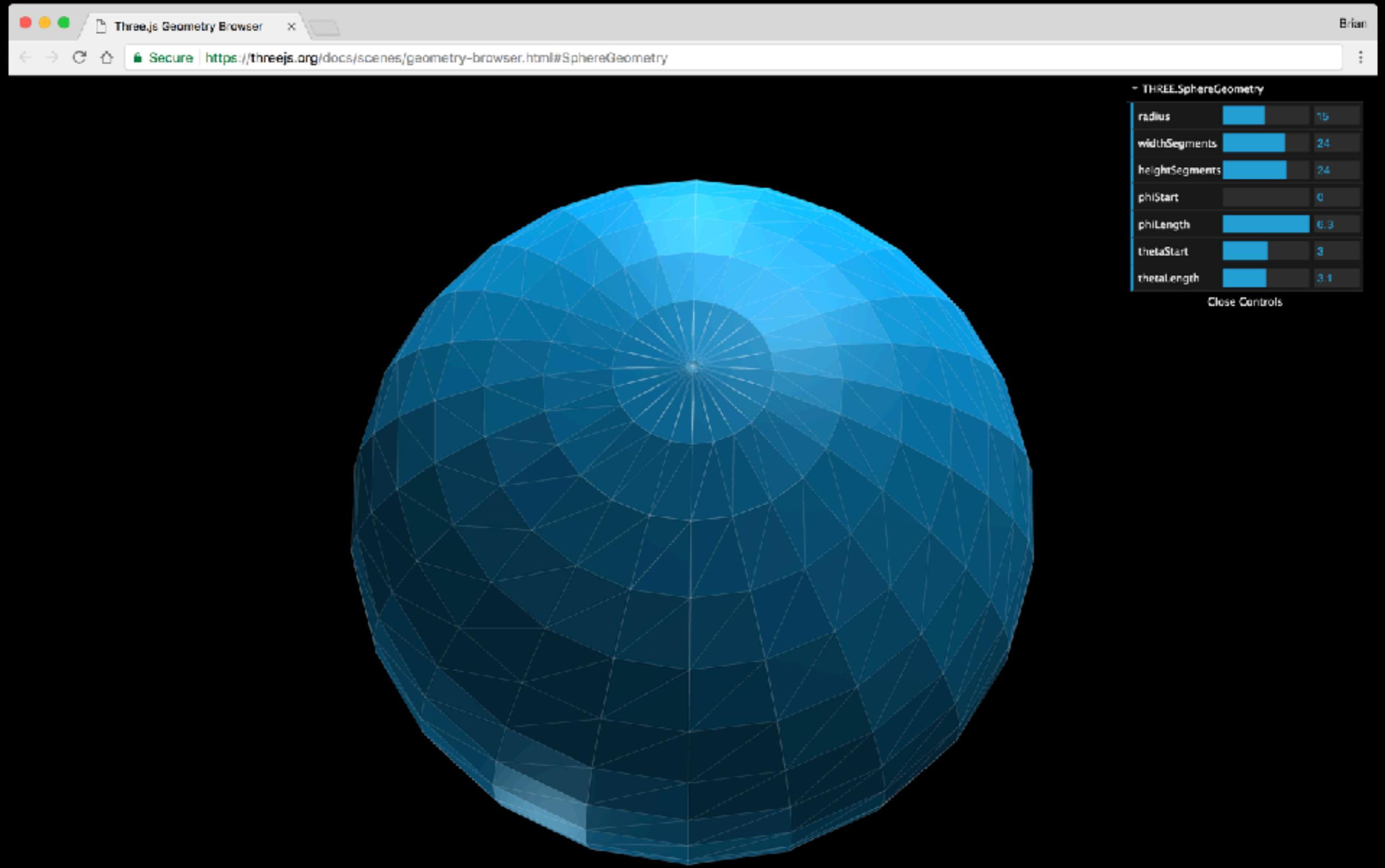
INNER PLANETS
Mercury (3,030 mi)
Venus (7,515 mi)
Earth (7,918 mi)
Mars (4,226 mi)



NATIONAL GEOGRAPHIC

MAP BY NATIONAL GEOGRAPHIC MAP STAFF
ILLUSTRATION BY JEFFREY C. MCKEE
PHOTOGRAPH BY JEFFREY C. MCKEE





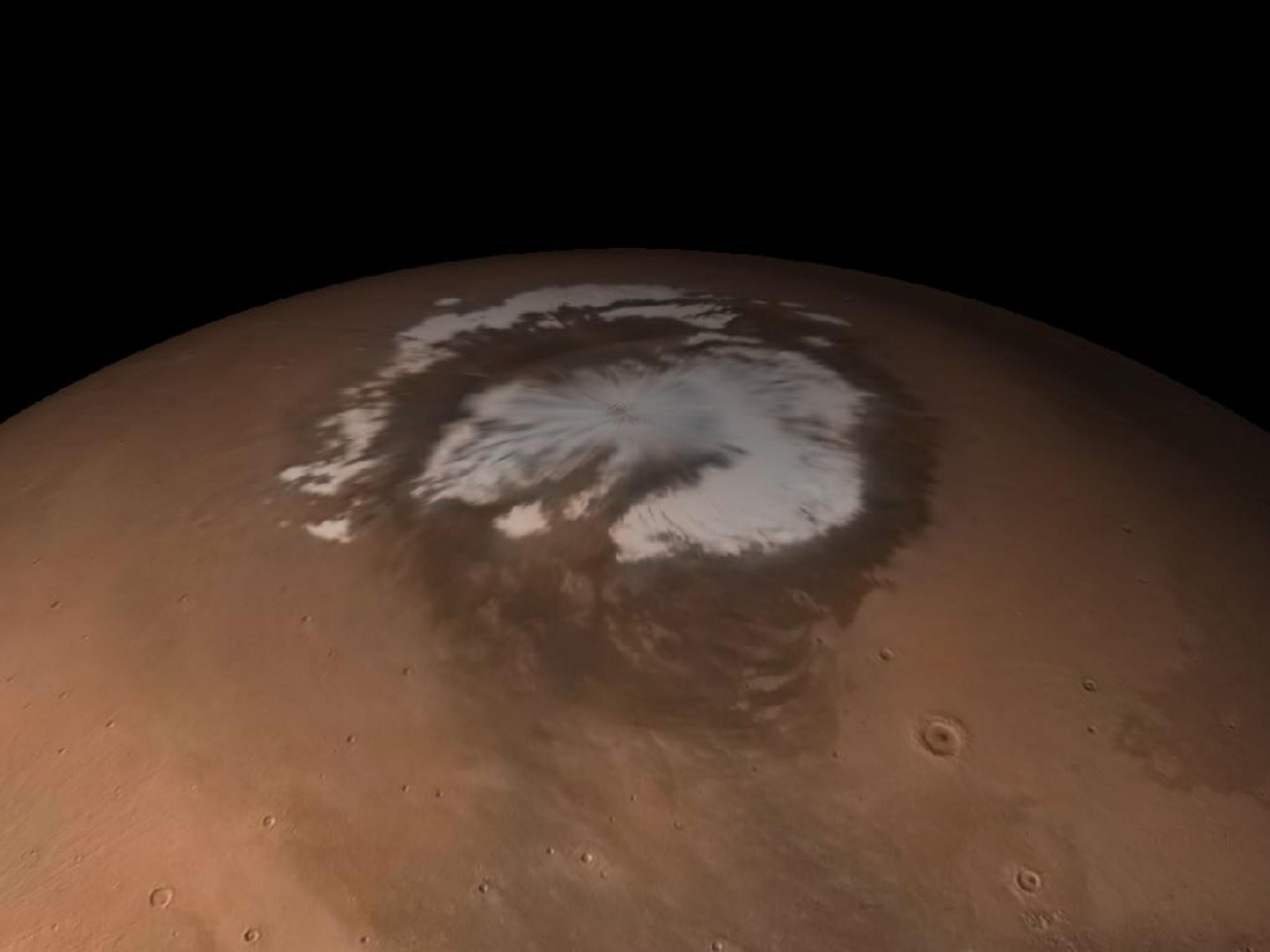
[Open in New Window](#)

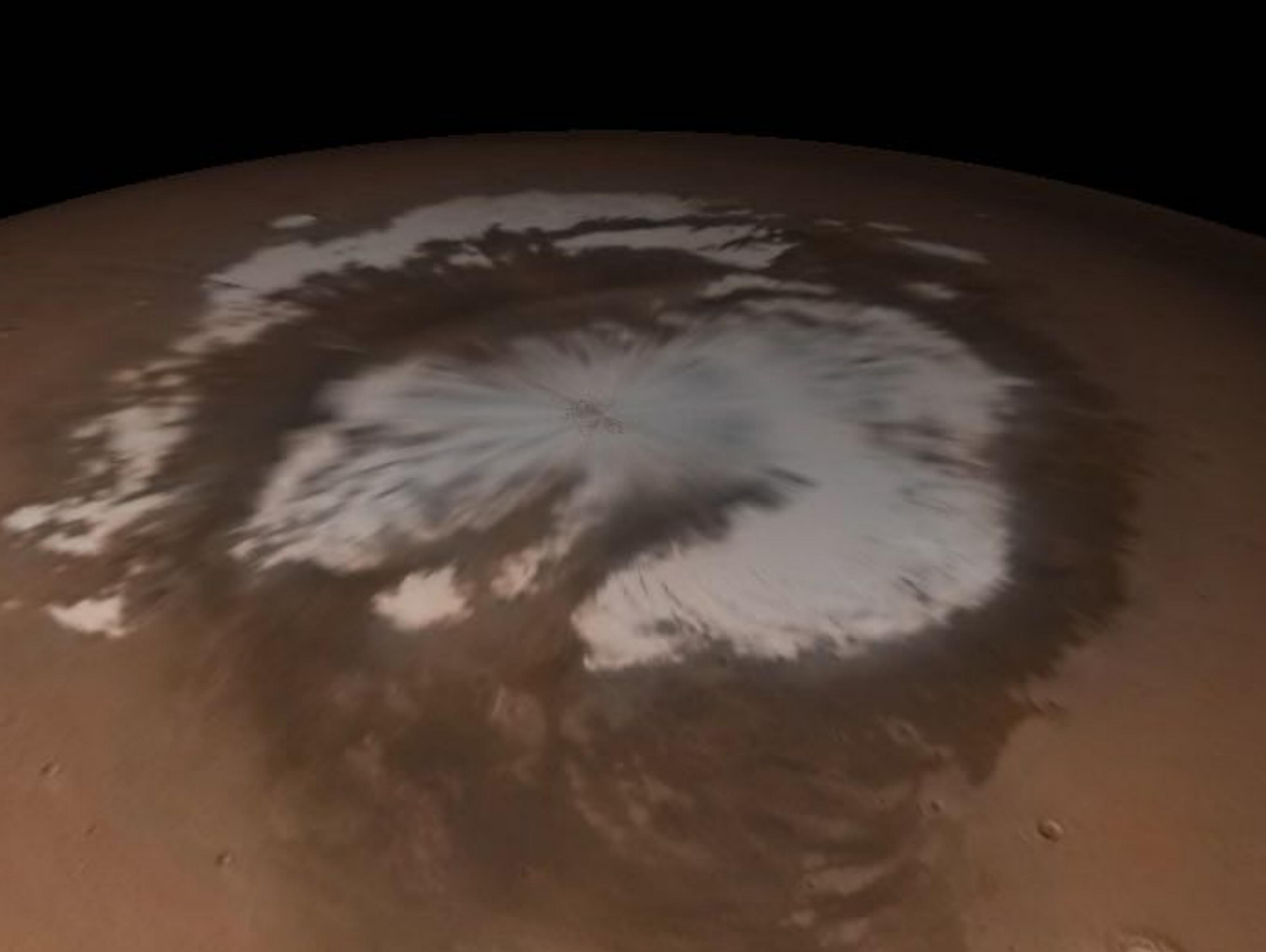
<https://threejs.org/docs/scenes/geometry-browser.html#SphereGeometry>

