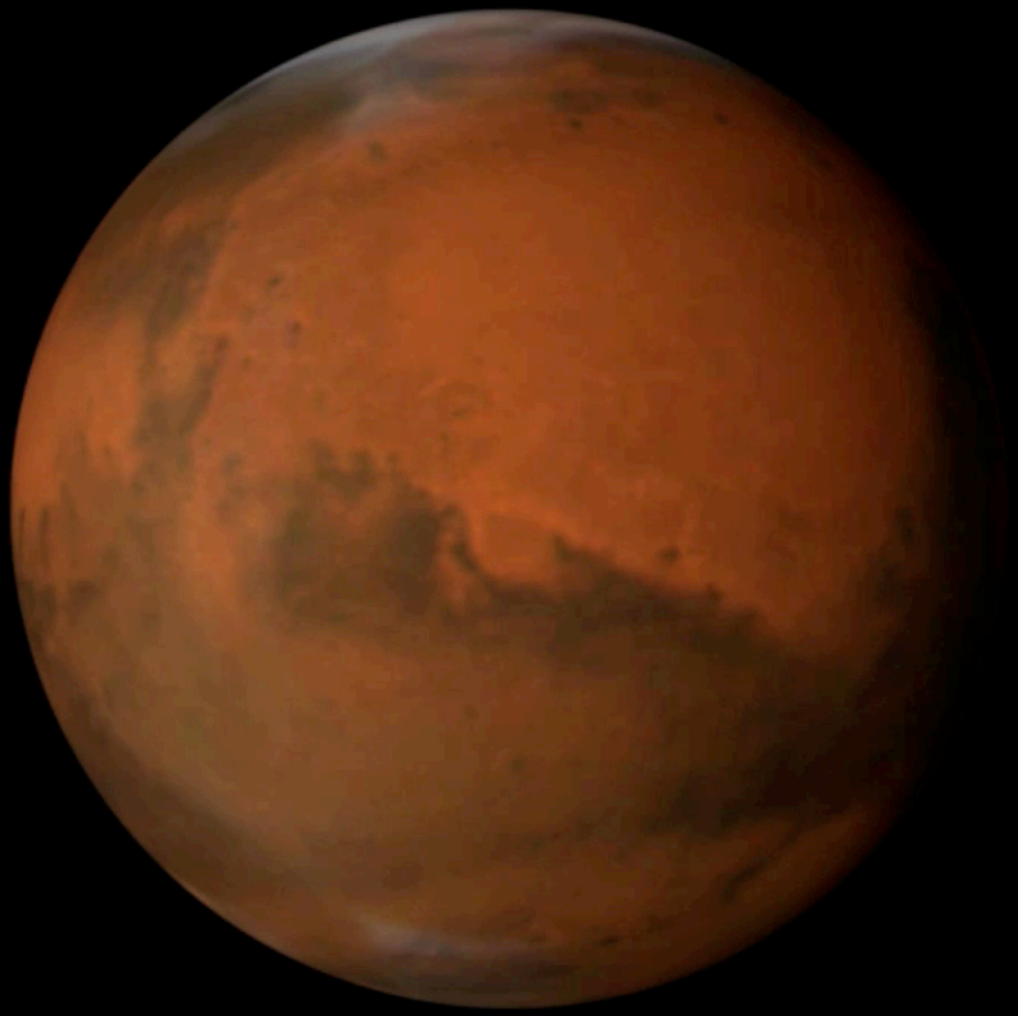
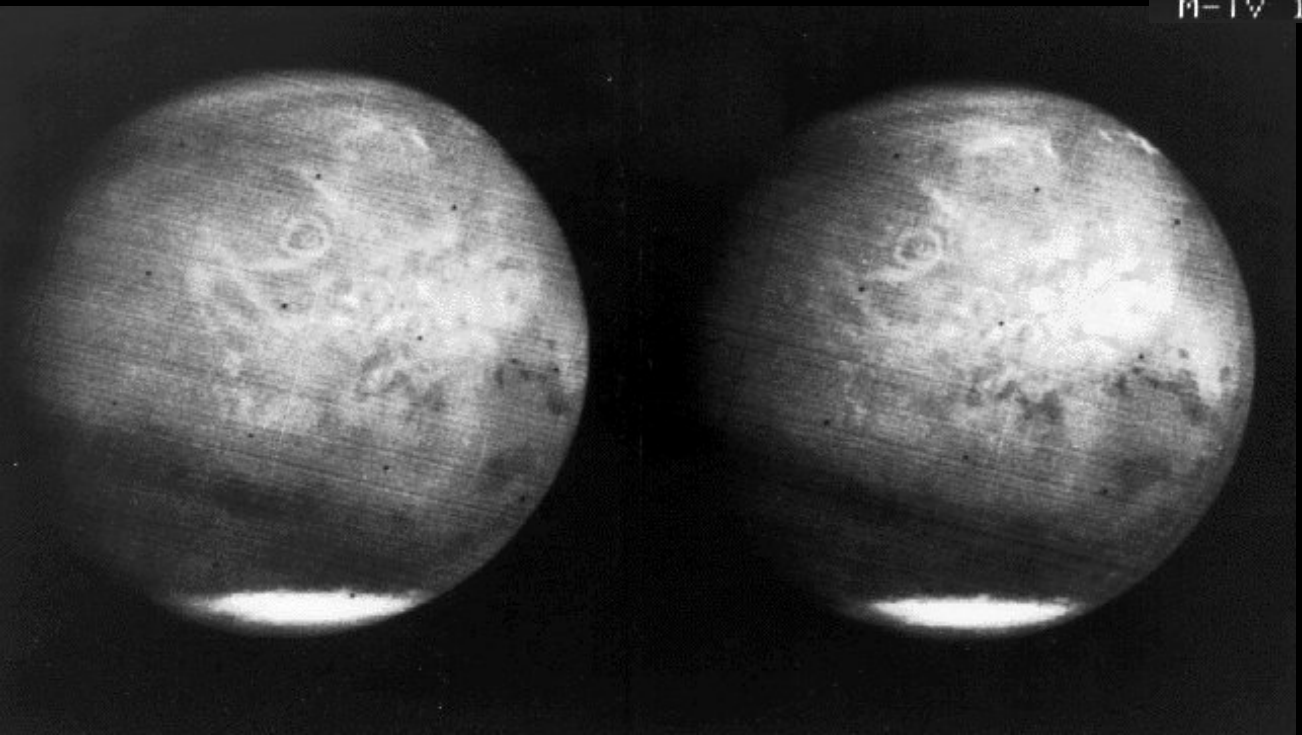
Mars Right Now



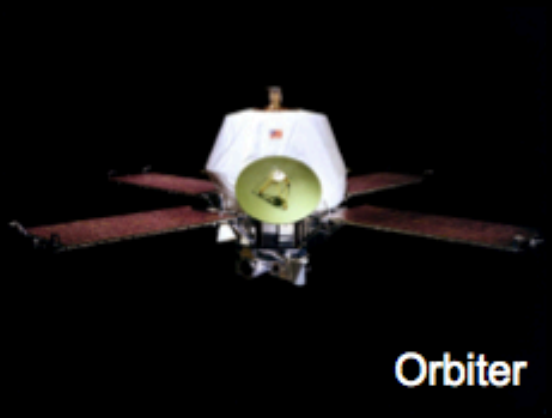
John Mace Grunsfeld PhD
Science Mission Directorate

Mars Revealed

1964 -- Mariner 4



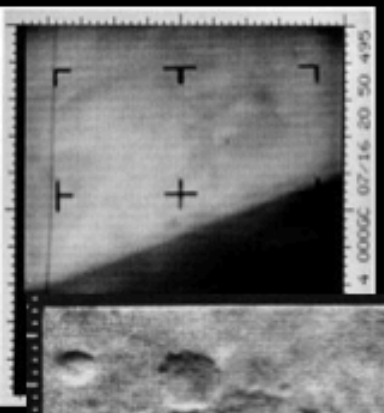
Mariner 1964-1971

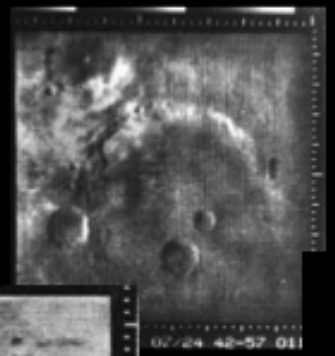


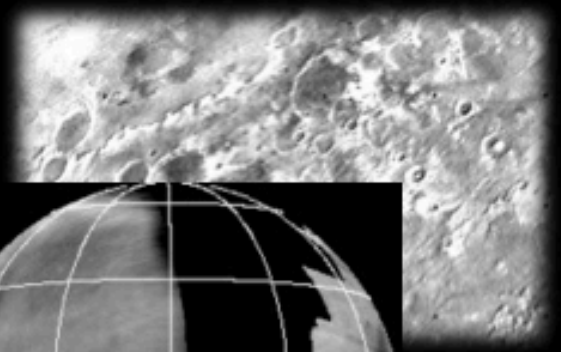
Mariner 4- 1964
First Image of Mars

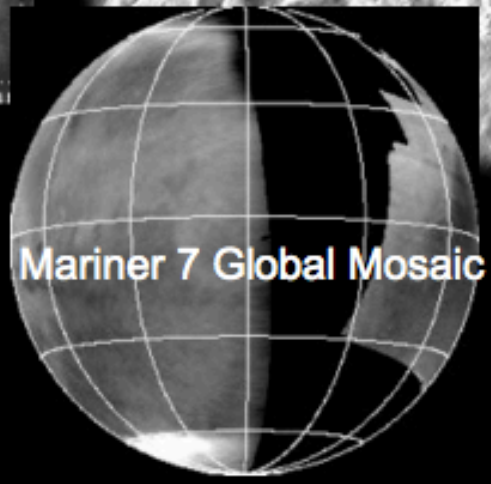
Mariner 6 & 7 – 1969
First Global Mosaic
Dark features are not canals

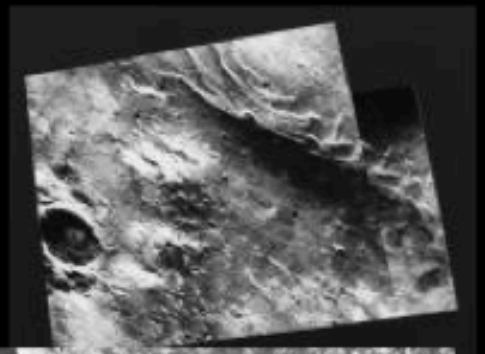
Mariner 9 – 1971
Imaged canyons and south pole cap

