



The University of Texas at Austin  
Environmental Science Institute

*Hot Science - Cool Talk # 113*

***Will We Really Live on Mars?:  
Investigating the Amazing Red Planet***

**Dr. Joe Levy  
April 27, 2018**

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# Will we really live on Mars?



What are the limits of life on Earth?

How is Antarctica Mars-like?

What do we need to get people to Mars?



# Beacon Valley, Antarctica

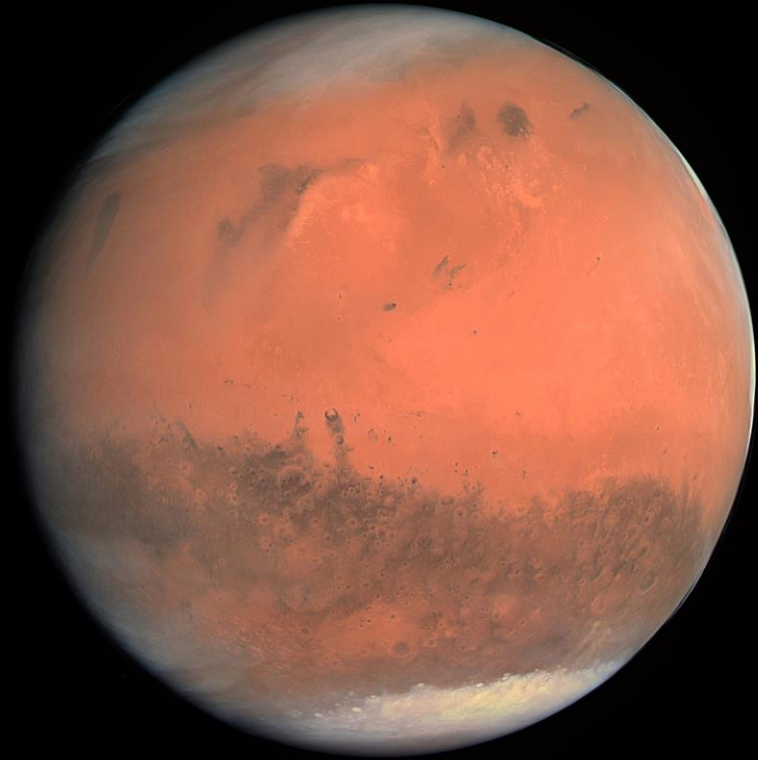