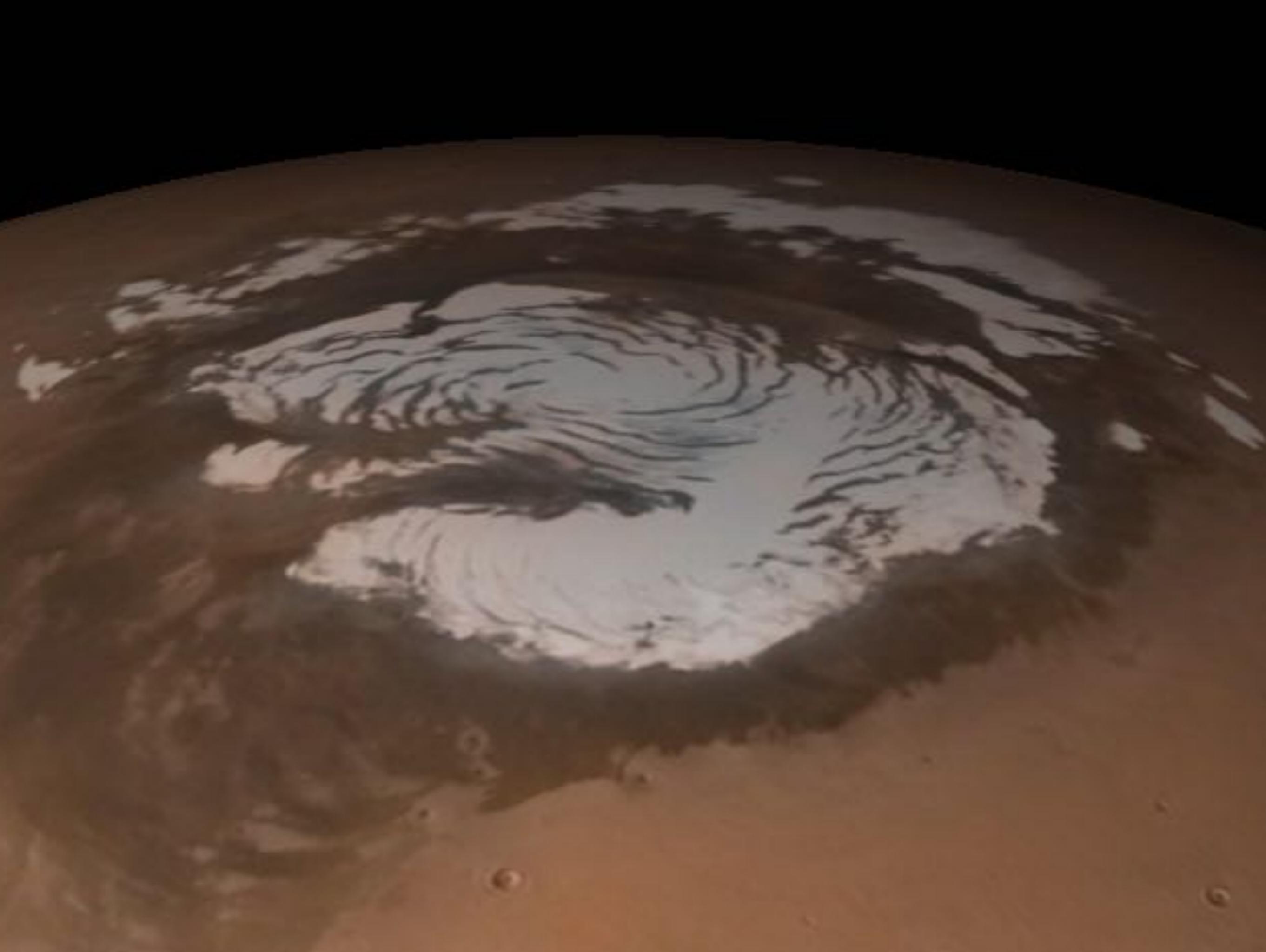
[WebGL](#) is a JavaScript API for rendering interactive 3D graphics in [modern web browsers](#) without the use of plug-ins. [Three.js](#) is built on top of WebGL, and allows you to create complex 3D scenes with a few lines of JavaScript.. If your browser supports WebGL you should see a rotating Earth below:

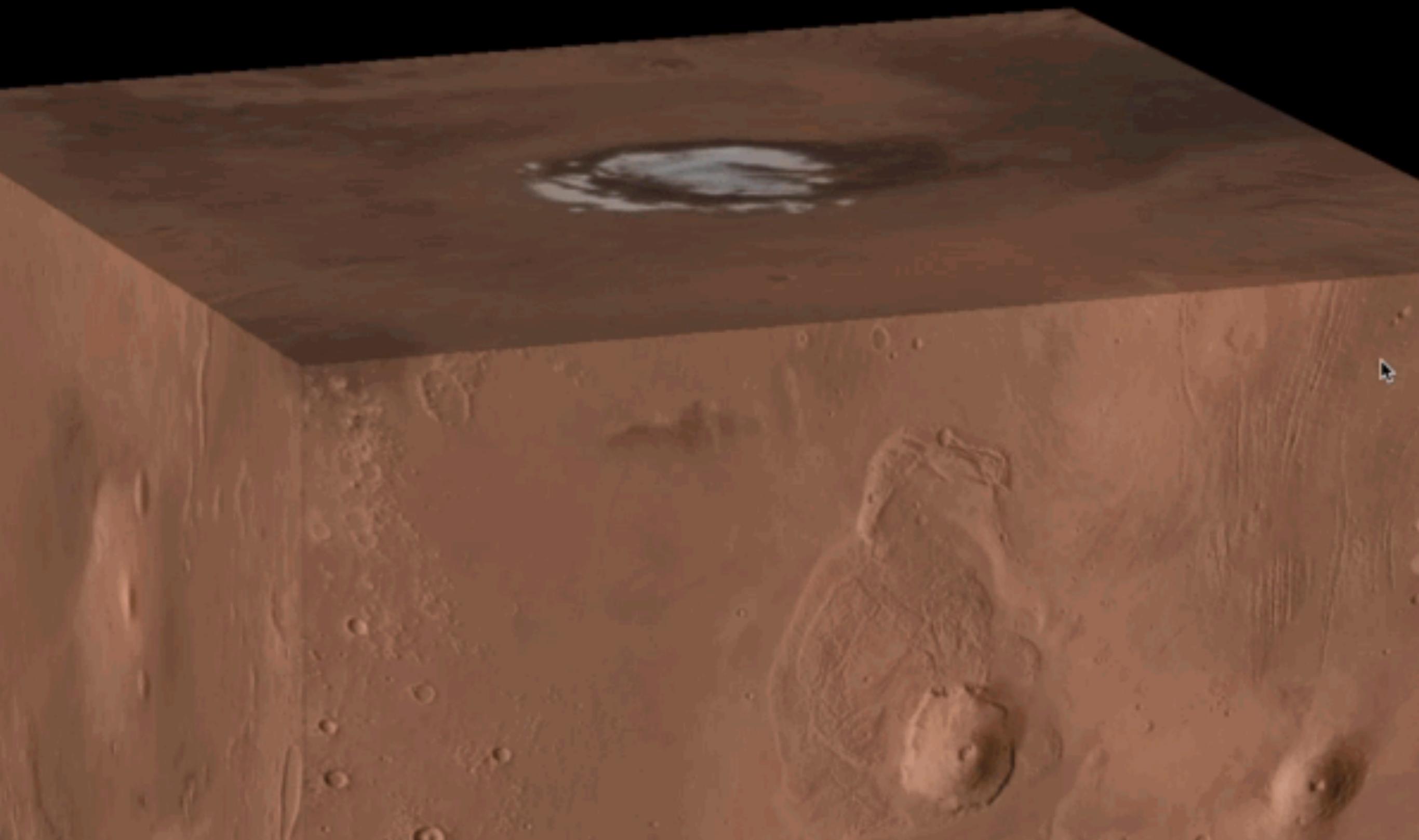


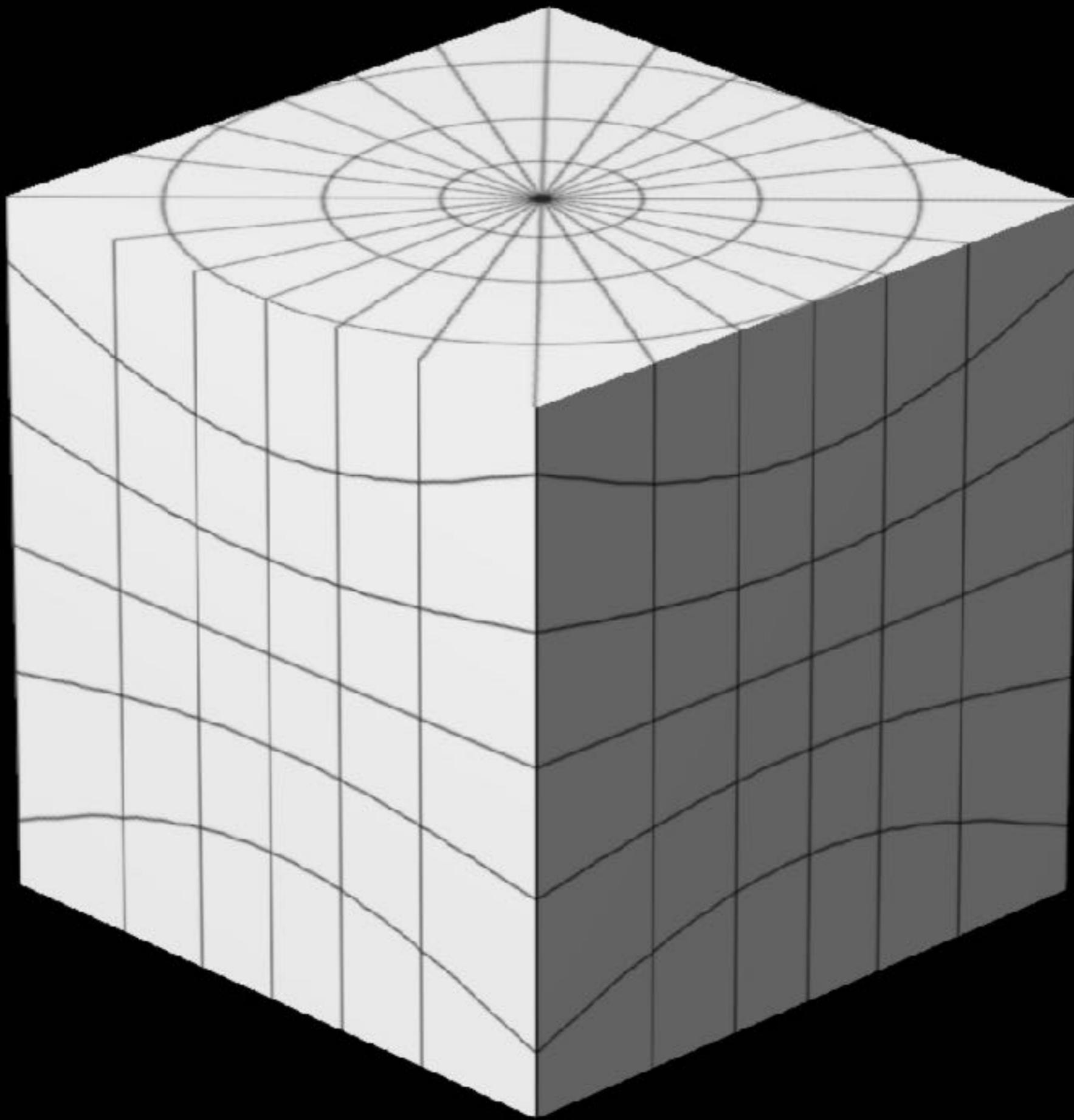
[[Fullscreen](#)]