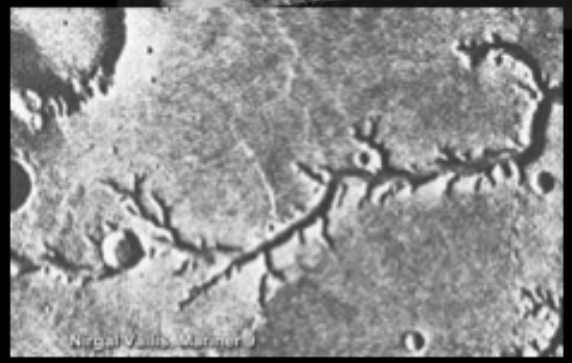






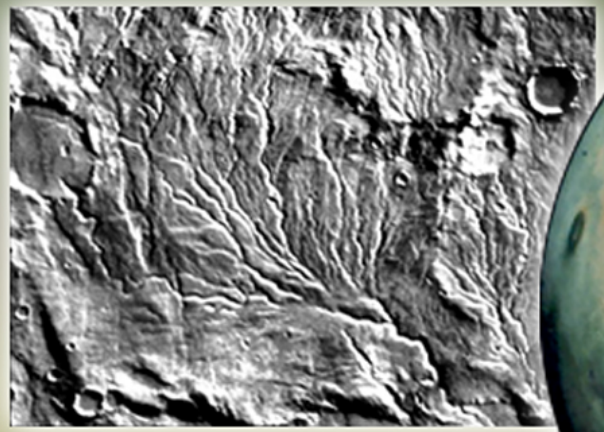


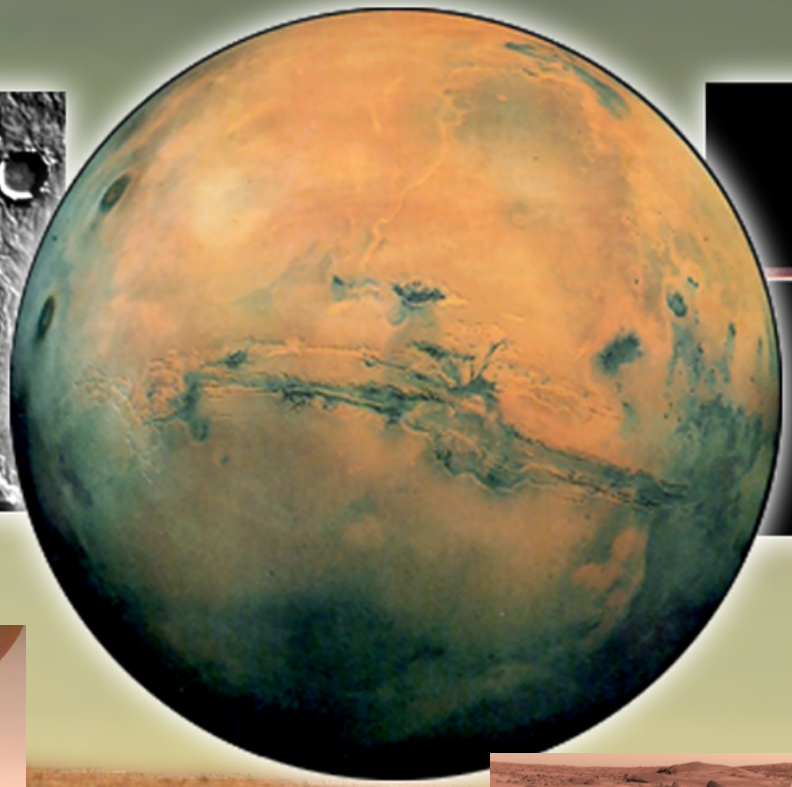


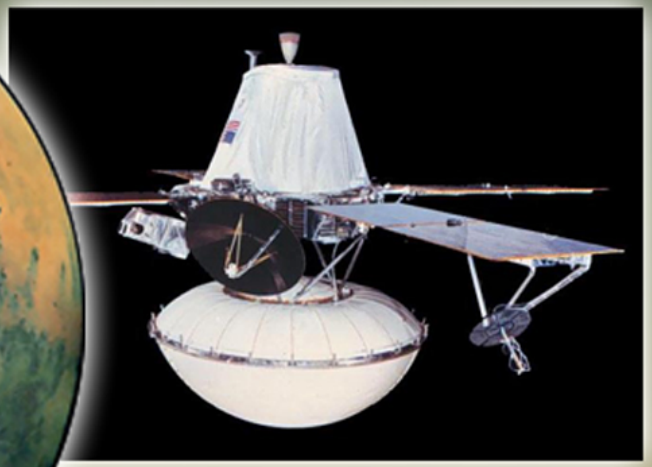


Viking on Mars 1976-1982

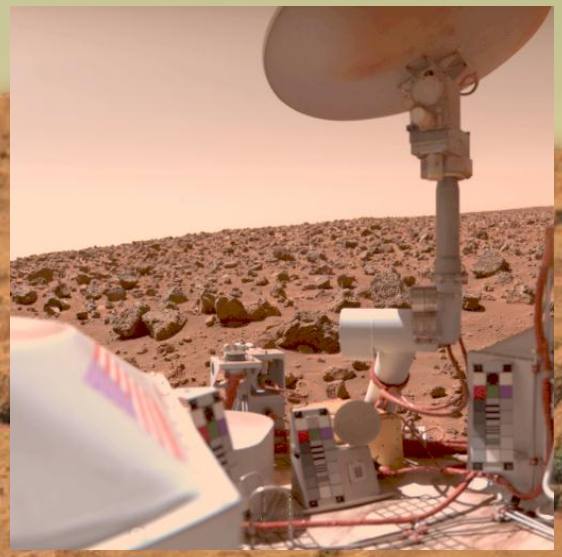
2 Orbiters

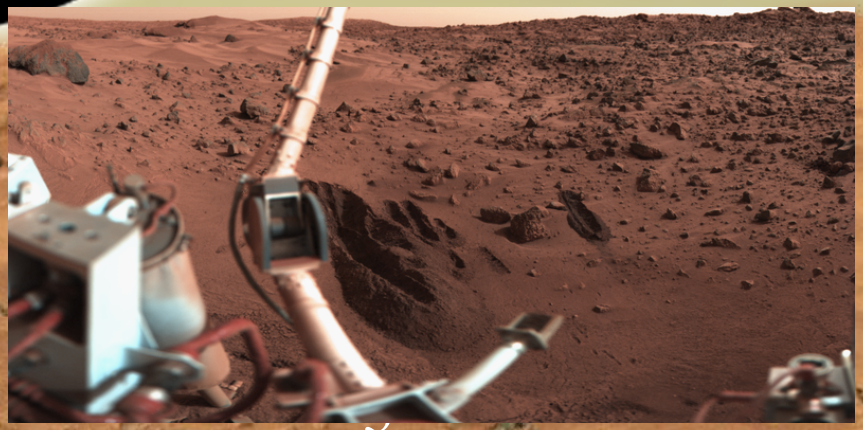






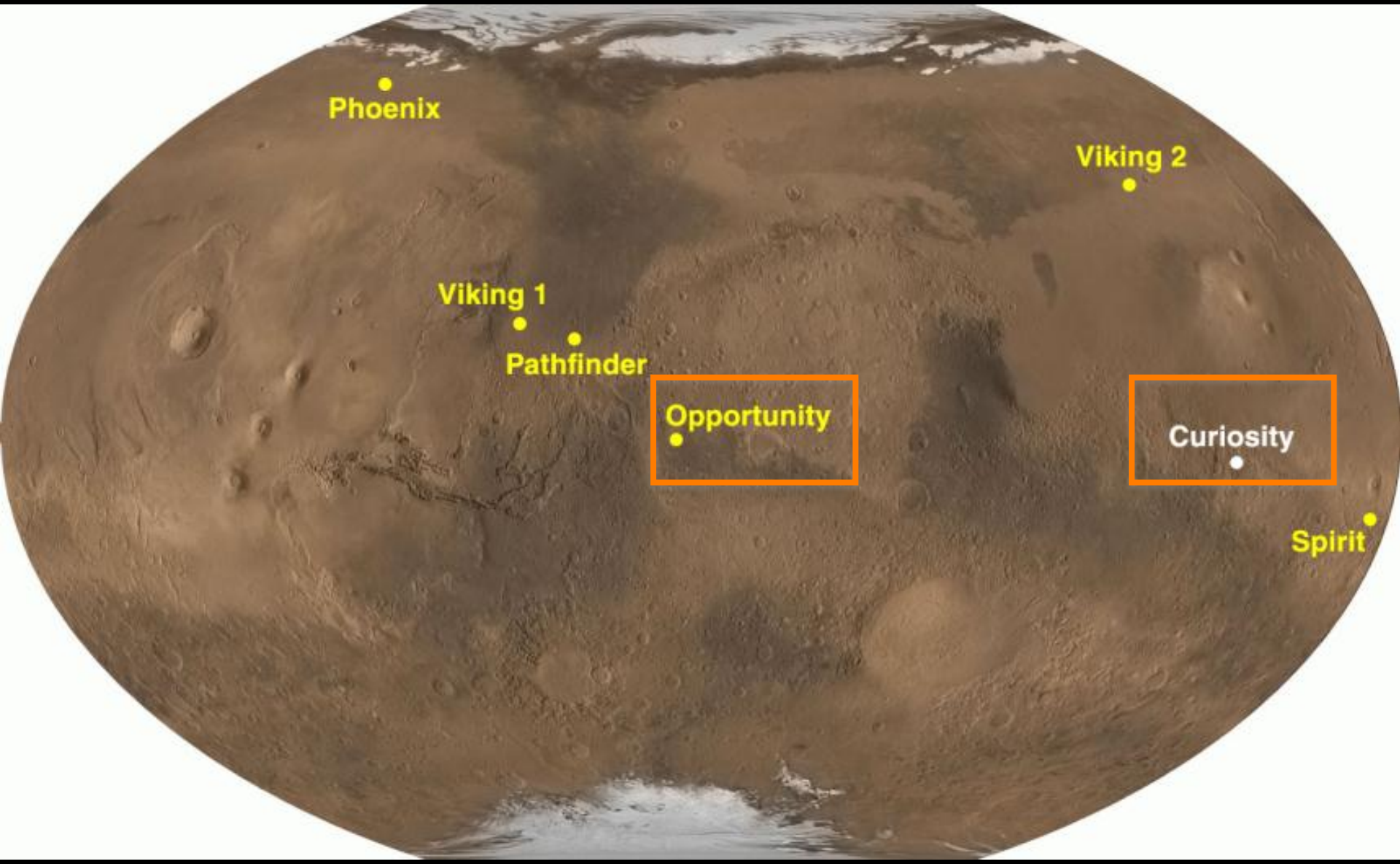