Courtesy NSF/BU/Prehensile Productions

**What are the limits of life on Earth?**

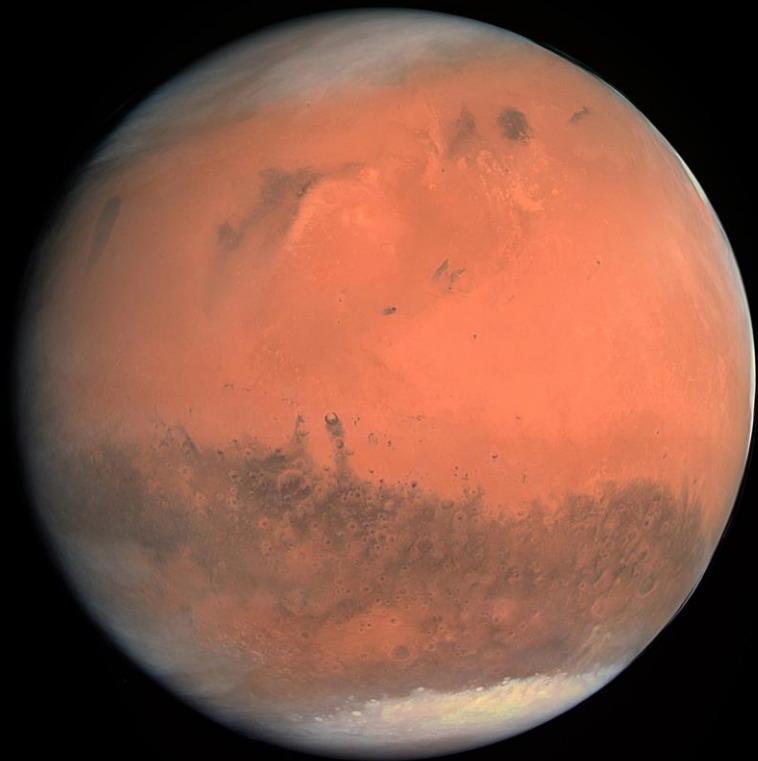
# Wright Valley, Antarctica

Courtesy NSF/BU/Prehensile Productions



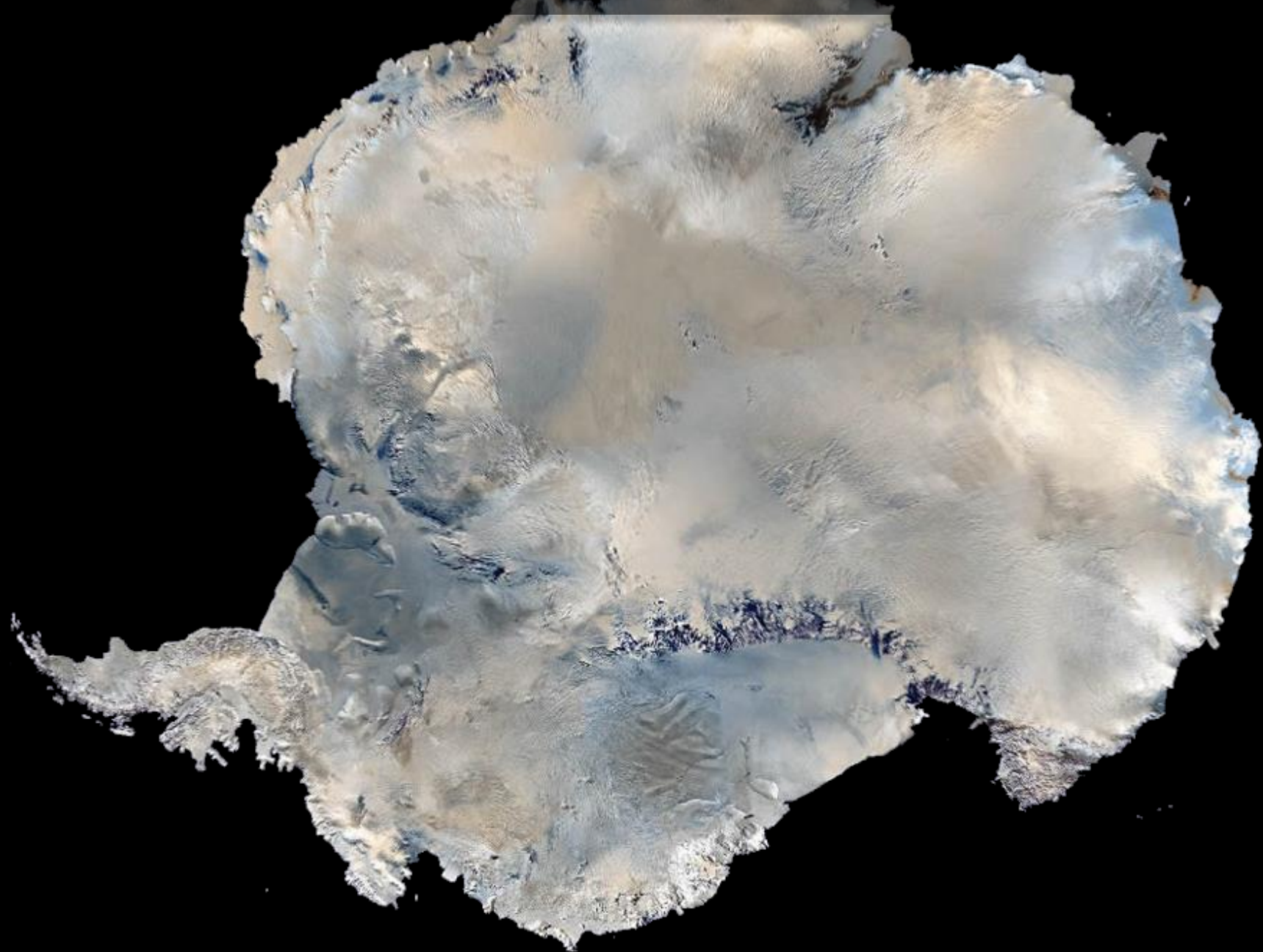


Courtesy ESA - European Space Agency/OSIRIS



Courtesy NASA/Goddard

# How is Antarctica Mars-Like?





# Trans-Antarctic Mountains



McMurdo  
Dry Valleys





50 km



**Not  
Habitable**

**50 km**



Next Stop

McMurdo Station  
(Landing Site)