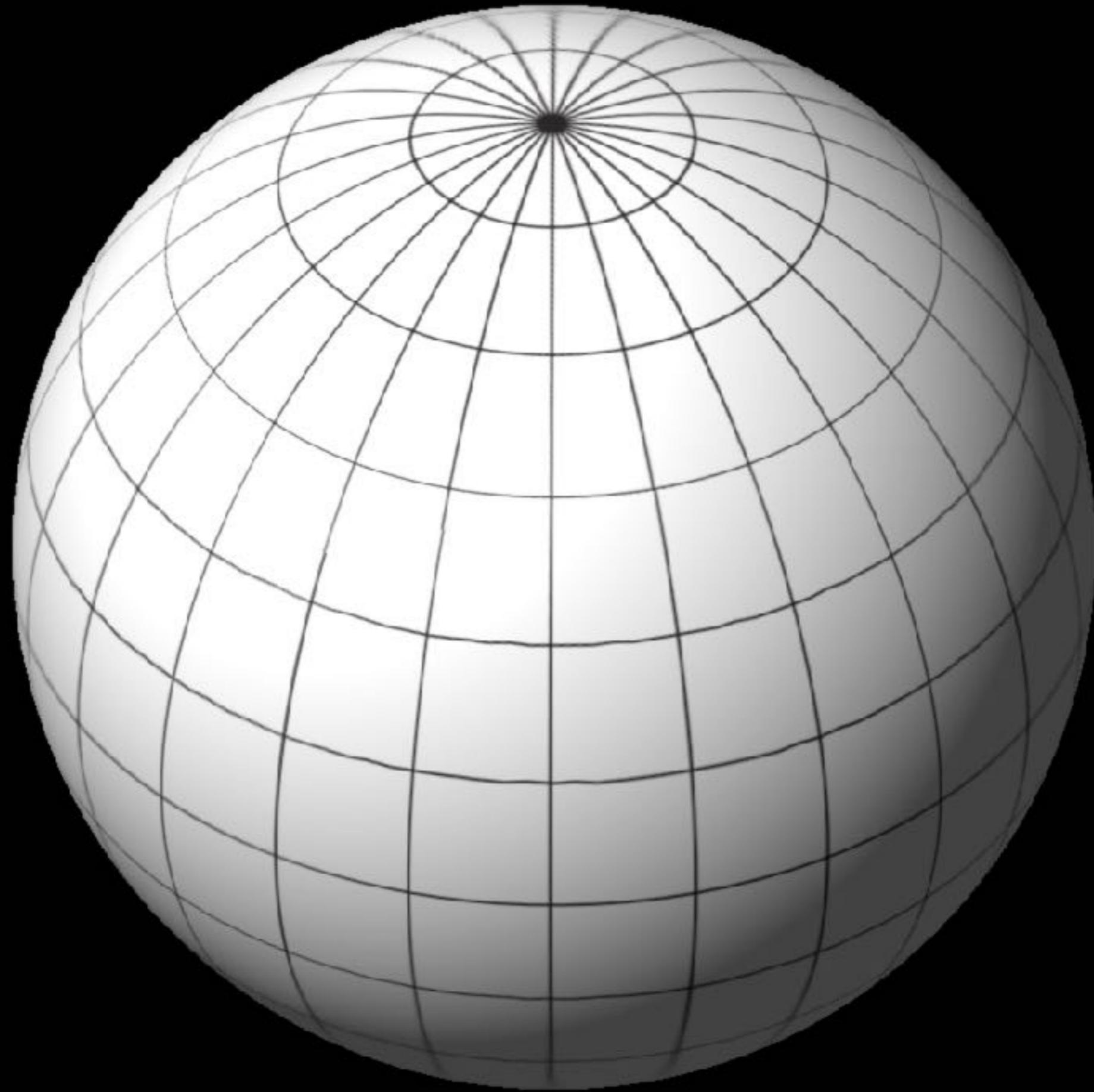




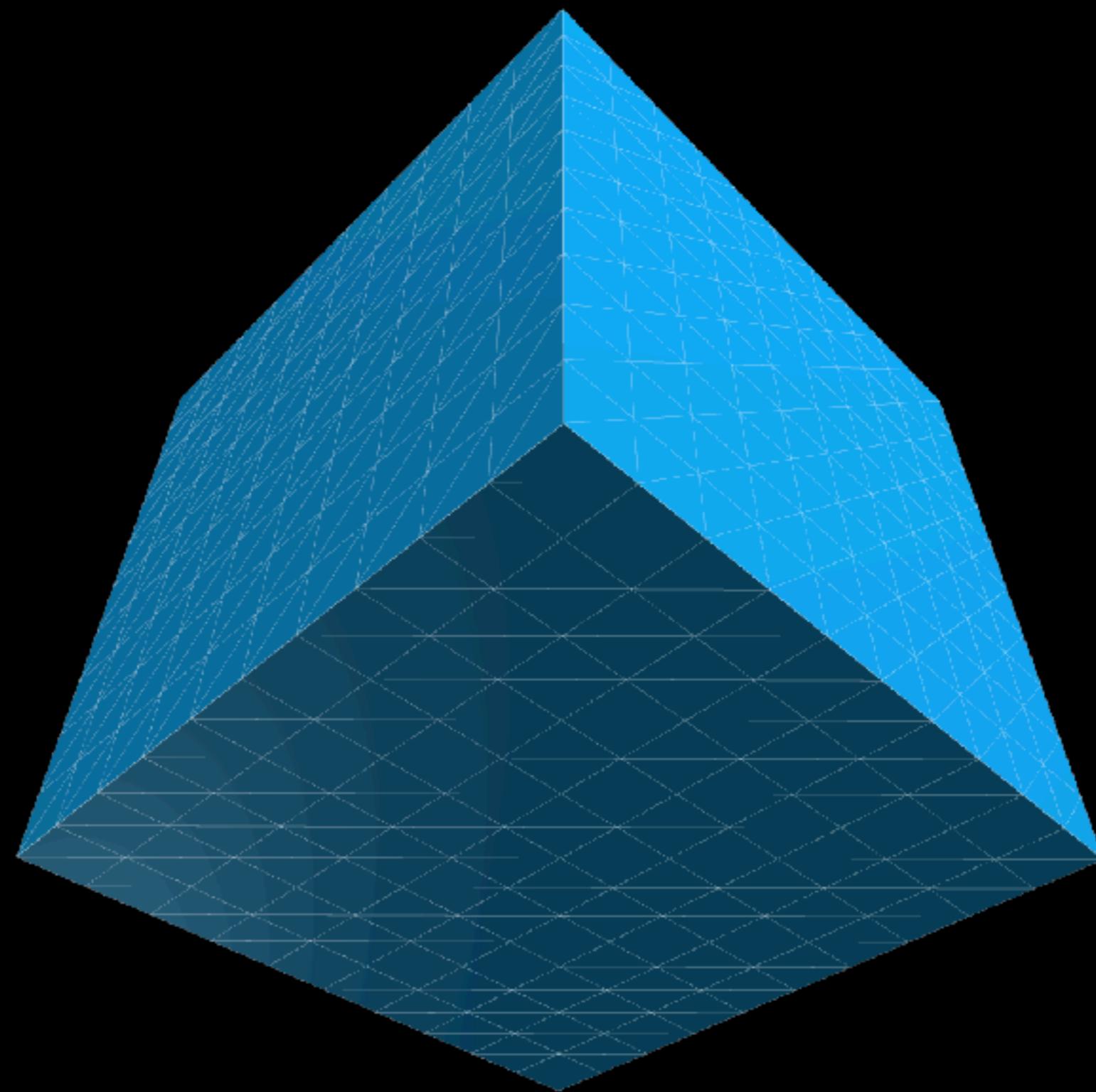


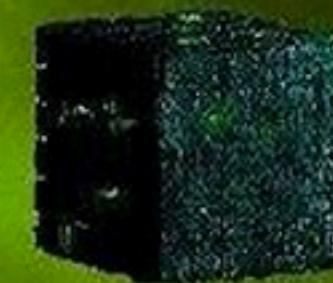
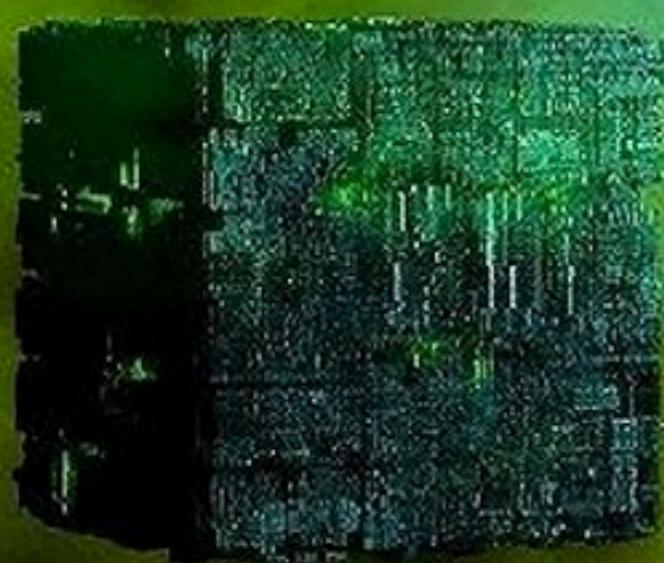
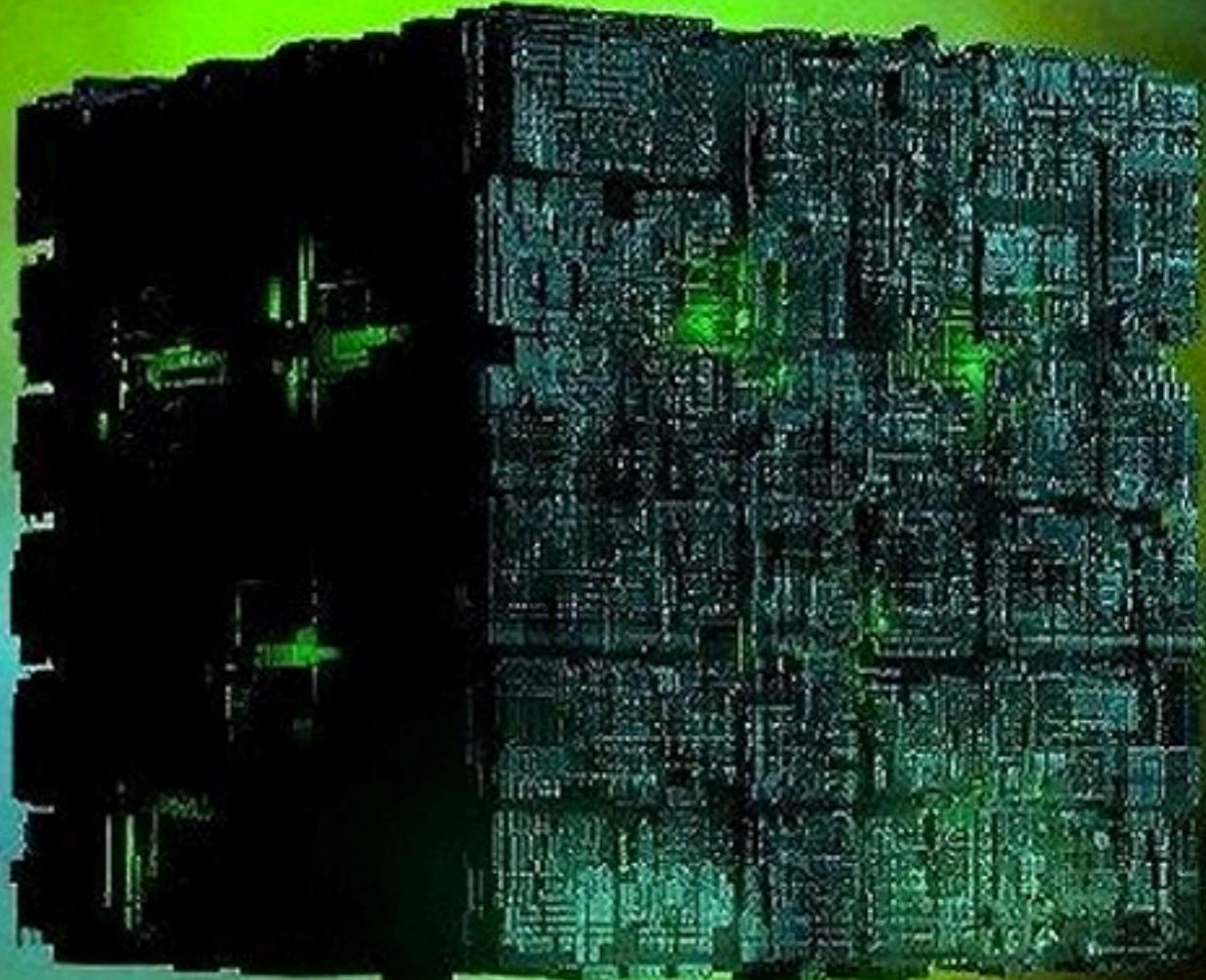
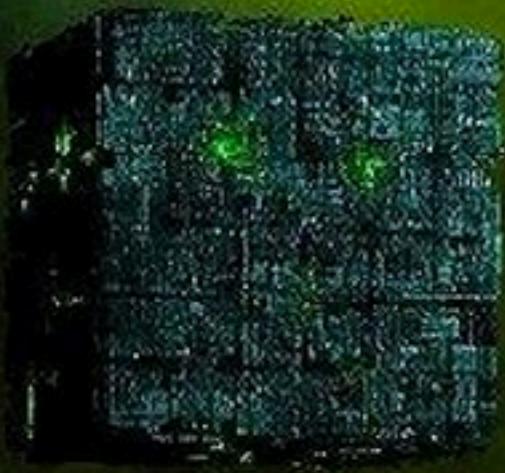