2 Landers



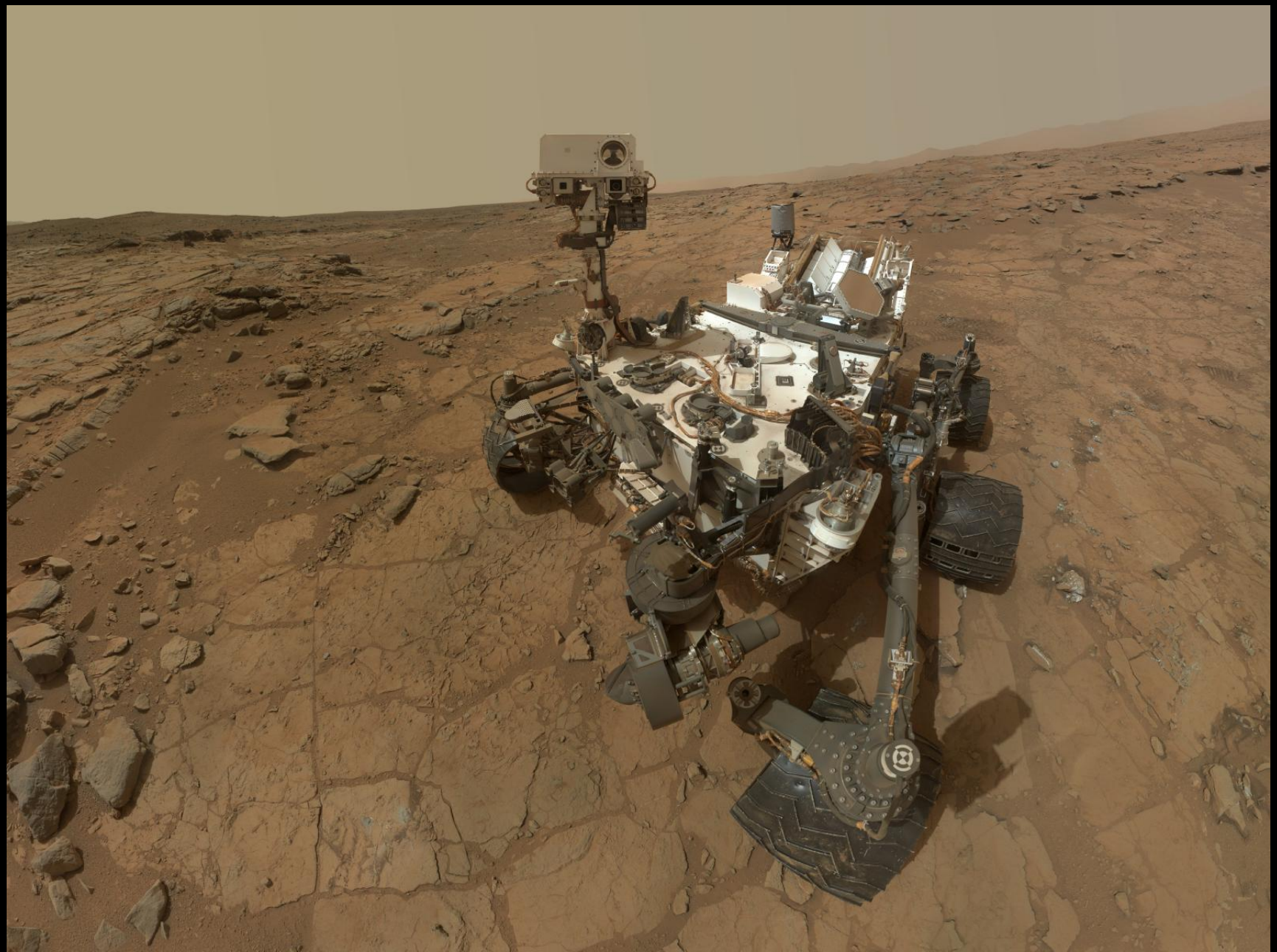


www.jpl.nasa.gov

Where are we on Mars today?

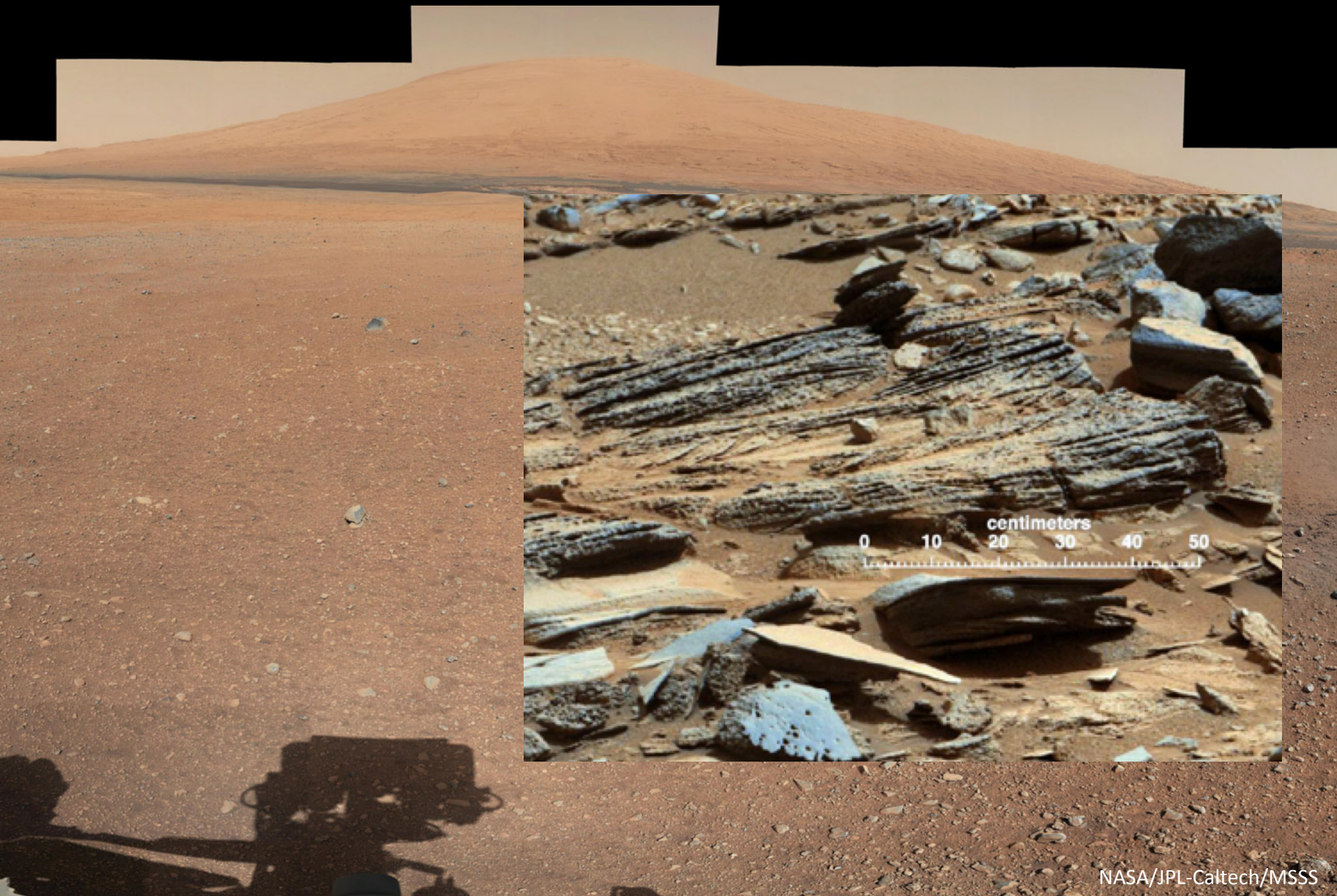

Phoenix
Viking 2
Viking 1
Pathfinder
Opportunity
Curiosity
Spirit

Curiosity Selfie



Curiosity Has Been Busy!

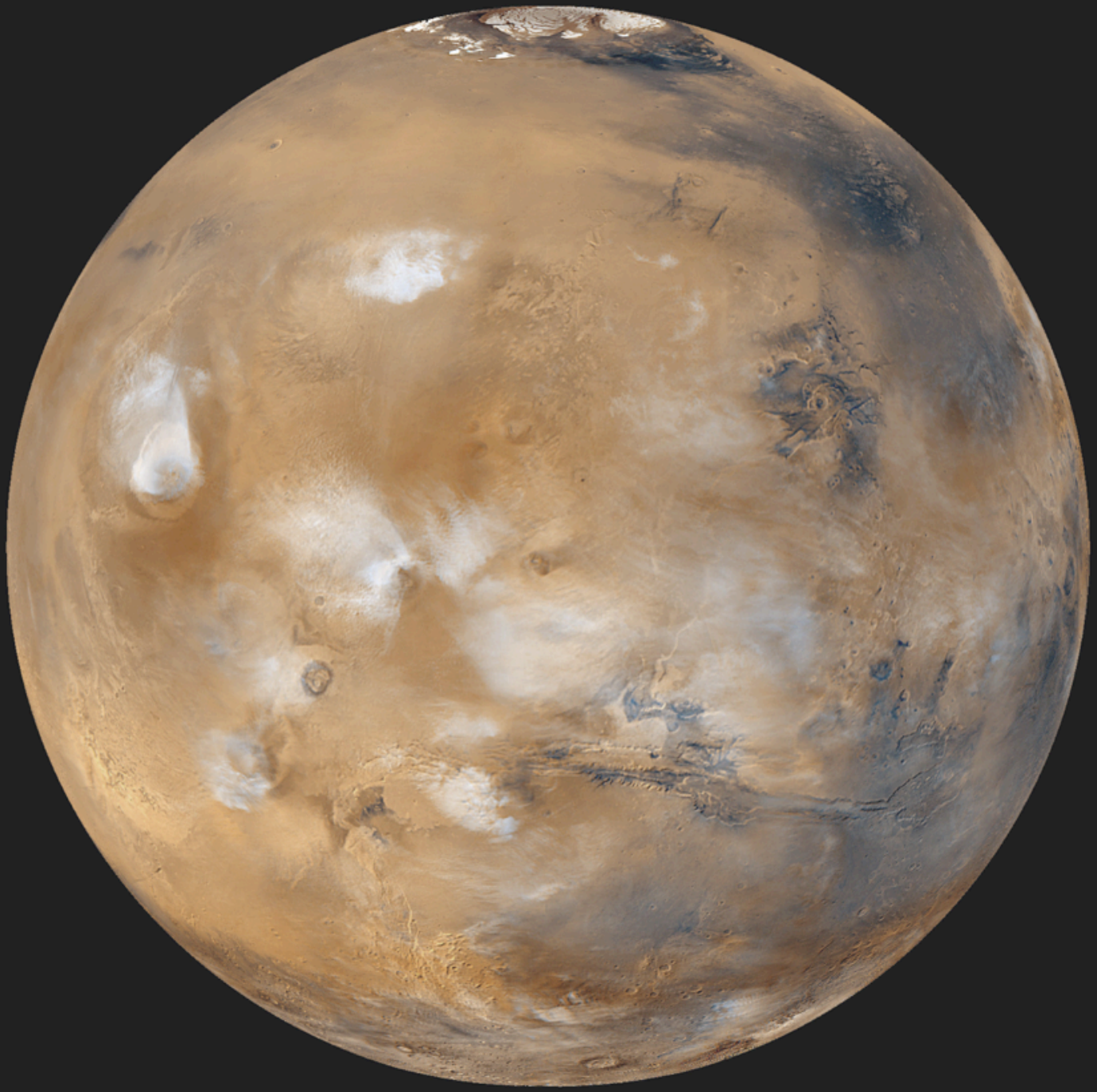
Curiosity Has Been Busy!