50 km



**Taylor Valley**  
Courtesy Jay Dickson

2013-12-07 07:36

# Wright Valley

Courtesy Jay Dickson



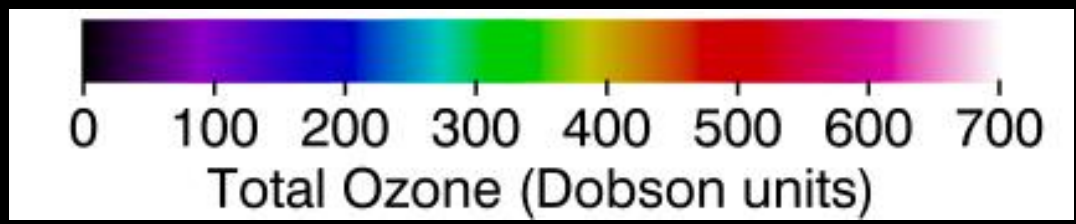
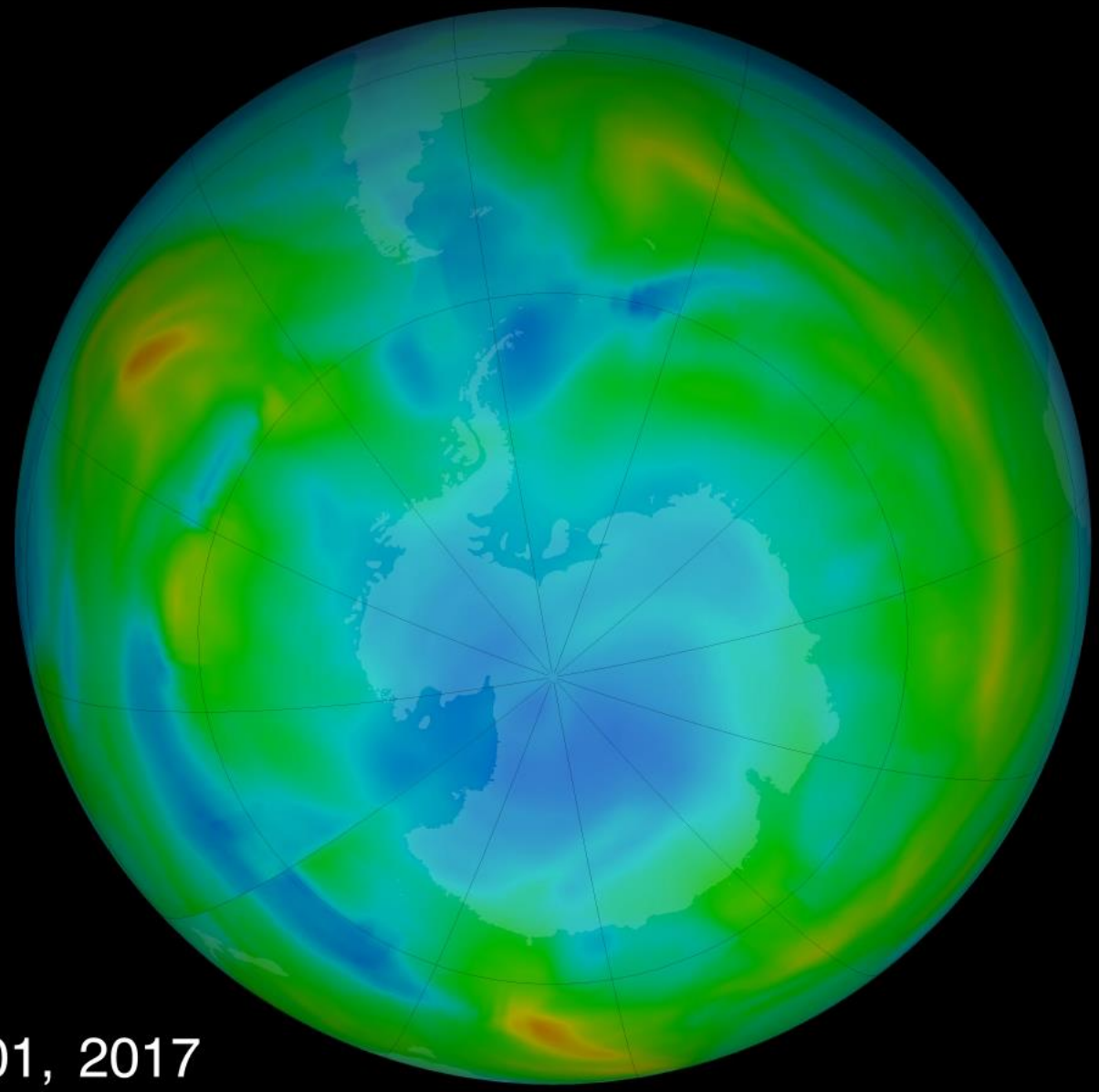
# Don Juan Pond, Wright Valley





# Antarctic Ozone Hole

Courtesy NASA Goddard SFC



Jul 01, 2017

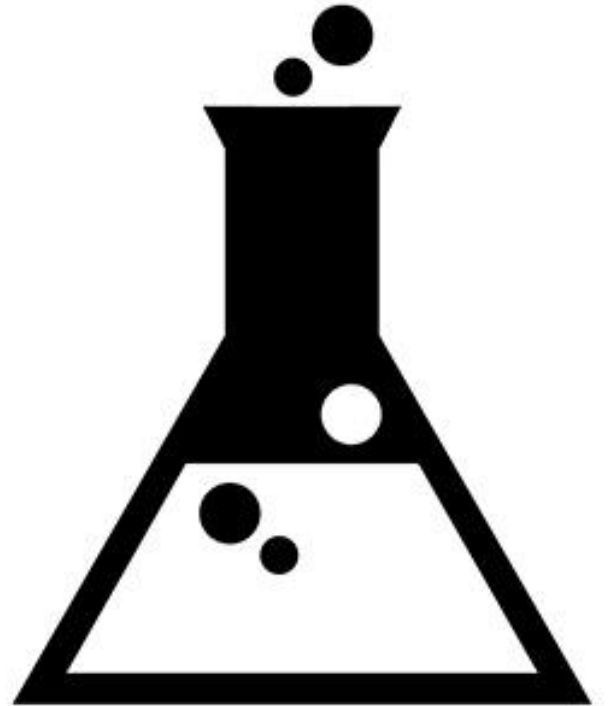




**If you want to explore, you'll need:**

- **A reason (science!)**
- **Consumables**
- **Hardware**
- **Political will**













**Beacon Valley**

**50 km**





**The Oldest  
Ice on Earth!  
8 Million  
Years Old**

**Mullins Glacier**  
Courtesy Jackie Hams

A satellite map of Antarctica showing the continent's topography and ice cover. The Taylor Valley is highlighted in a dark brown color, indicating a region of low ice accumulation. A white arrow points from the text label to this valley. A scale bar in the bottom right corner indicates 50 km.