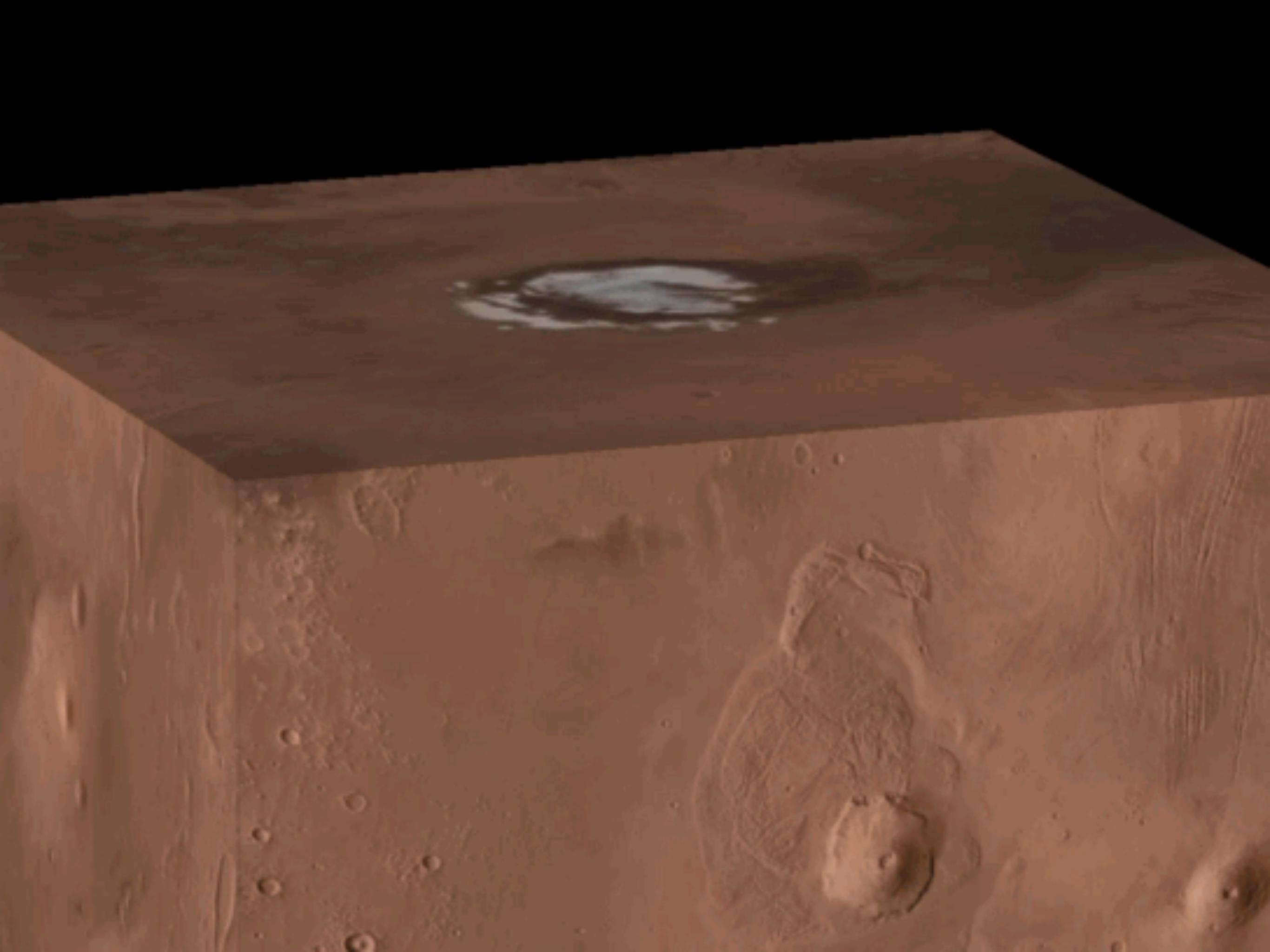


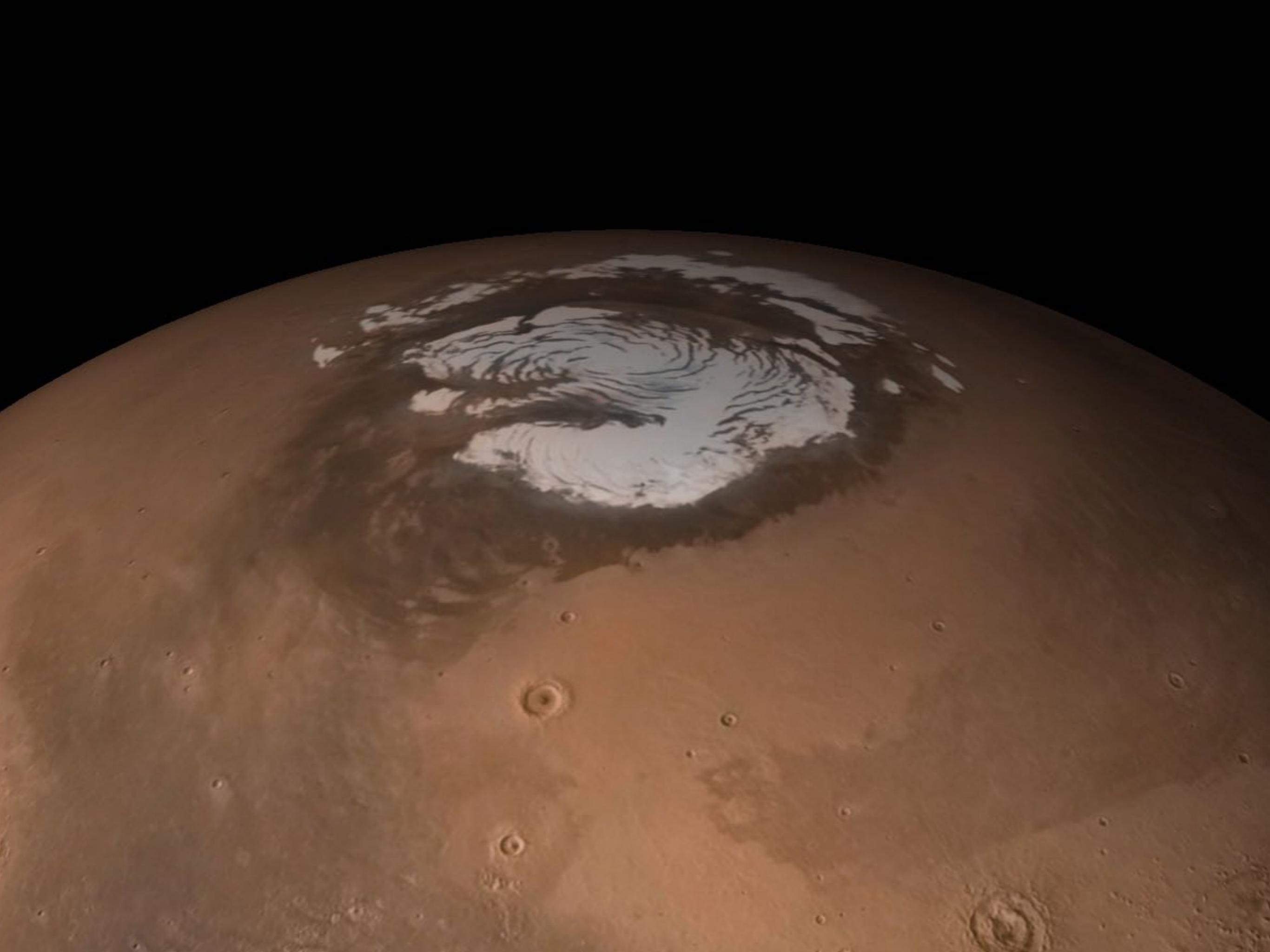




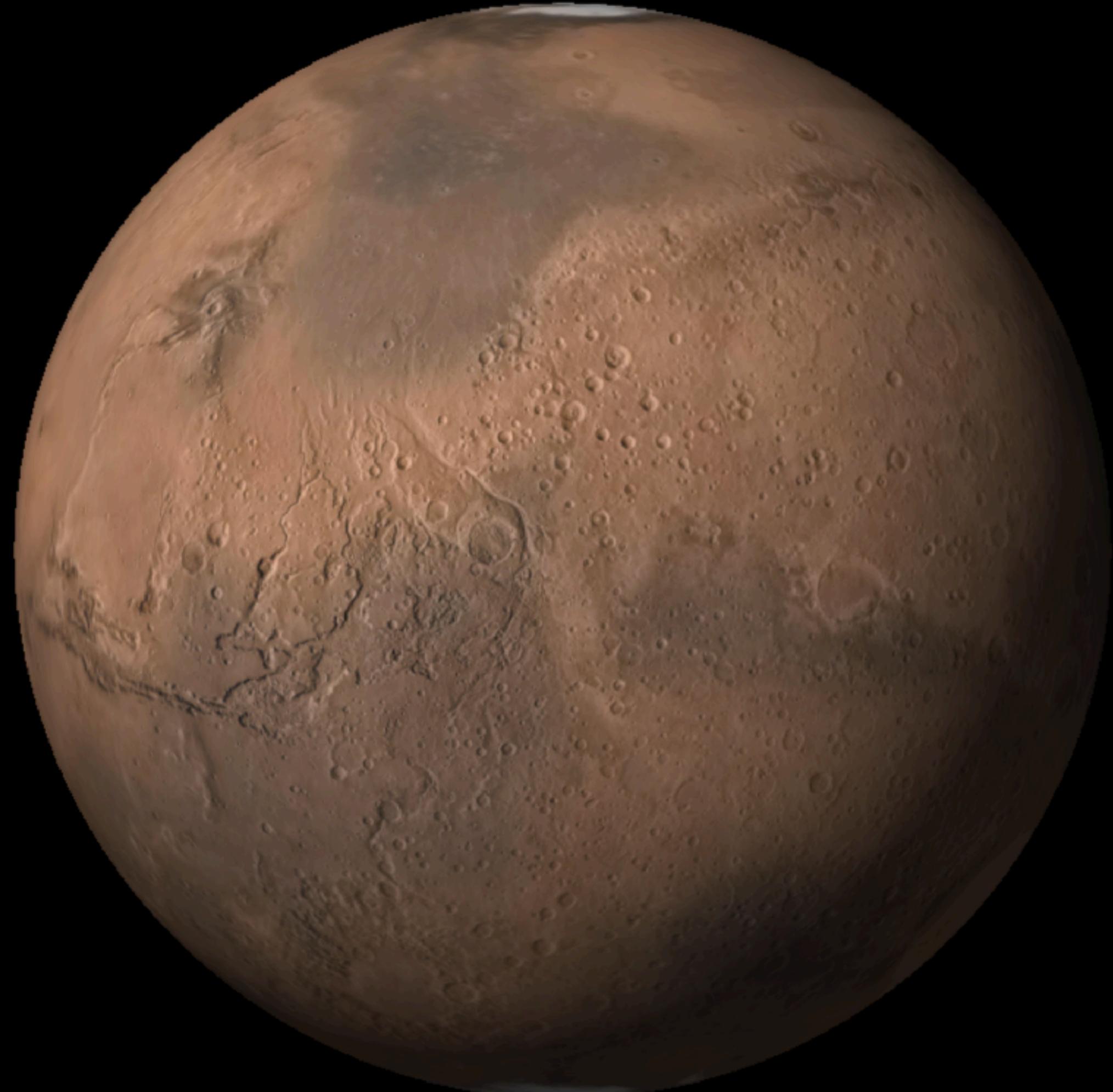








AGU





briantjacobs / cubeSphere-example.js

Last active 5 minutes ago

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0

[Code](#)[Revisions 5](#)[Embed](#) ▾

<script src="https://gist.