NASA/JPL-Caltech/MSSS

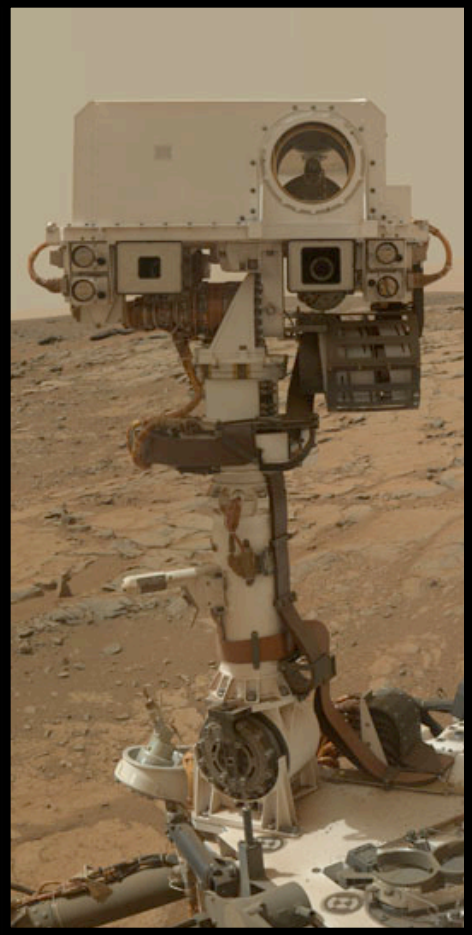

Science
24 January 2014 | $10
EXPLORING
MARTIAN HABITABILITY

What have we Learned?




The Martian atmosphere today is very thin,
surface pressure is very low (1% of Earth's).
Long-lasting surface water (liquid) is no longer possible

Curiosity has studied the atmosphere and weather



Mars Weather from REMS

El clima de Marte - MSL REMS

Sol: 586

Datos Diarios

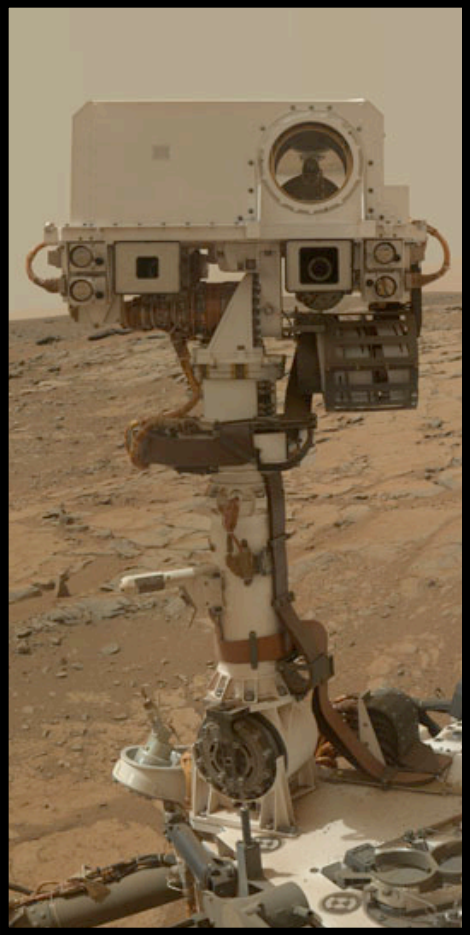
Actualizado: December -2147483629, 1969

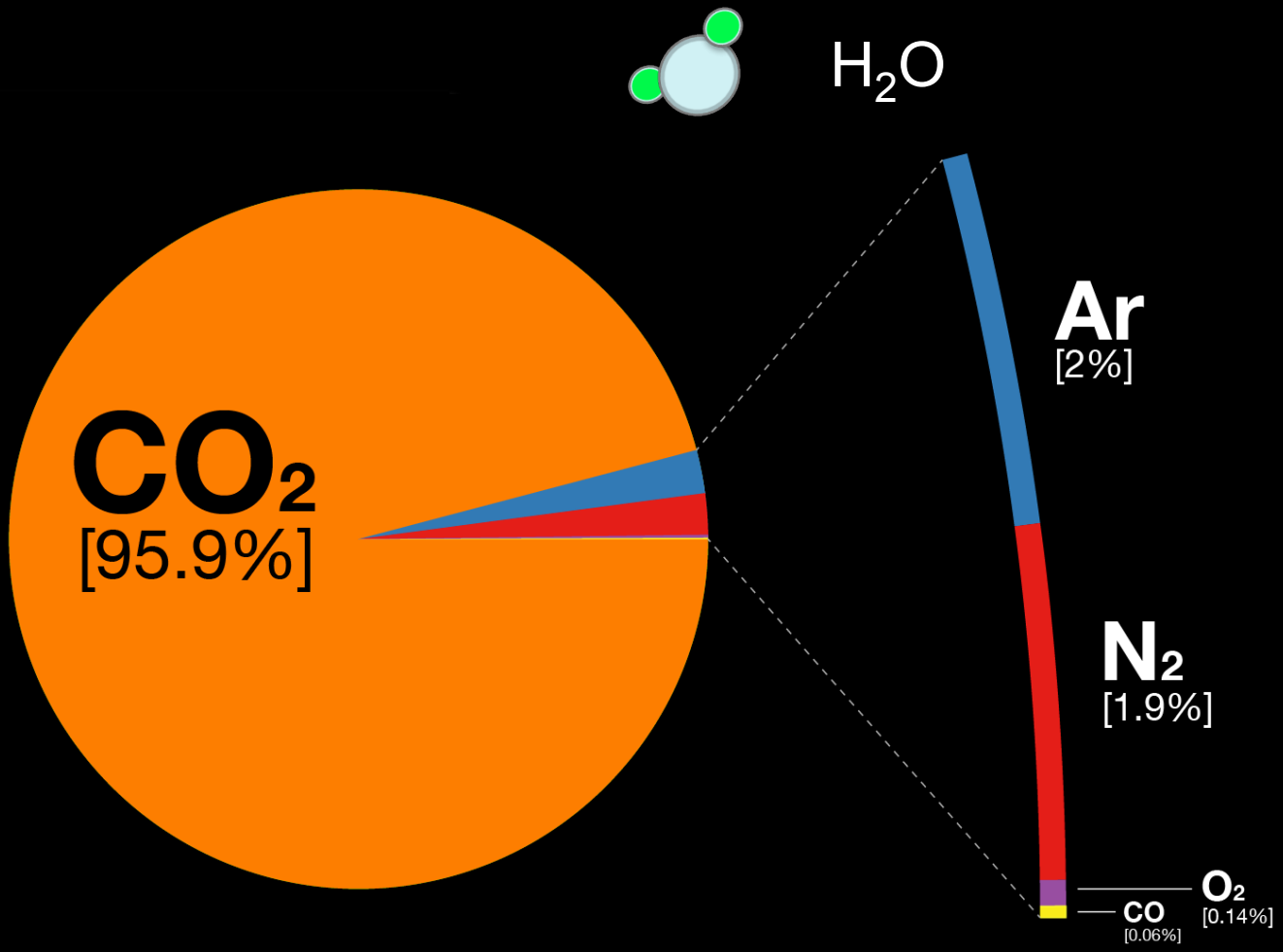
-82°C	-24°C	8.02 hPa
Temp Máxima	Temp Mínima	Presión

N
O N/A E
S

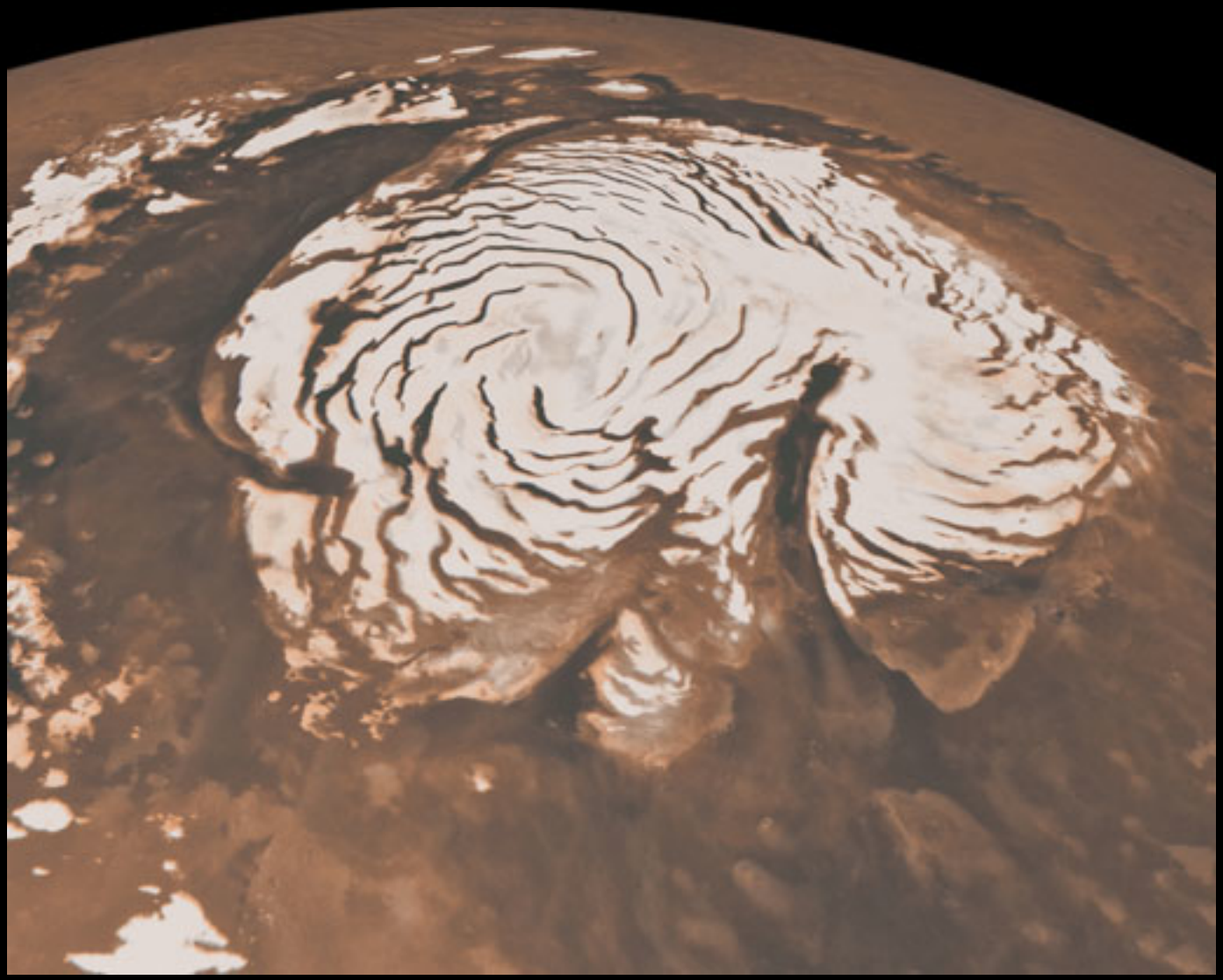
N/A	N/A
Salida del Sol	Puesta del Sol
julio	109°
Mes Equivalente de la Tierra	Ls