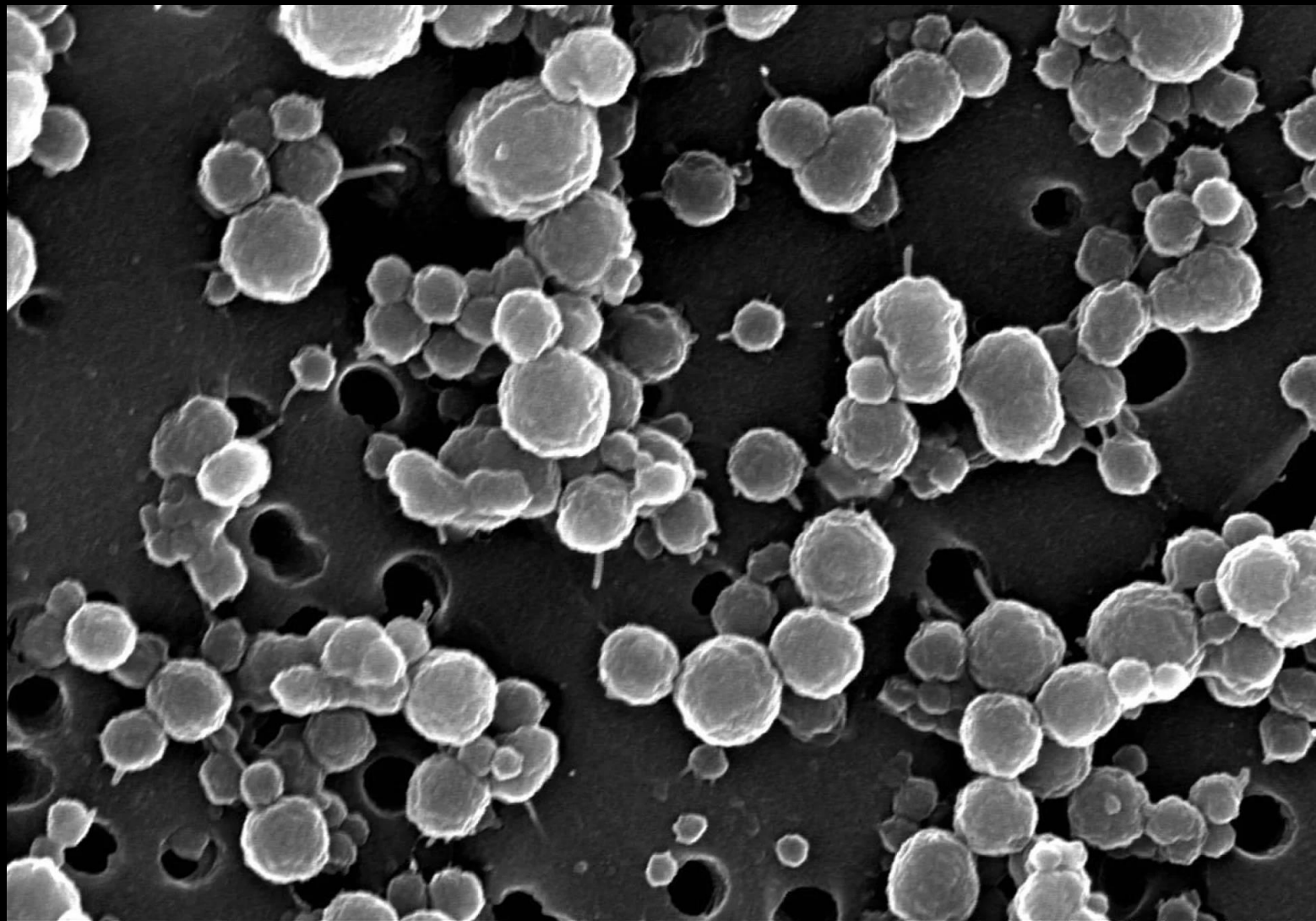
**Taylor Valley**

**50 km**

250m

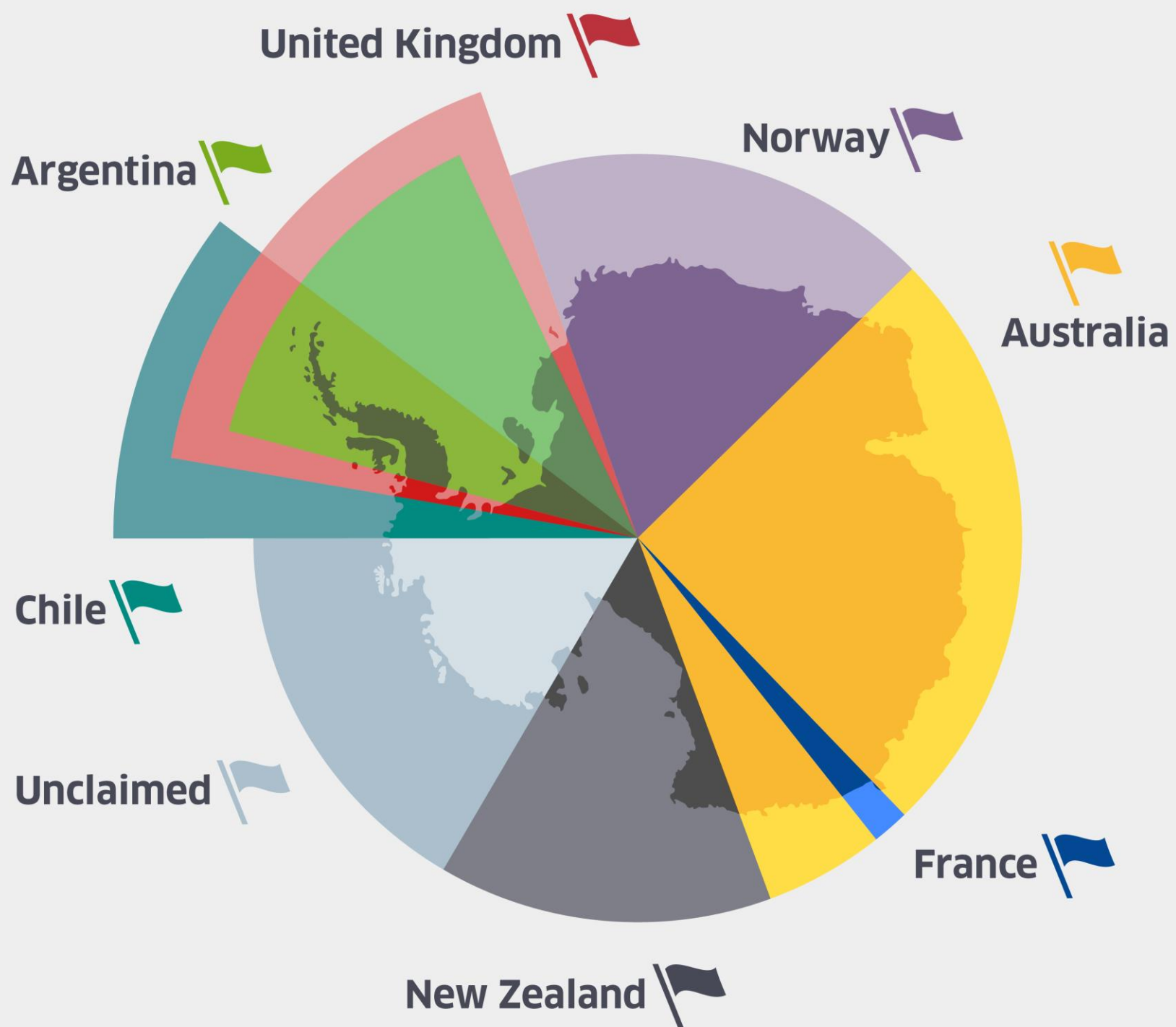
15 Dec 2010

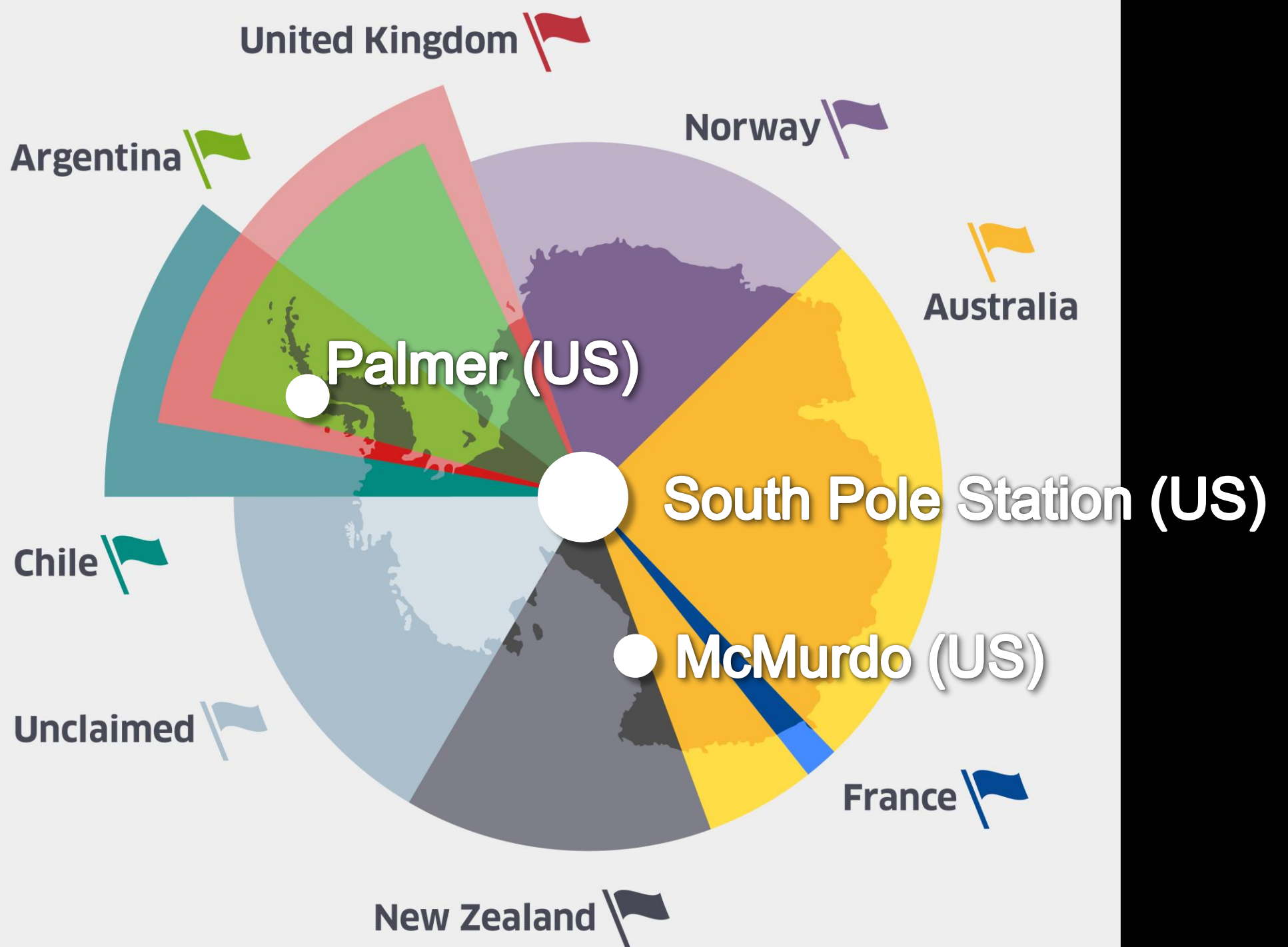
# Taylor Valley Water Tracks

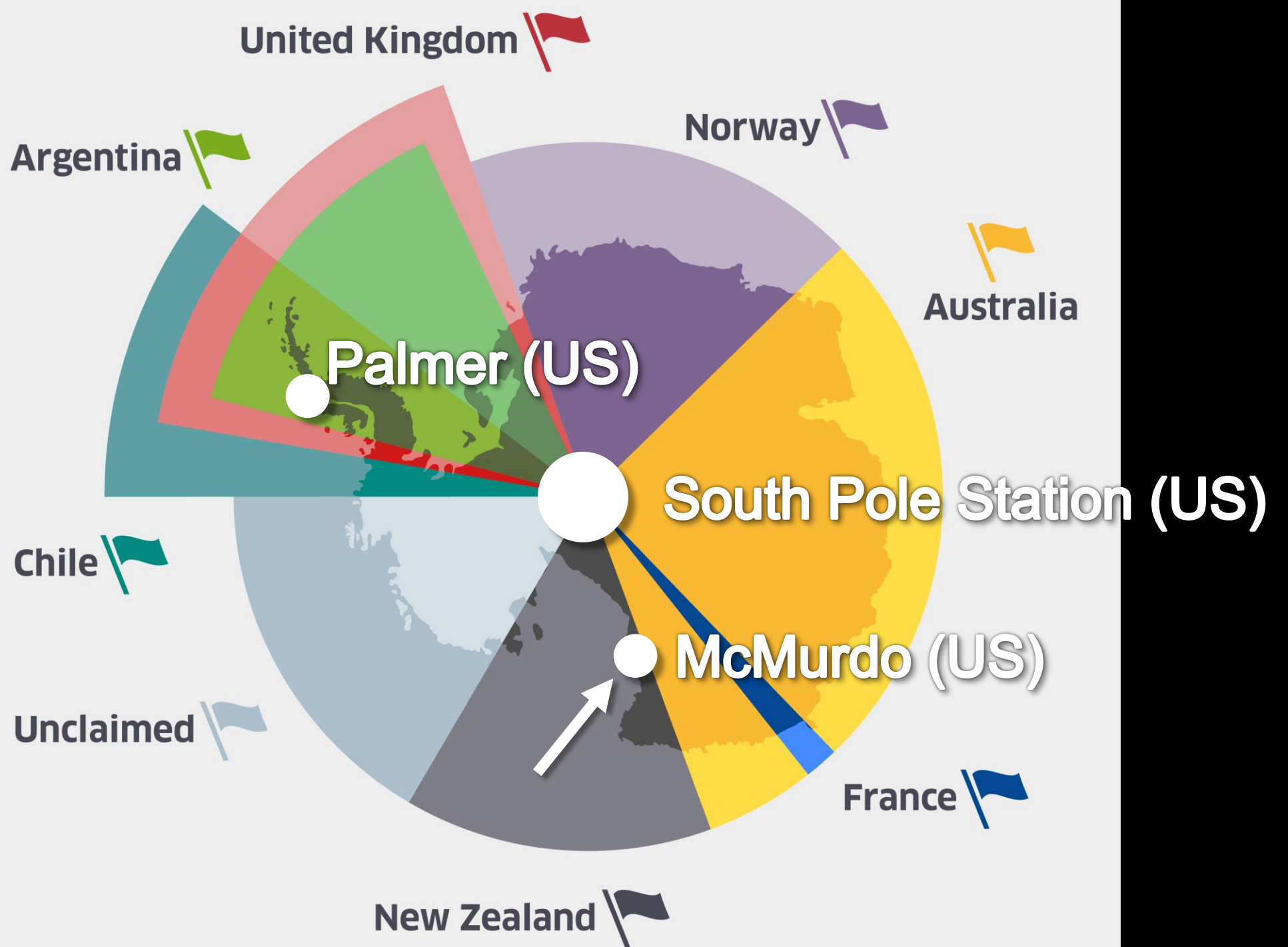


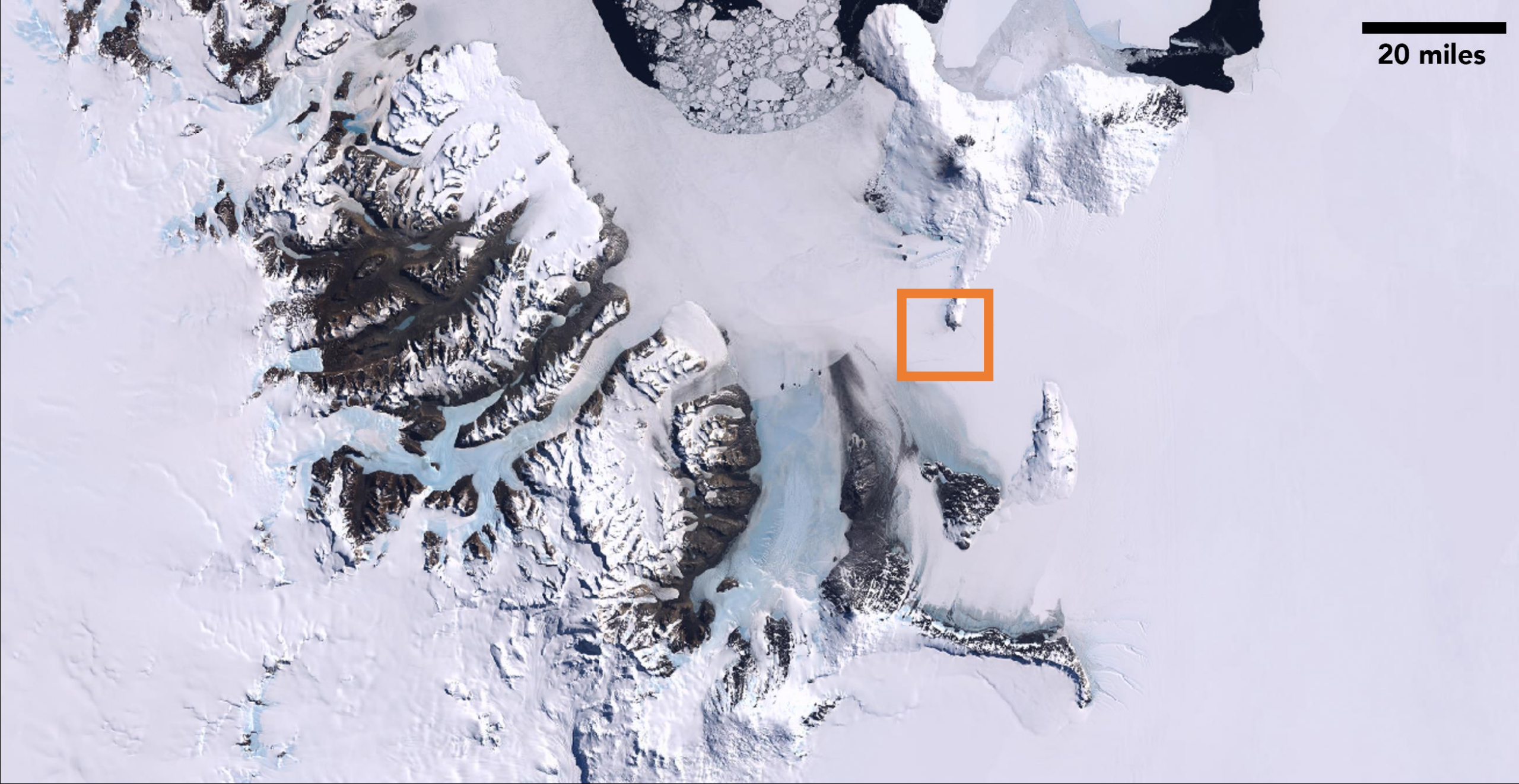
**Brine Channel Microbes**

Courtesy Christ Fritsen









20 miles

Courtesy PGC/UMN

2 miles







0.3 miles



0.3 miles