[Download ZIP](#)

Create 6 gnomonic cube faces from a WGS84 input geotiff, render in three.js

SCRIPTS TO DO THIS

[cubeSphere-example.js](#)[Raw](#)

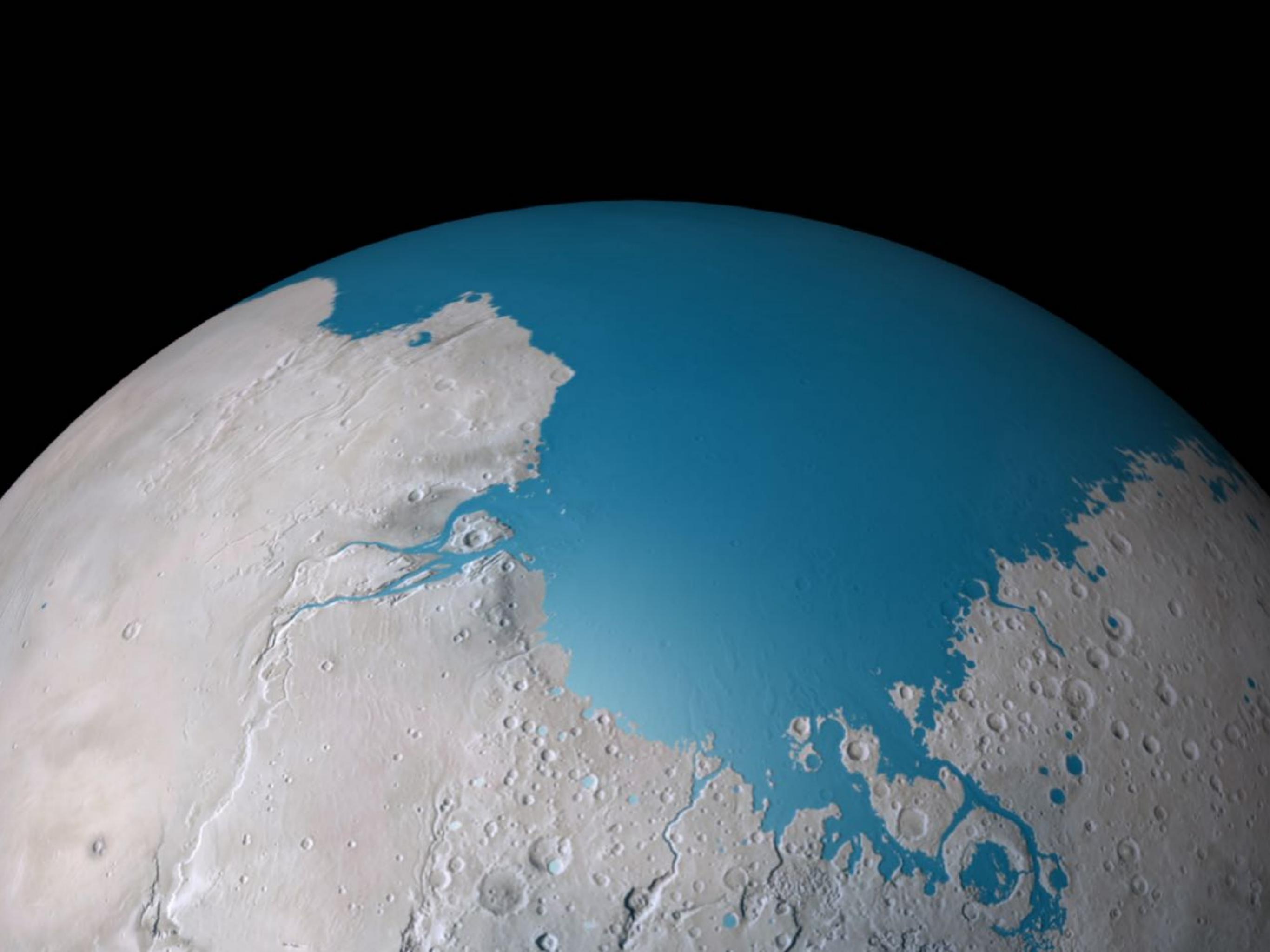
```
1 var cubeSphere = new CubeSphere({
2     parent: PARENT, // scene or Object3D
3     scale: 1, // in case scaling according to other objects in scene
4     radius: 5, // size of sphere
5     textureFace0: new THREE.TextureLoader().load('cubeFace0.jpg'),
6     textureFace1: new THREE.TextureLoader().load('cubeFace1.jpg'),
7     textureFace2: new THREE.TextureLoader().load('cubeFace2.jpg'),
8     textureFace3: new THREE.TextureLoader().load('cubeFace3.jpg'),
9     textureFace4: new THREE.TextureLoader().load('cubeFace4.jpg'),
10    textureFace5: new THREE.TextureLoader().load('cubeFace5.jpg'),
11    textureFace6: new THREE.TextureLoader().load('cubeFace6.jpg')
12 }
13 )
14 }
```

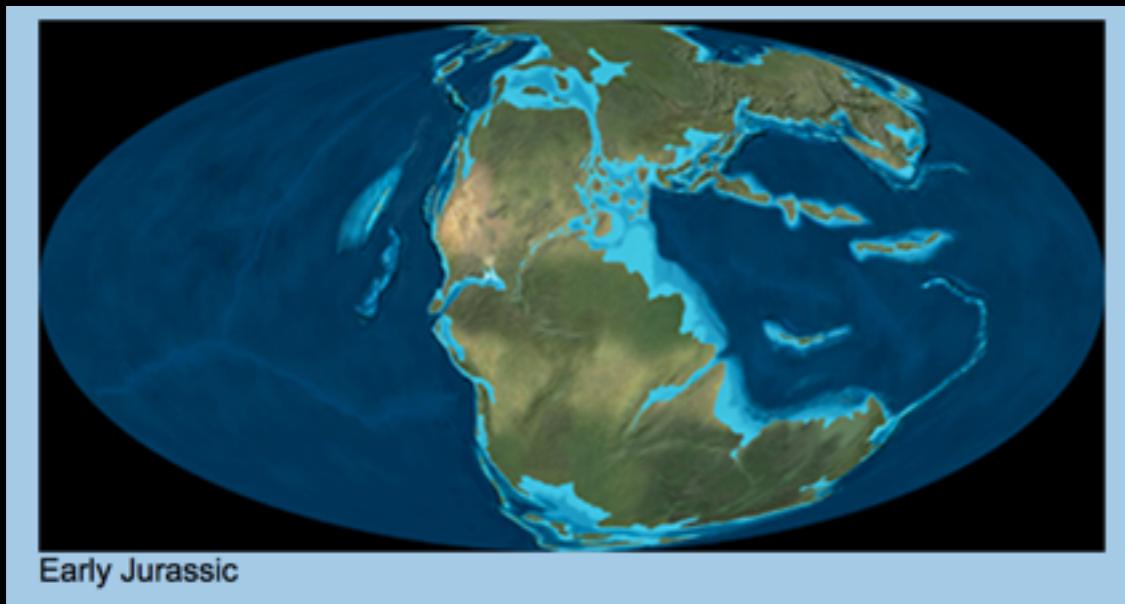
Python/GDAL script to automate face creation
three.js snippets to render the faces and inflate

<https://github.com/briantjacobs/foss4g-2017-talk/>

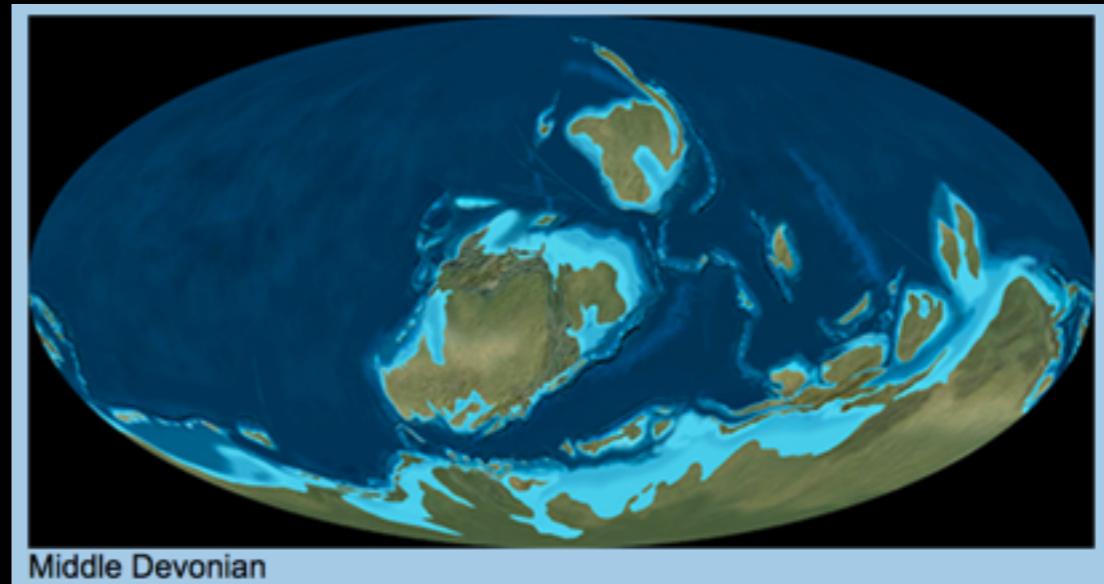
[processWGS84intoGnomonicFaces.py](#)[Raw](#)

```
1 # requires gdal cli installed
2 # run like this:
3 # python processWGS84intoGnomonicFaces.py input-geotiff.tif
4
5 import subprocess
6 import sys
7 inputFile = sys.argv[-1]
8 outputPath = "/path/to/faces/"
9
```