Curiosity has studied the atmosphere and weather

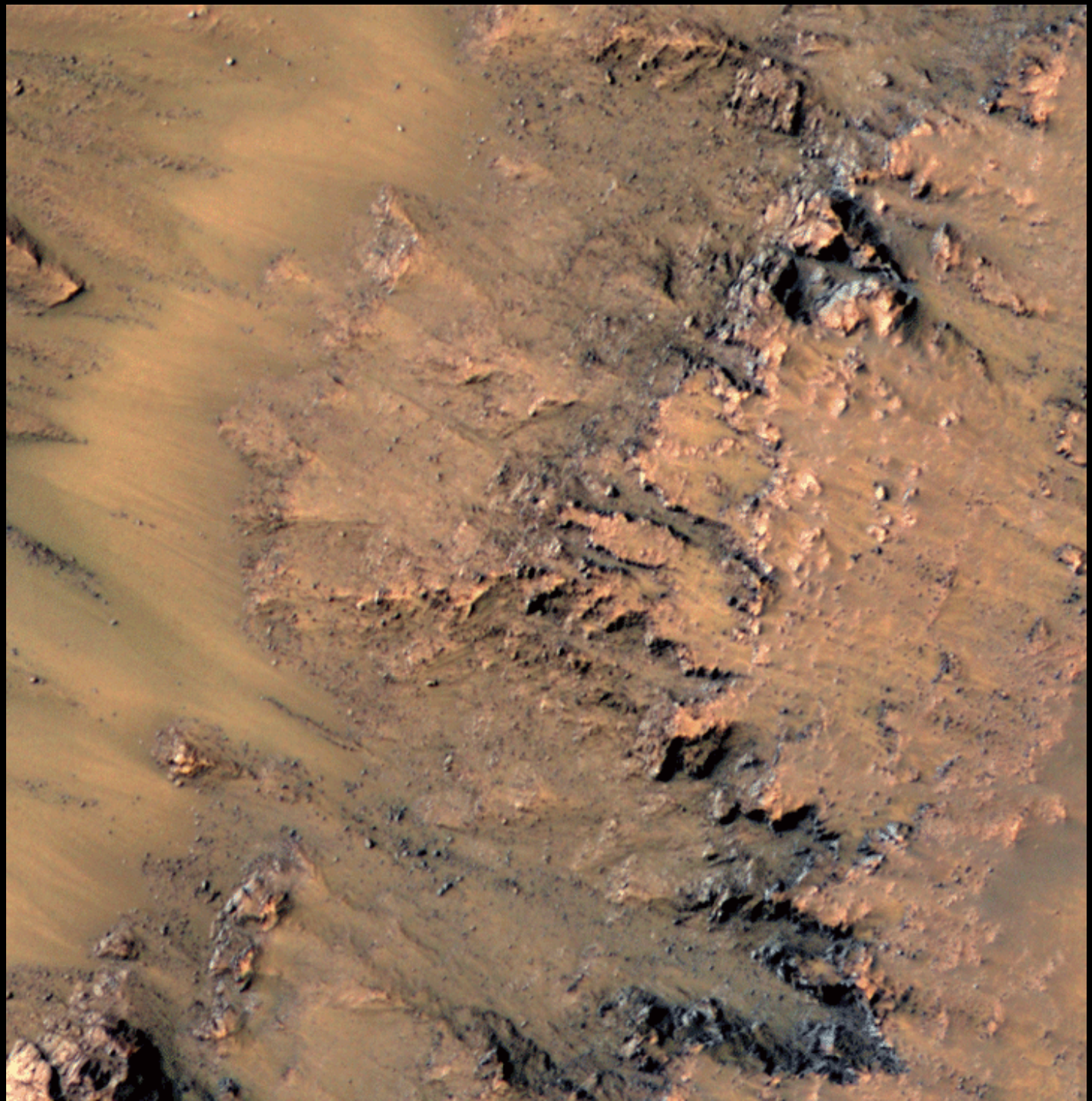




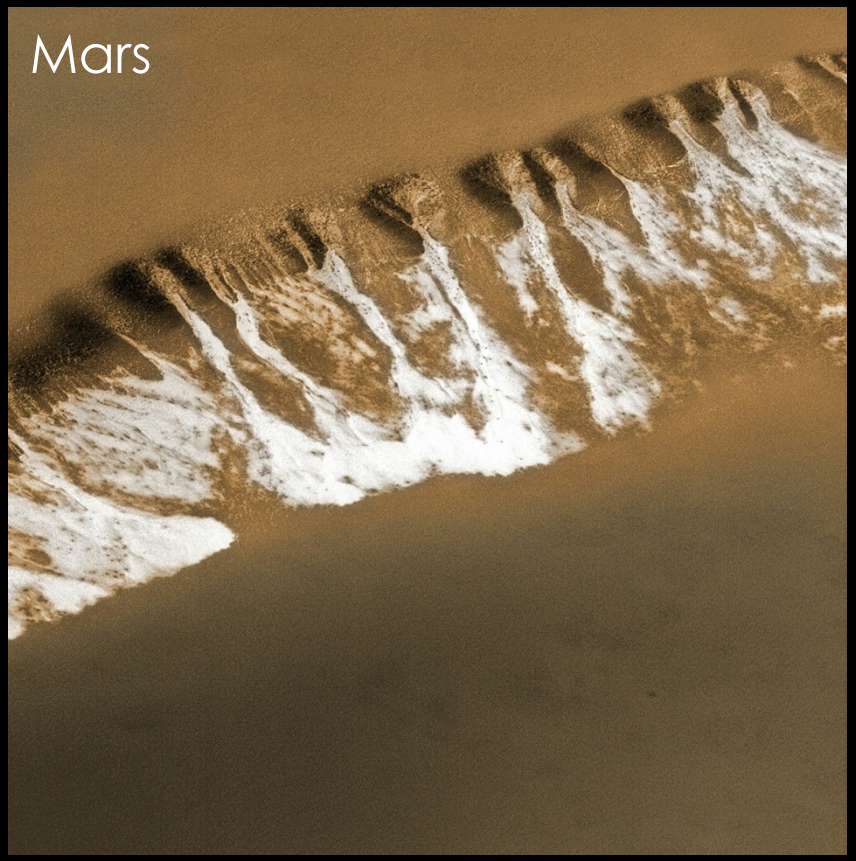
Water on Mars



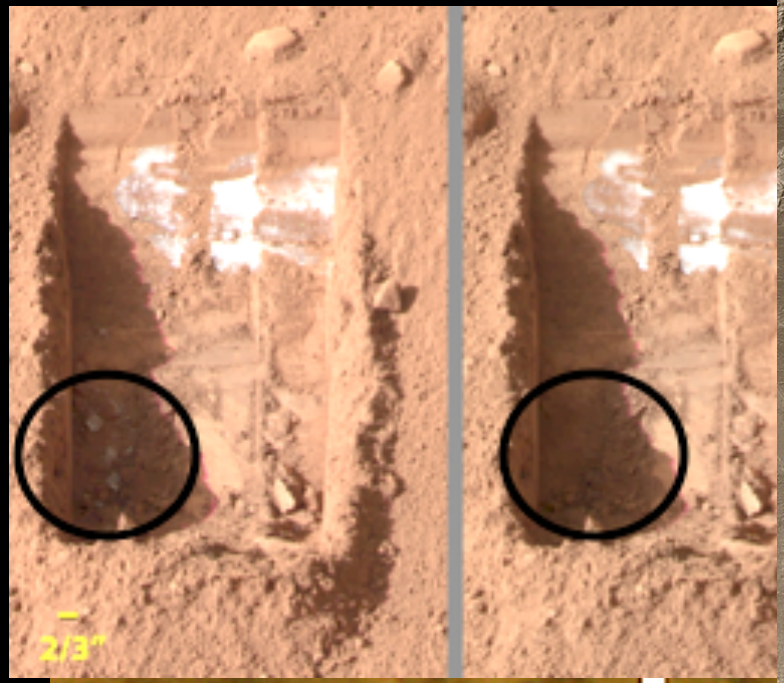
NASA/MRO

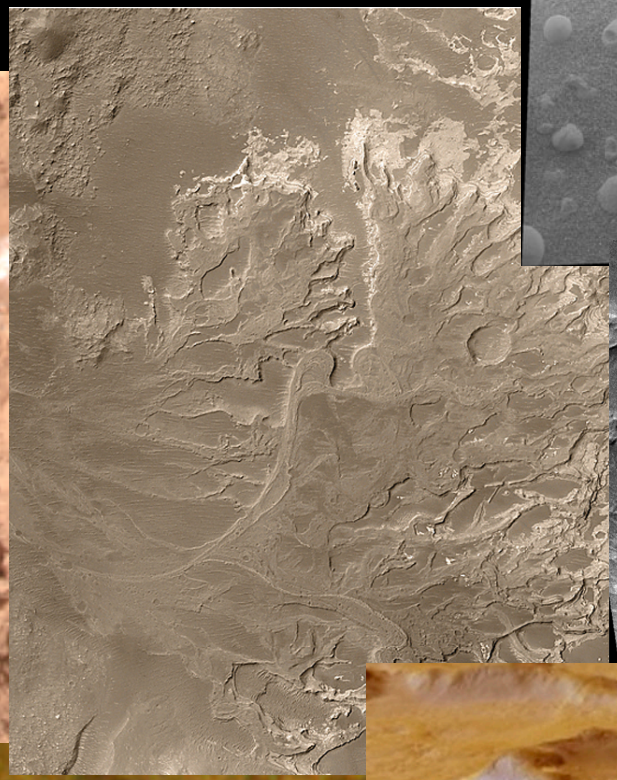


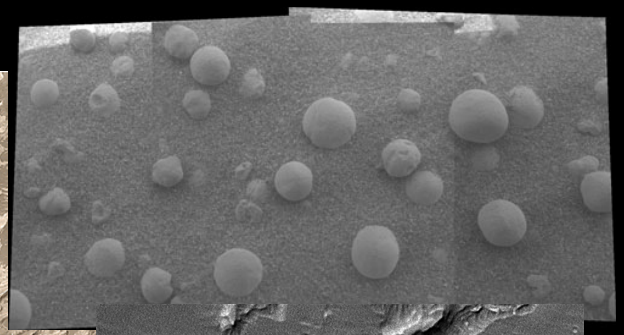
Studying Gullies on Mars and Earth

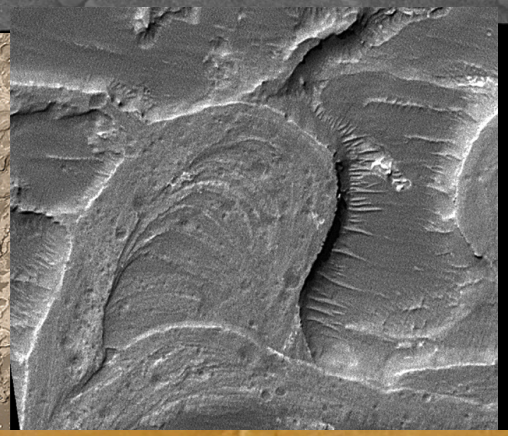


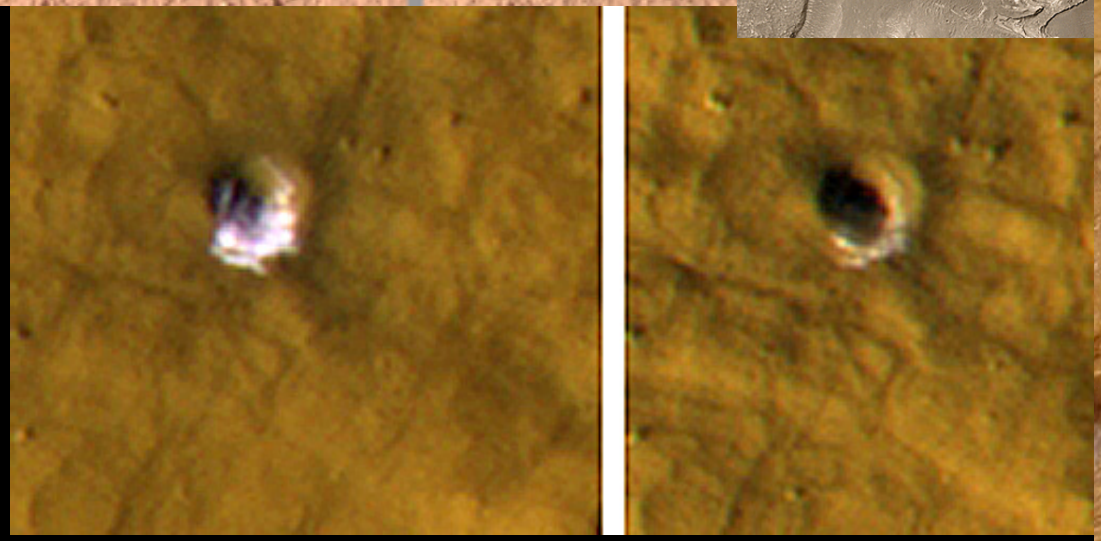
Mars – The Evidence for Water

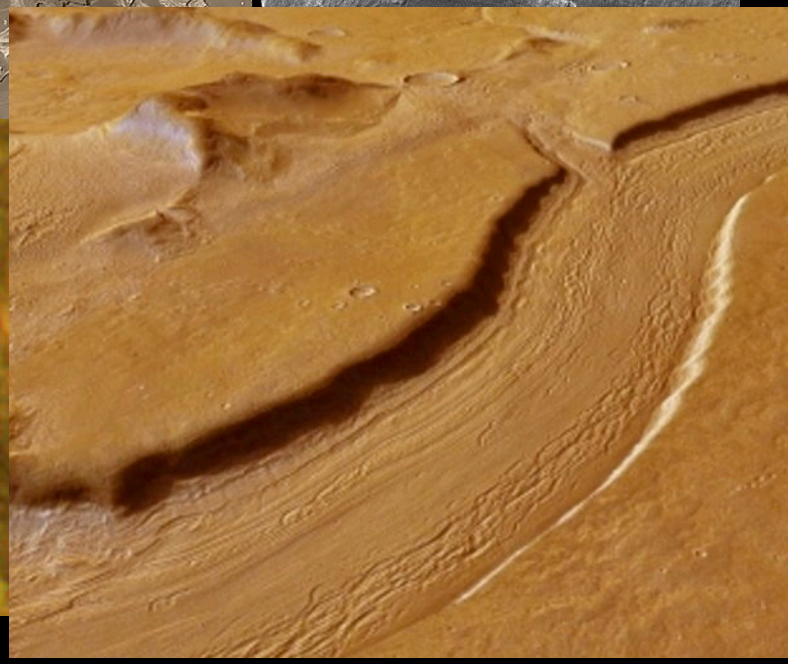




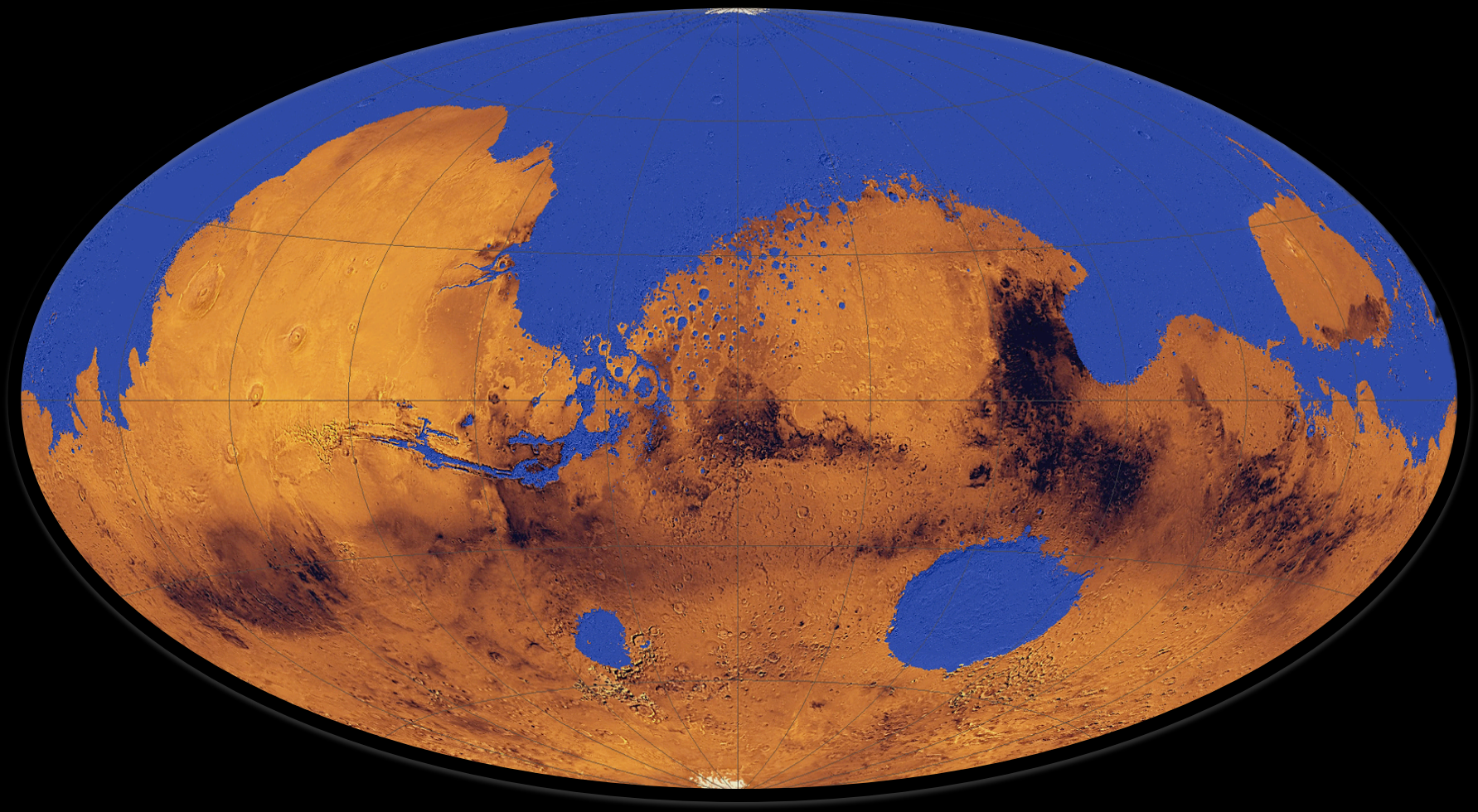






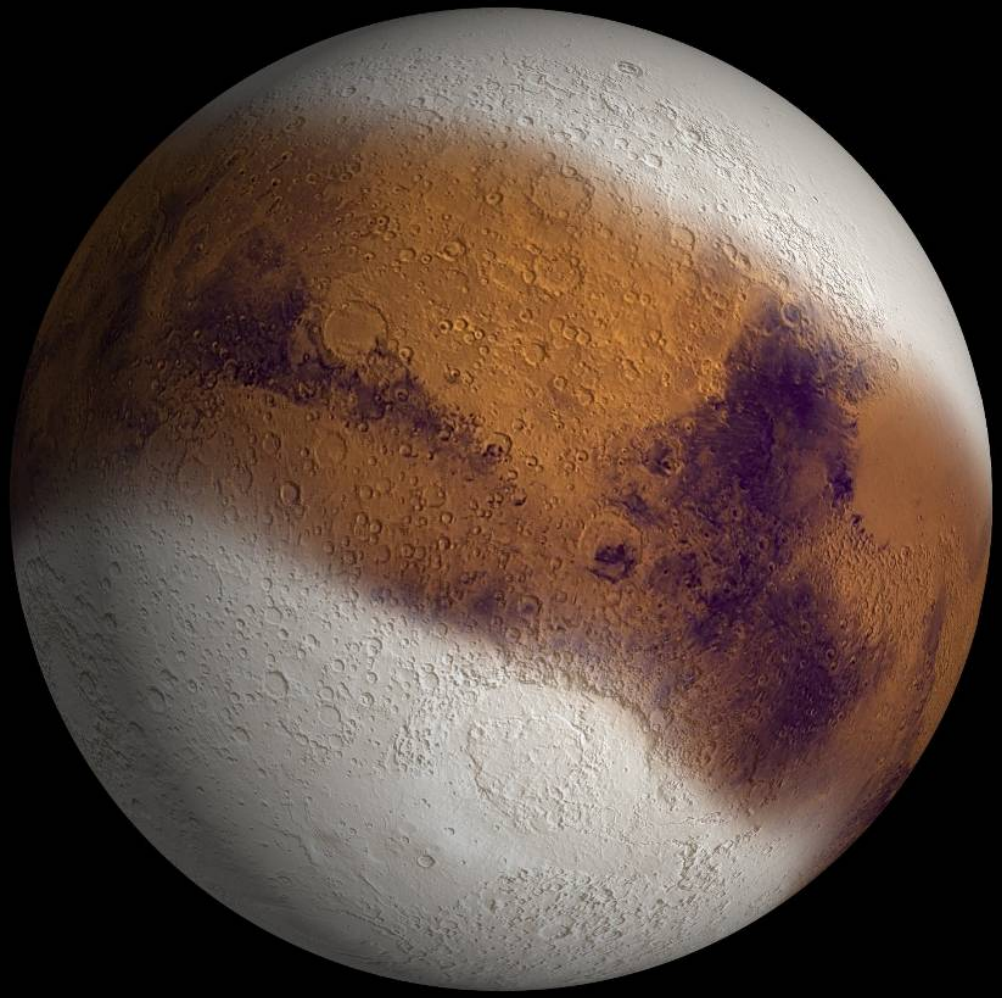


Early Mars may have had a global ocean (or seas).