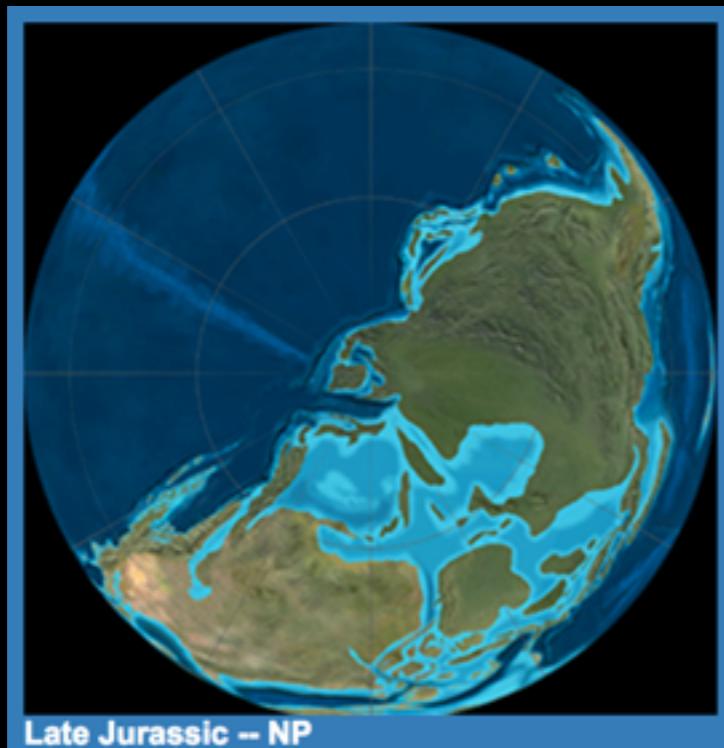




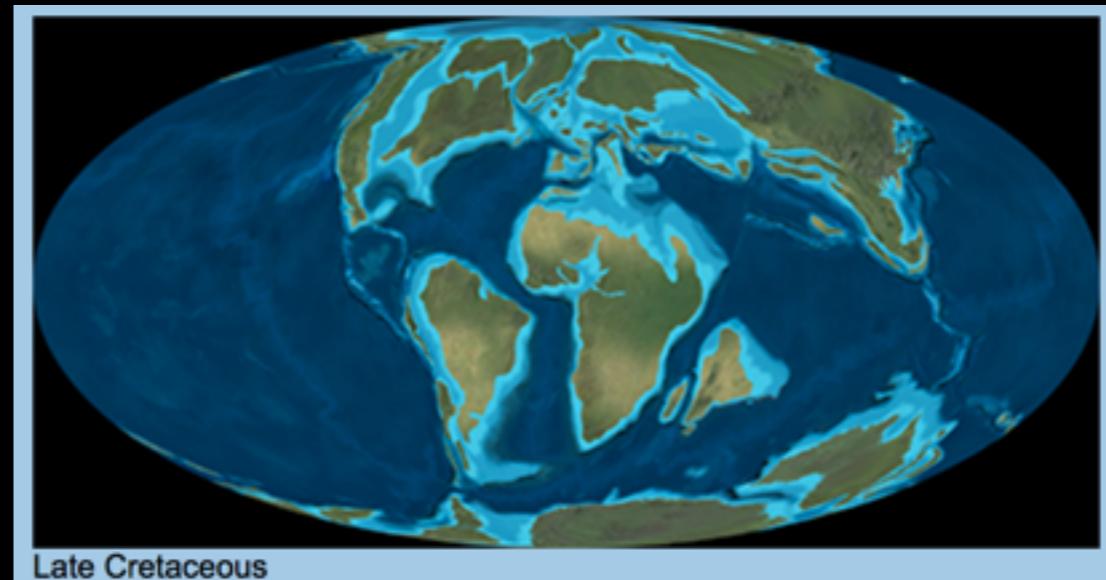
Early Jurassic



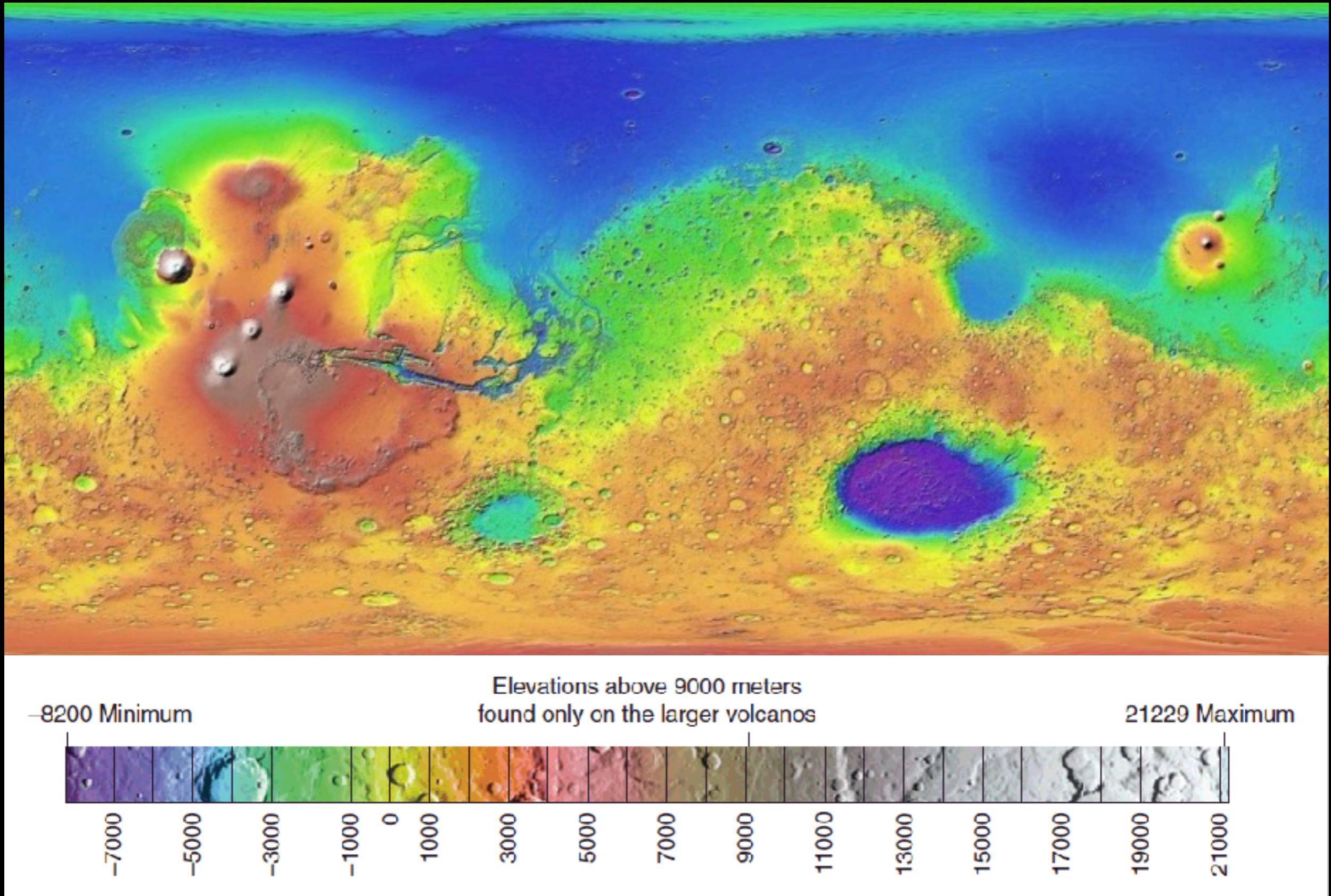
Middle Devonian



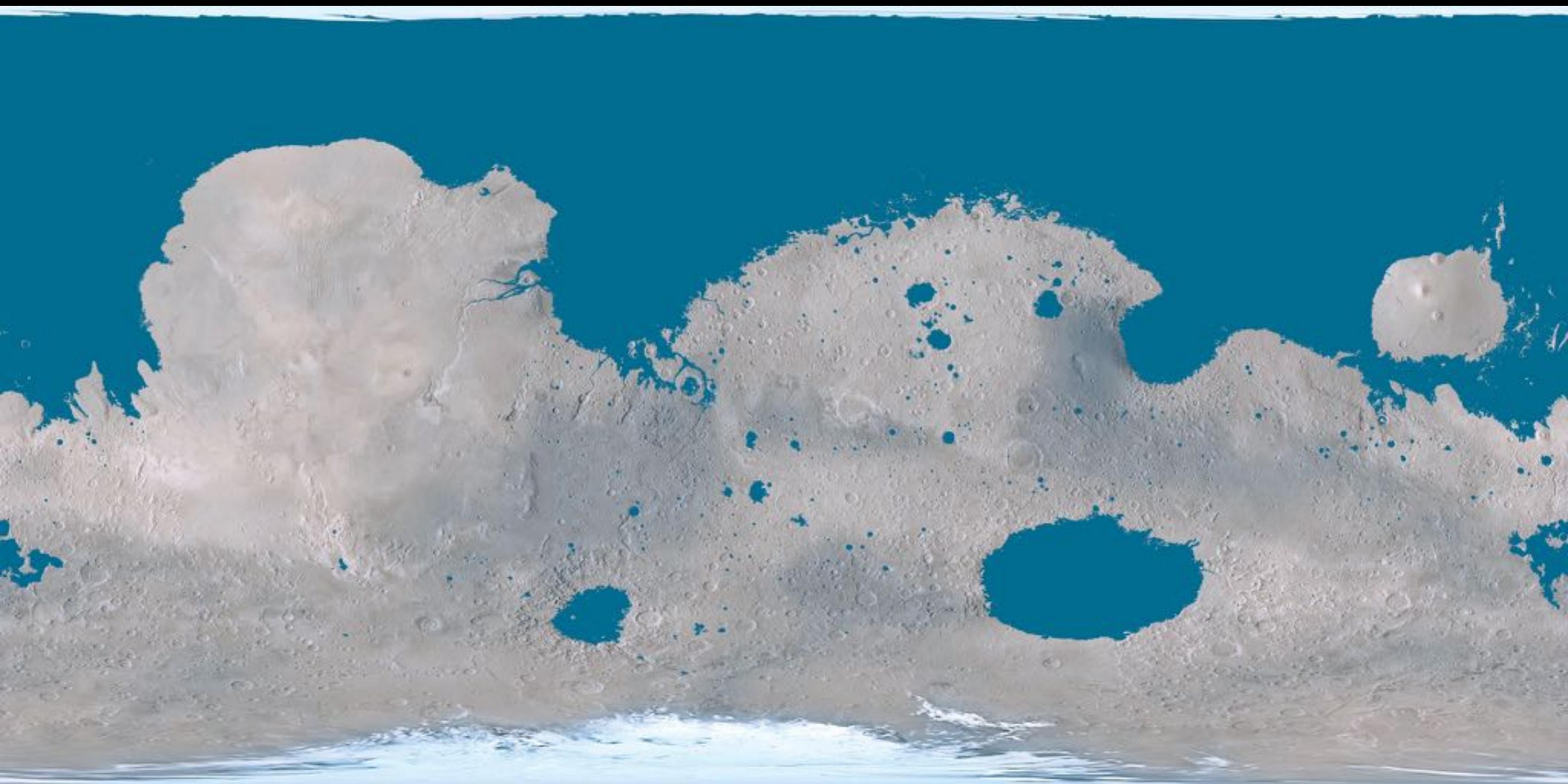
Late Jurassic -- NP



Late Cretaceous

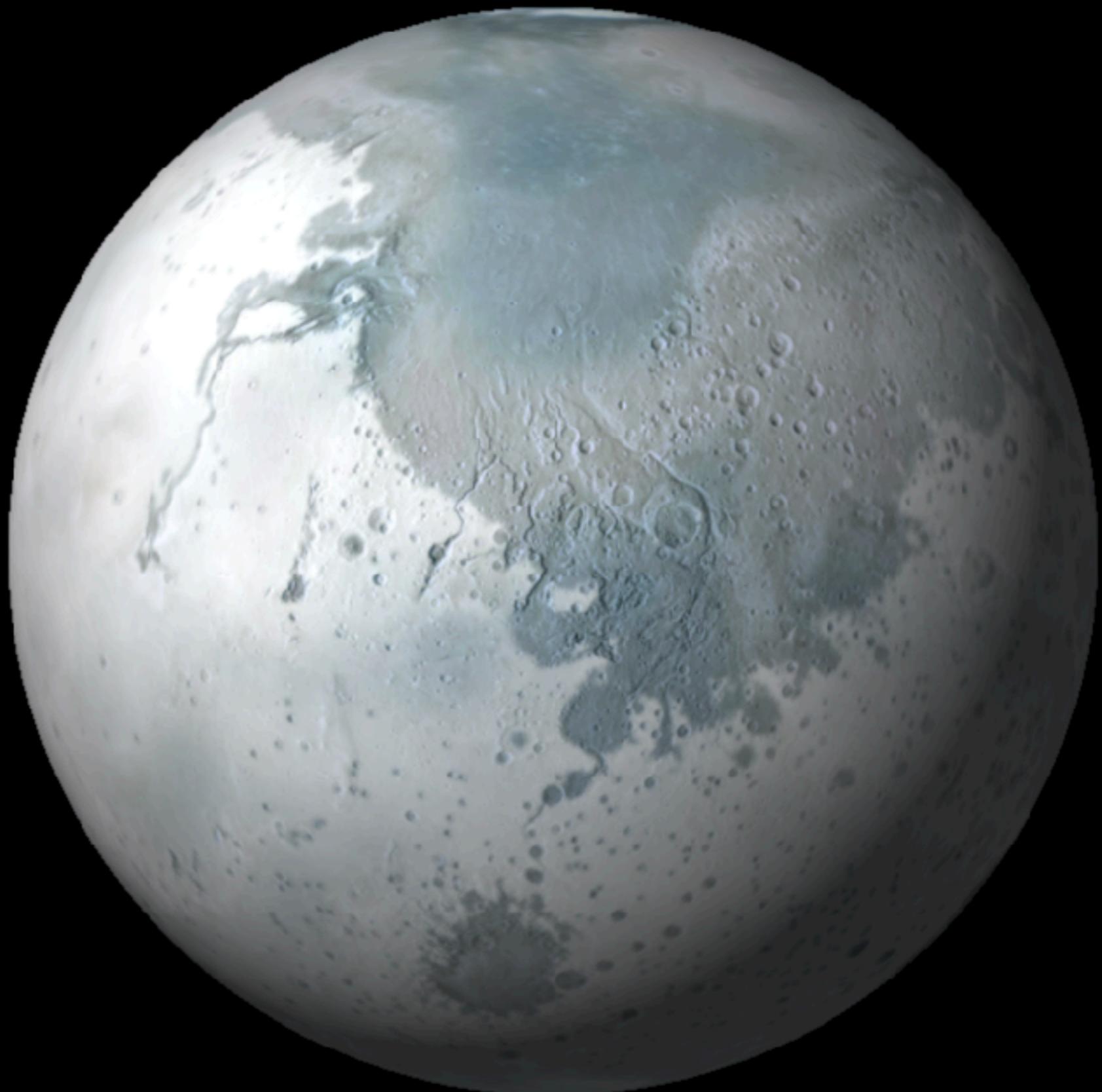


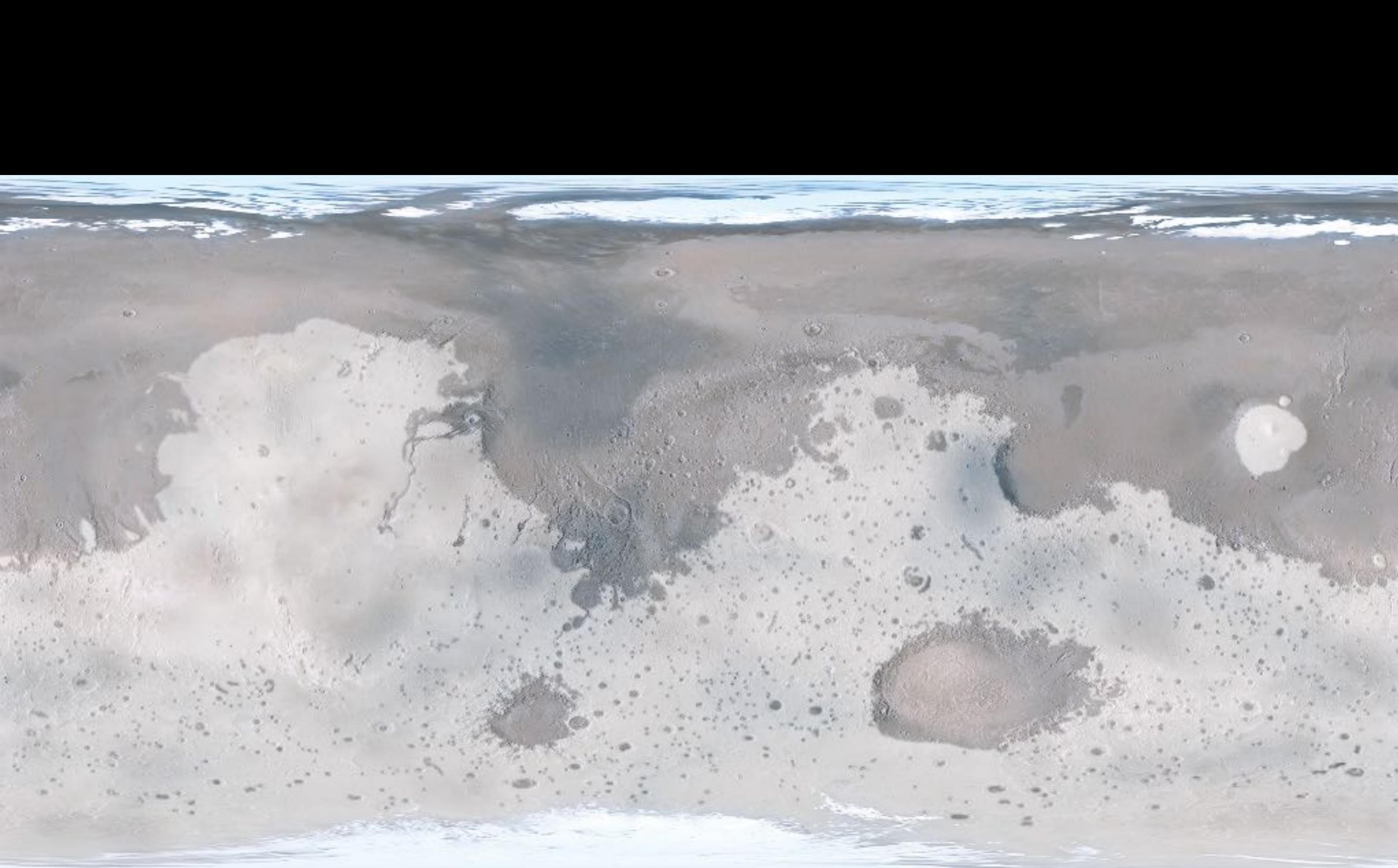
[https://astrogeology.usgs.gov/search/map/Mars/GlobalSurveyor/MOLA/