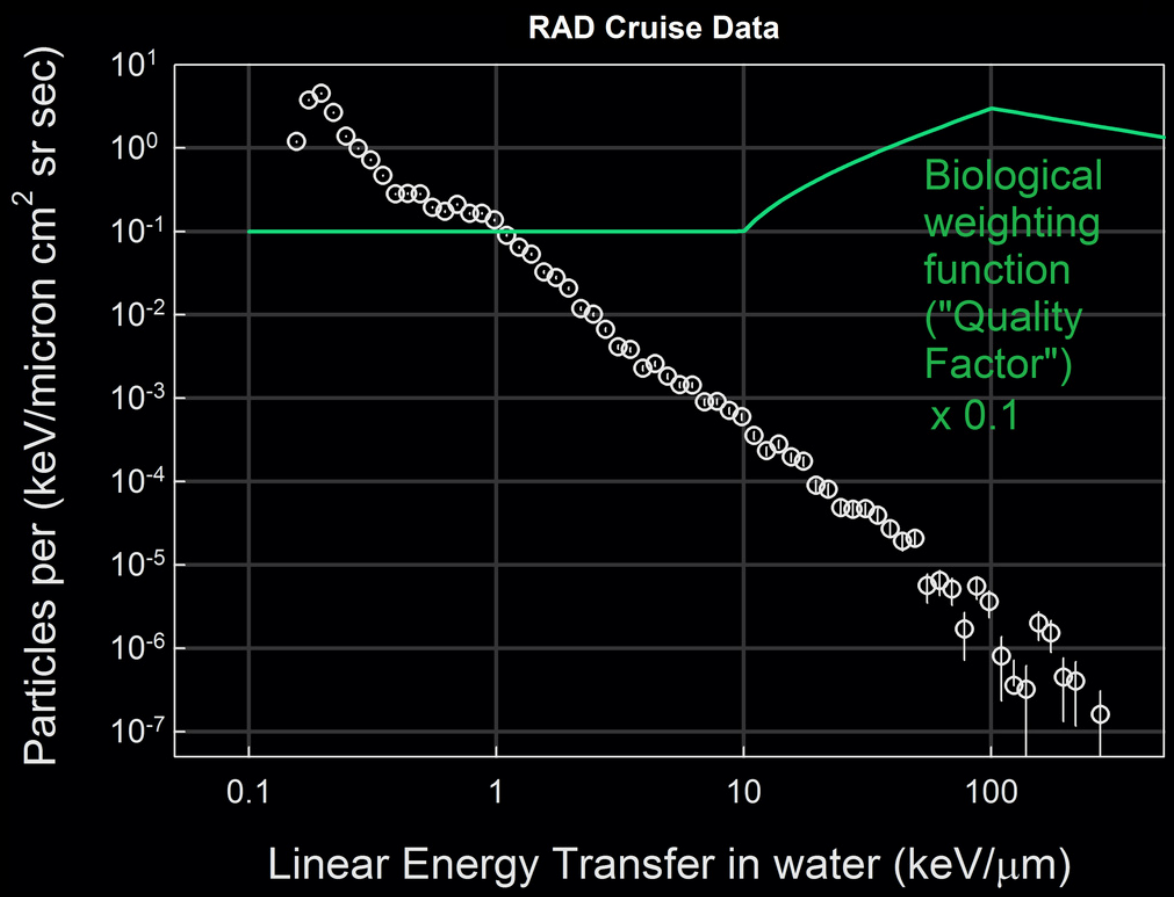
Water is necessary for life as we know it, along with carbon-bearing and other molecules that life needs to thrive

Mars 500,000 Years Ago



Mars "ice age" NASA/JPL/Brown University

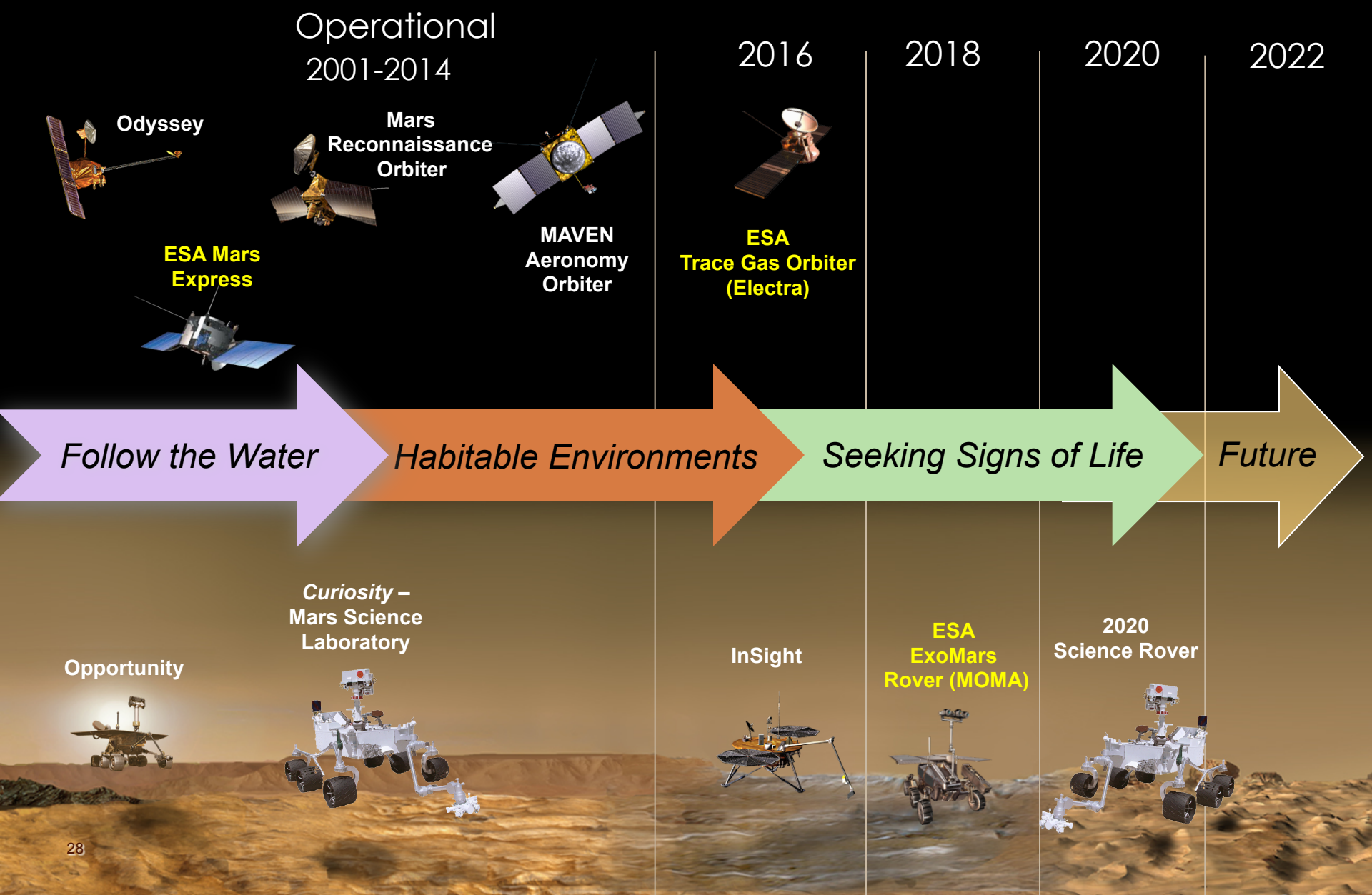

DANGER


RAD Cruise Data
Particles per (keV/micron cm^2 sr sec)
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
0.1
1
10
100
Linear Energy Transfer in water (keV/μm)
Biological weighting function ("Quality Factor") x 0.1

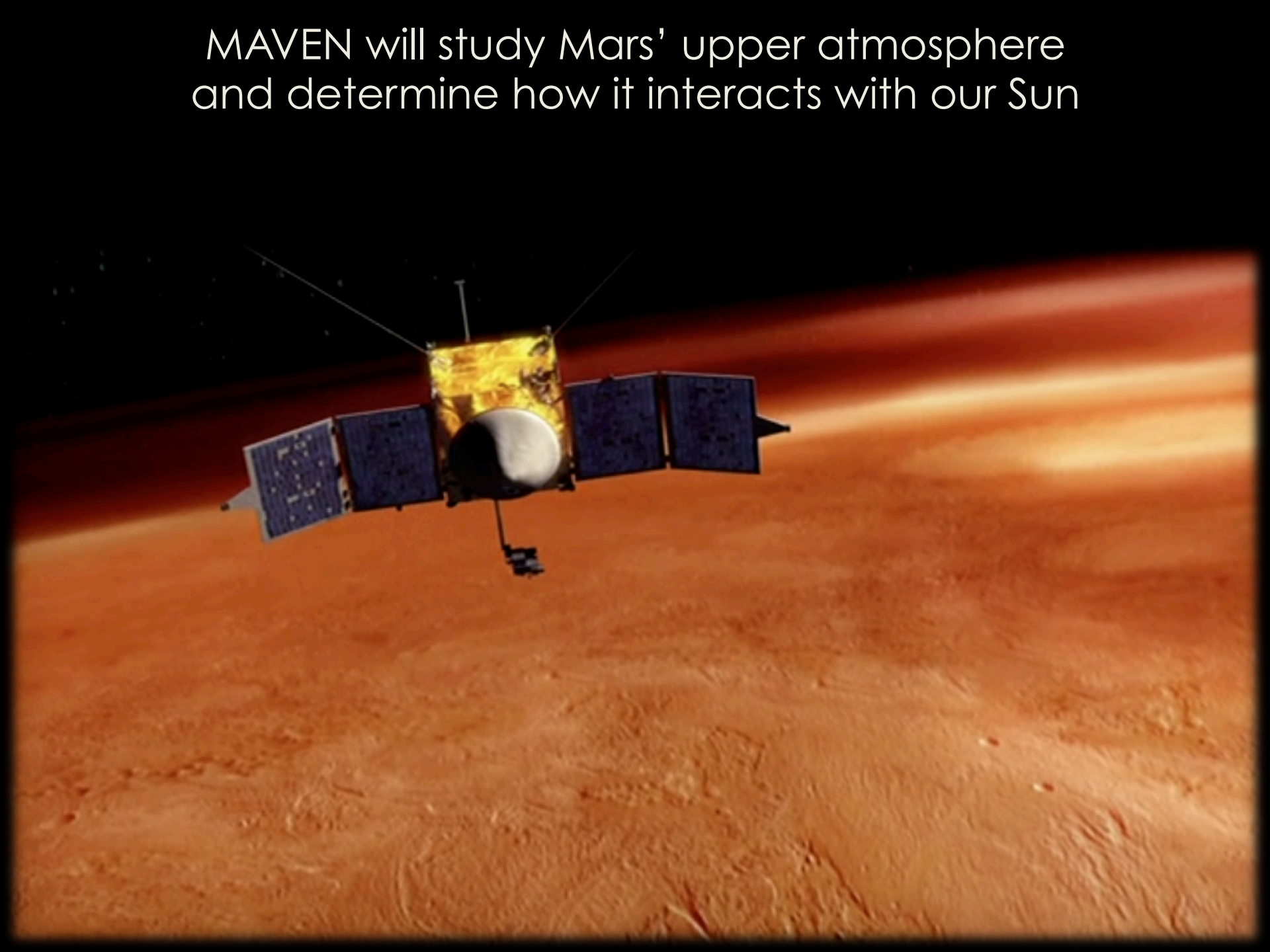
Collapsed Lava Tube Roof

What are our next steps on Mars?

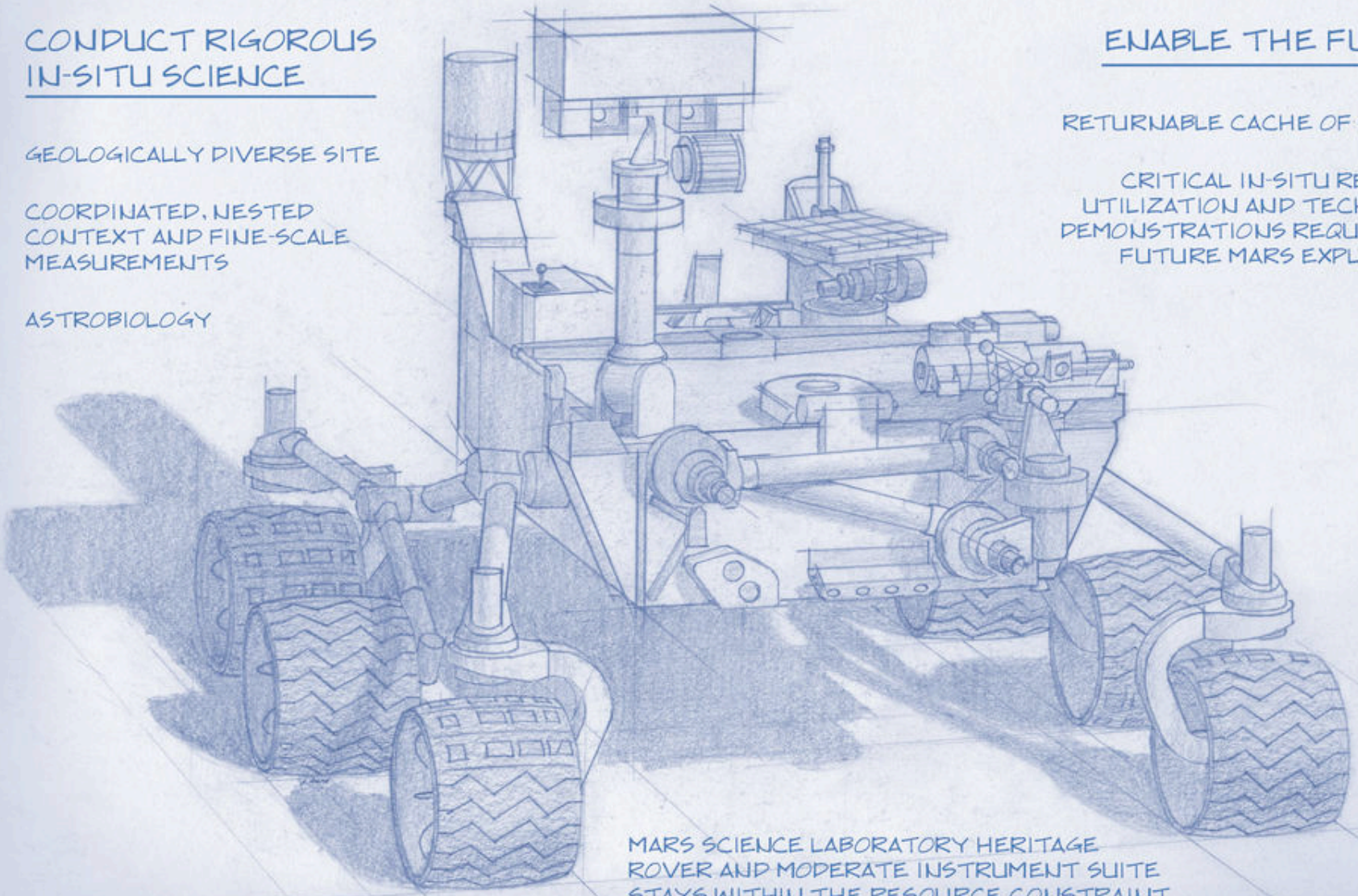
Mars Missions this Decade



MAVEN will study Mars' upper atmosphere and determine how it interacts with our Sun



Mars 2020



CONDUCT RIGOROUS IN-SITU SCIENCE

GEOLOGICALLY DIVERSE SITE

COORDINATED, NESTED CONTEXT AND FINE-SCALE MEASUREMENTS

ASTROBIOLOGY

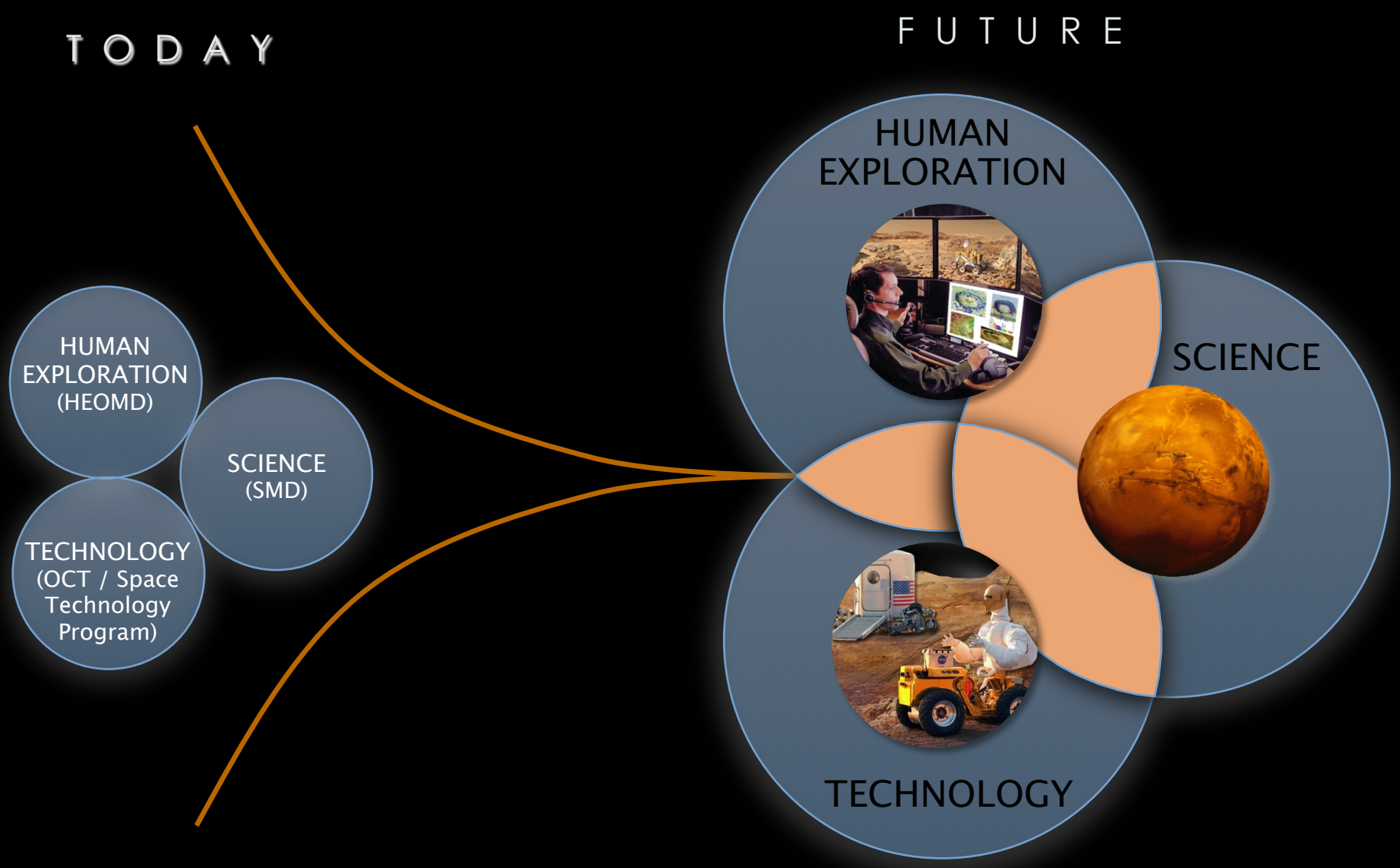
ENABLE THE FUTURE

RETURNABLE CACHE OF SAMPLES

CRITICAL IN-SITU RESOURCE UTILIZATION AND TECHNOLOGY DEMONSTRATIONS REQUIRED FOR FUTURE MARS EXPLORATION

MARS SCIENCE LABORATORY HERITAGE ROVER AND MODERATE INSTRUMENT SUITE STAYS WITHIN THE RESOURCE CONSTRAINT

Mars Exploration as a Common Goal for NASA

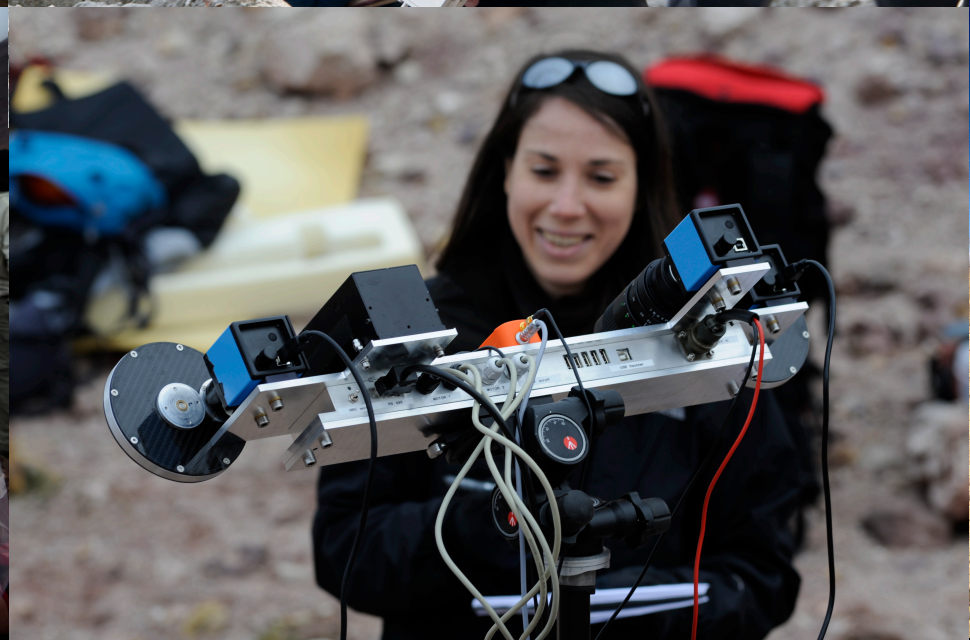


Apollo 11 Astronaut Footprints on the Moon

Curiosity's Wheel-print on Mars at 'Rocknest'

Astronauts on Earth prepared for the Moon

Scientists exploring on Earth today are preparing for Mars in the future



Our future is on Mars!