Mars_MGS_MOLA_DEM_mosaic_global_463m](https://astrogeology.usgs.gov/search/map/Mars/GlobalSurveyor/MOLA/Mars_MGS_MOLA_DEM_mosaic_global_463m)

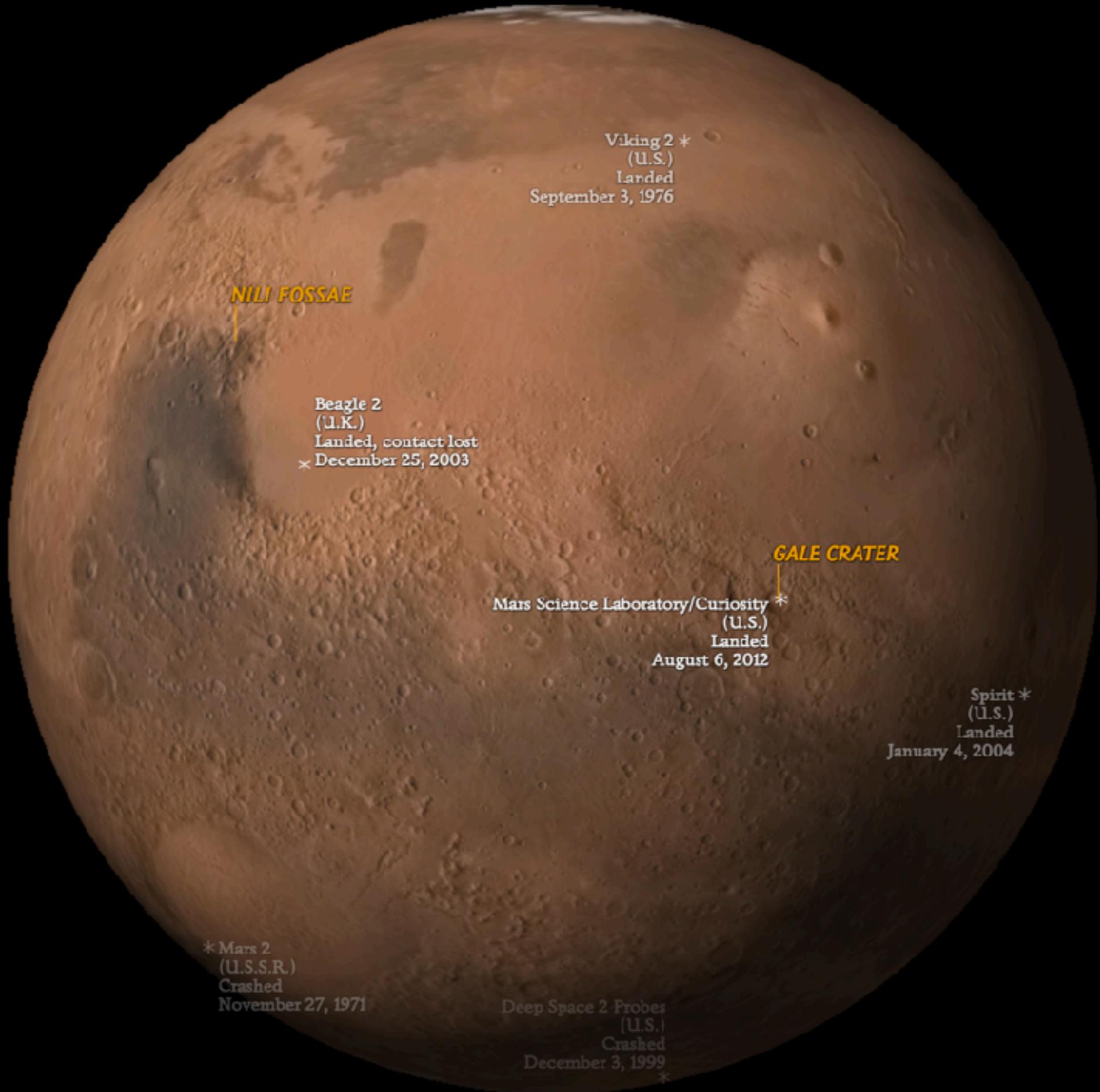


SNOW GLOBE HYPOTHESIS

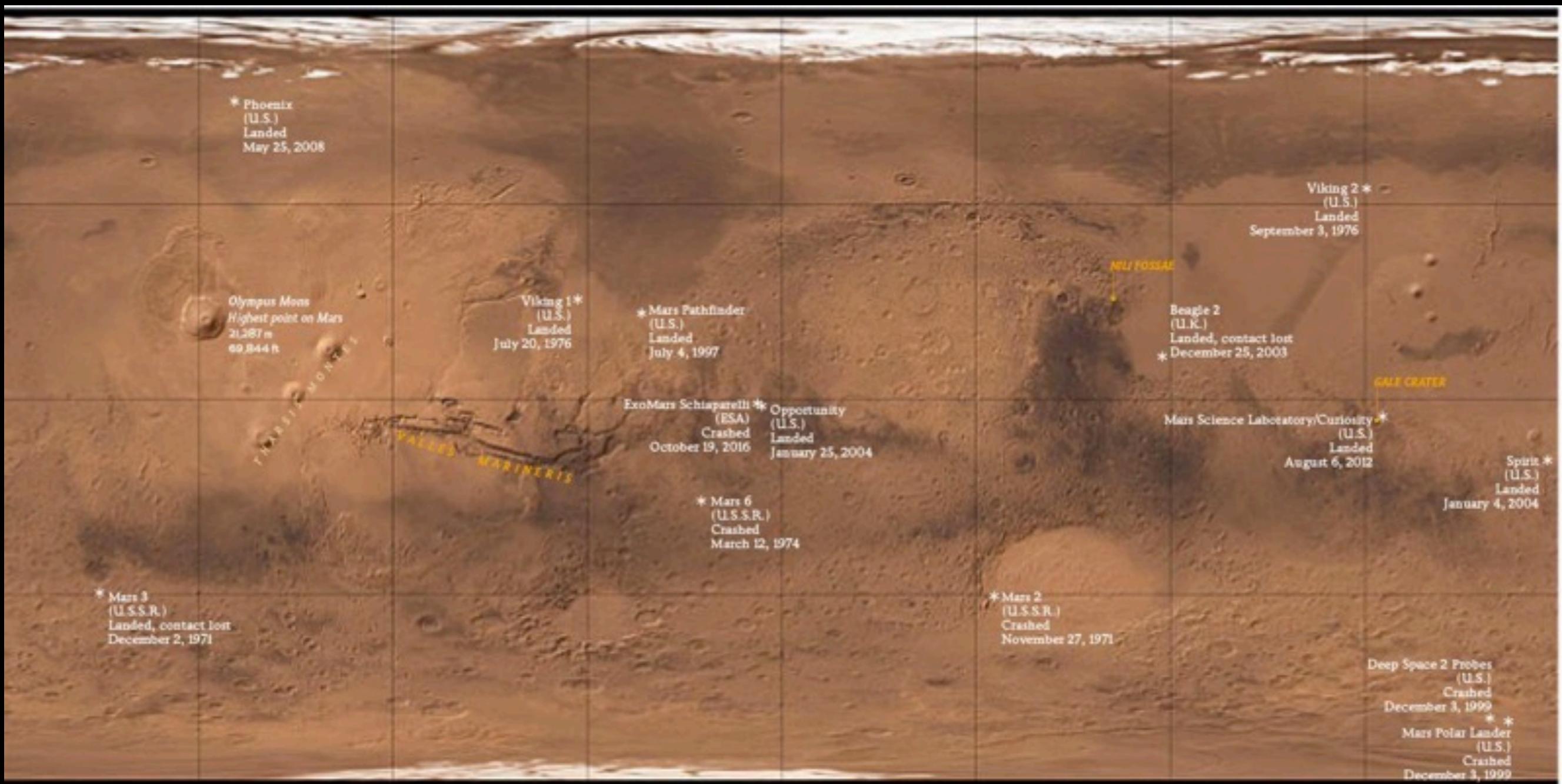
3.8 BILLION YEARS AGO







Text in SVG, not AI2HTML



(<http://ai2html.org/>)

2D SVG X/Y to 3D XYZ

```
var longitude = (xSVGPos * (360 / widthSVG))  
var latitude = (ySVGPos * (180 / heightSVG))
```

```
var latitudeRadians = latitude * (Math.PI / 180.0);  
var longitudeRadians = longitude * (Math.PI / 180.0);  
  
var x = sphereRadius * Math.sin(latRadians) * Math.cos(lngRadians);  
var y = sphereRadius * Math.cos(latRadians);  
var z = sphereRadius * Math.sin(latRadians) * Math.sin(lngRadians);
```

PERFORMANCE

requestAnimationFrame

<https://developer.mozilla.org/en-US/docs/Web/API/window/requestAnimationFrame>

<http://creativejs.com/resources/requestanimationframe/index.html>

Texture sizes

ifMobile ? 512x512.jpg : 1024x1024.jpg

Antialiasing

`new THREE.WebGLRenderer({ antialias: ifMobile ? false : true });`





Curiosity Rover
Landing Site
Aug 6 2012

Curiosity Rover
location, sol 1519
NASA 2014

Destination
peak of
Aeolis Mons

APPROXIMATELY
9 MILES

360 PANORAMA

three.js 360

https://threejs.org/examples/webgl_panorama_equirectangular.html

Nice Writeup

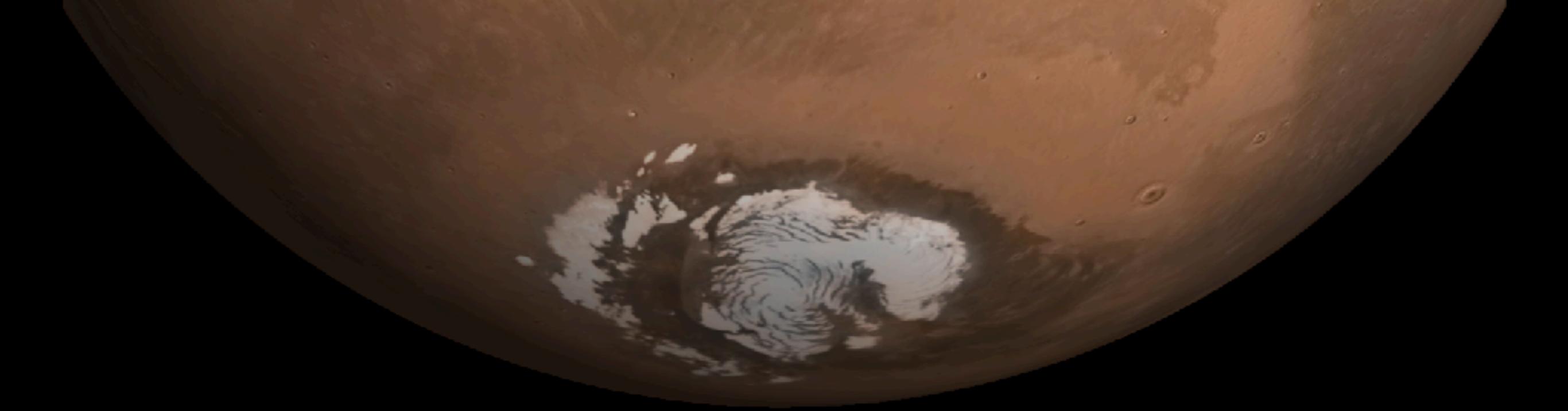
<https://open.blogs.nytimes.com/2016/11/11/building-a-cross-platform-360-degree-video-experience-at-the-new-york-times/>

Enter the Sphere

<https://codepen.io/thiagopnts/pen/RRQVpa>

Dependency free library

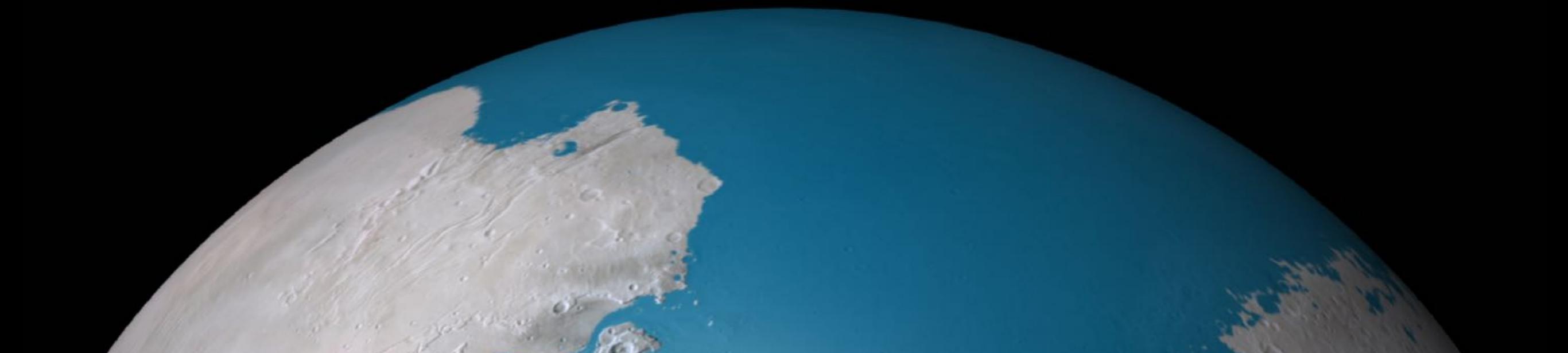
<https://github.com/thiagopnts/kaleidoscope>



"How We Made a Rewind the Red Planet"

<https://source.opennews.org/articles/how-we-made-rewind-red-planet/>

Scroll to bottom for resources section on 3D globes/maps



ARTICLE RESOURCES

<https://source.opennews.org/articles/how-we-made-rewind-red-planet/#resources>

Scroll to bottom for resources section on 3D globes/maps

THREE.JS resources and examples

3D Globes

3D Maps

3D Object Manipulation

CUBESPHERE SCRIPT+CODE

<https://github.com/briantjacobs/foss4g-2017-talk/>

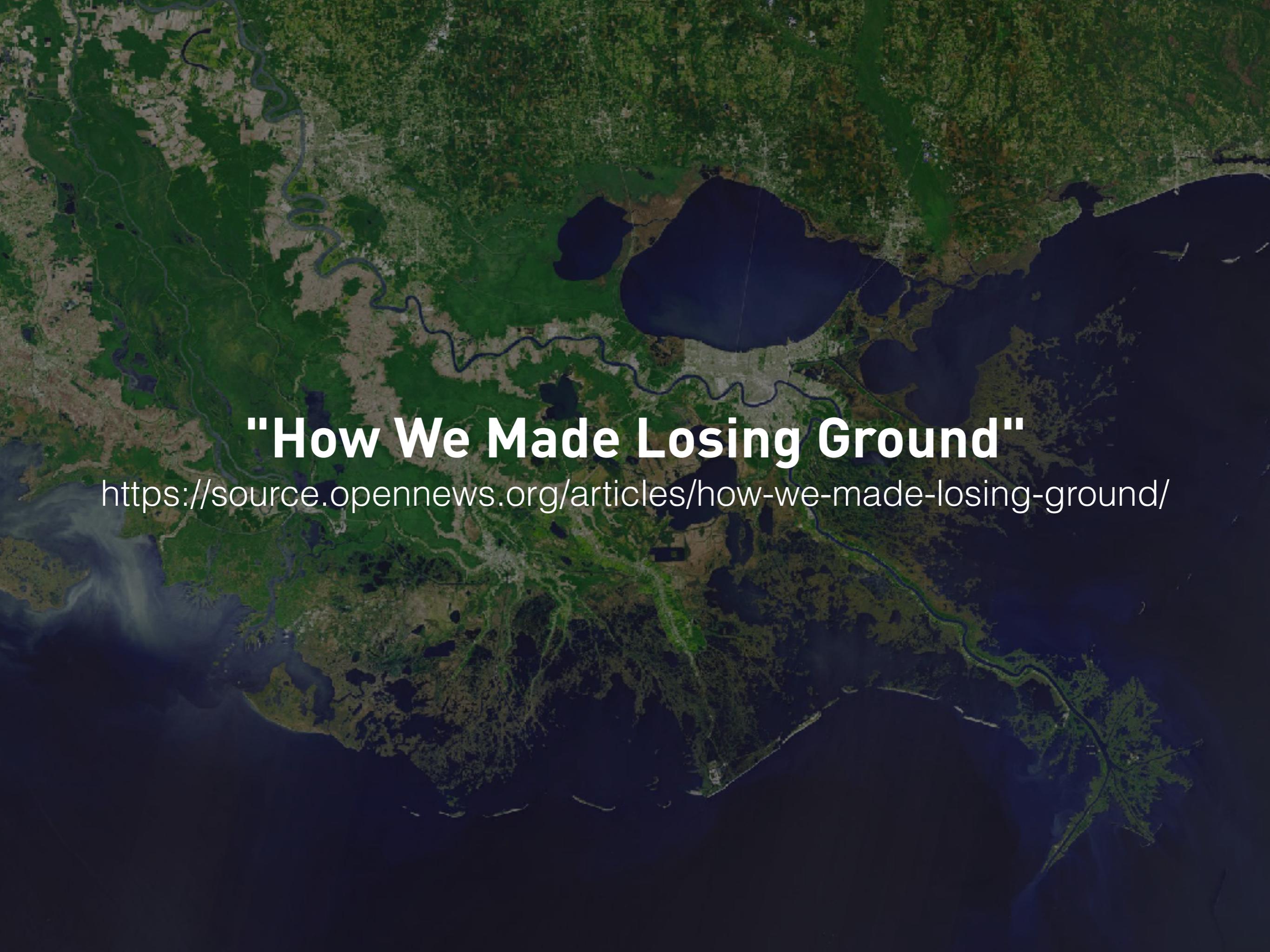
SEARCH "REWIND THE RED PLANET"

<http://www.nationalgeographic.com/science/2016/11/exploring-mars-map-panorama-pictures/>



"How We Resurrected a Dragon"

<https://source.opennews.org/articles/resurrecting-dragon/>

The background image is a detailed aerial satellite photograph of a coastal wetland area, likely the Mississippi River delta. It shows a complex network of water bodies, including several large lakes and numerous smaller, winding channels and marshes. The terrain is a mix of dark green vegetation and brownish, lighter-colored land areas, indicating different soil types or land use. The overall scene illustrates significant environmental changes, particularly land loss and subsidence, over time.

"How We Made Losing Ground"

<https://source.opennews.org/articles/how-we-made-losing-ground/>

THANK YOU!

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