# McMurdo Station, Antarctica

Courtesy Reinhart Piuk, NSF



**Bars**

**Labs**

**Dining Hall**

**Coffee Shop**

**Dorms**



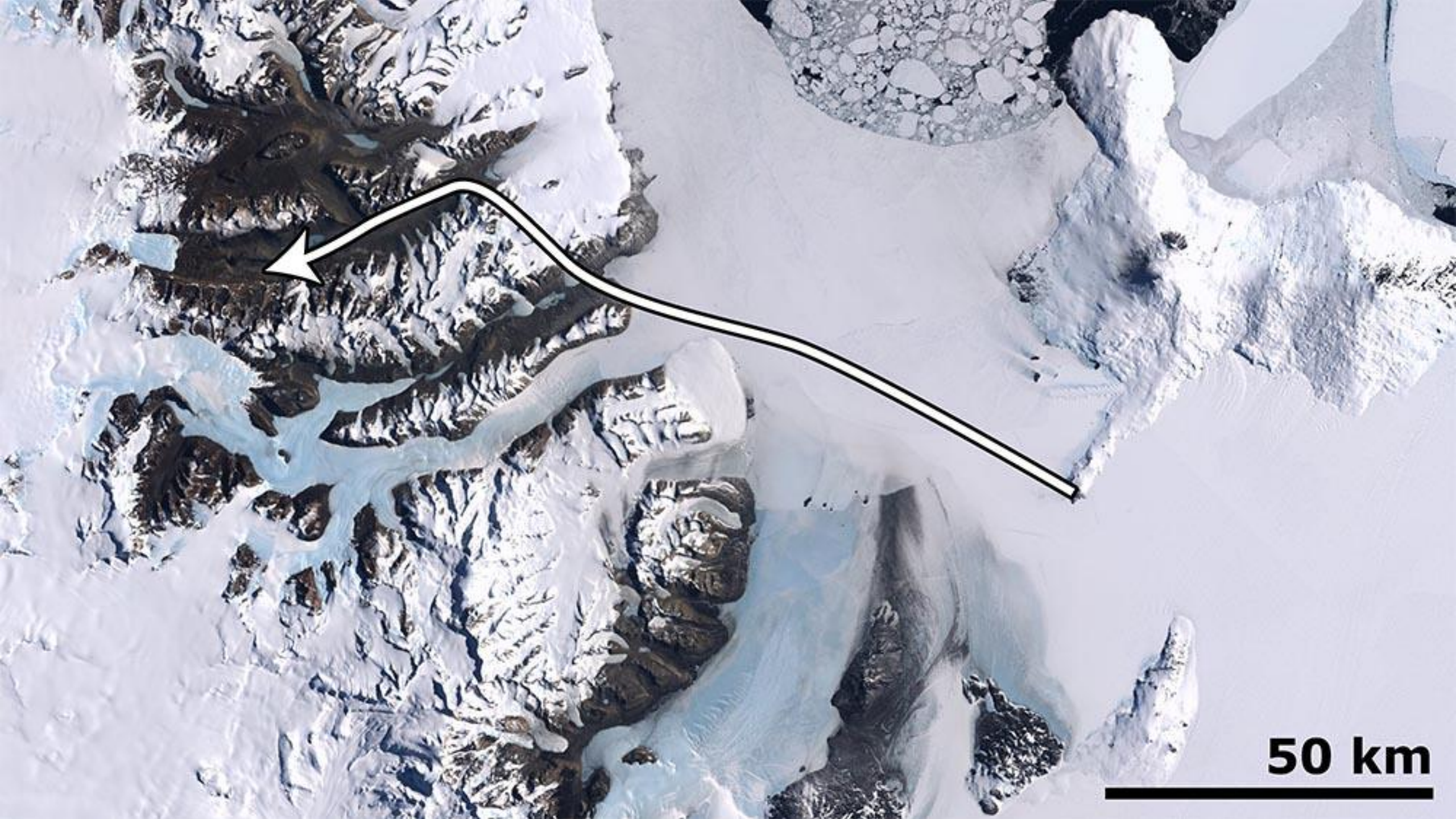
McMurdo Station,  
Antarctica







GREEN WAVE  
MOBILE, AL



**50 km**



# Helo Pickup in Taylor Valley

Courtesy Steve Chignell



# Setting Up Camp in Garwood Valley

Courtesy Jay Dickson





**Garwood Valley  
Camp Life**  
Courtesy Jay Dickson

# 24 Hours in Beacon Valley

Courtesy Jay Dickson



# Melting Snow

Courtesy Jay Dickson



**CARBON MONOXIDE HAZARD**  
This appliance can produce carbon monoxide, which has no odor. Using it in an enclosed space can be dangerous. Never use this appliance in an enclosed space such as a camper, tent, car or garage.

# Taco Night

Courtesy Jay Dickson



An aerial night photograph of a mining town, likely in a high-altitude or mountainous region. The town is illuminated by warm yellow and orange lights from buildings and streetlights, contrasting with the dark, rugged terrain. In the background, a large, dark mountain peak rises against a dark sky. The foreground shows rocky, uneven ground with some snow or light-colored patches. The overall scene conveys a sense of industrial activity in a remote, natural setting.

If you want to explore, you'll need:

- A reason (science!)
- Hardware
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- Political will

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# If you want to explore, you'll need:

- A reason (science!)
- Hardware
- Consumables
- Political will
- Potatoes



# Mars from Hubble

Courtesy NASA



**Why go to Mars?**

Today

ASTEROID  
AND MASS EXTINCTION

DINOSAURS

CAMBRIAN

HUMANS

1 Billion Years Ago

10

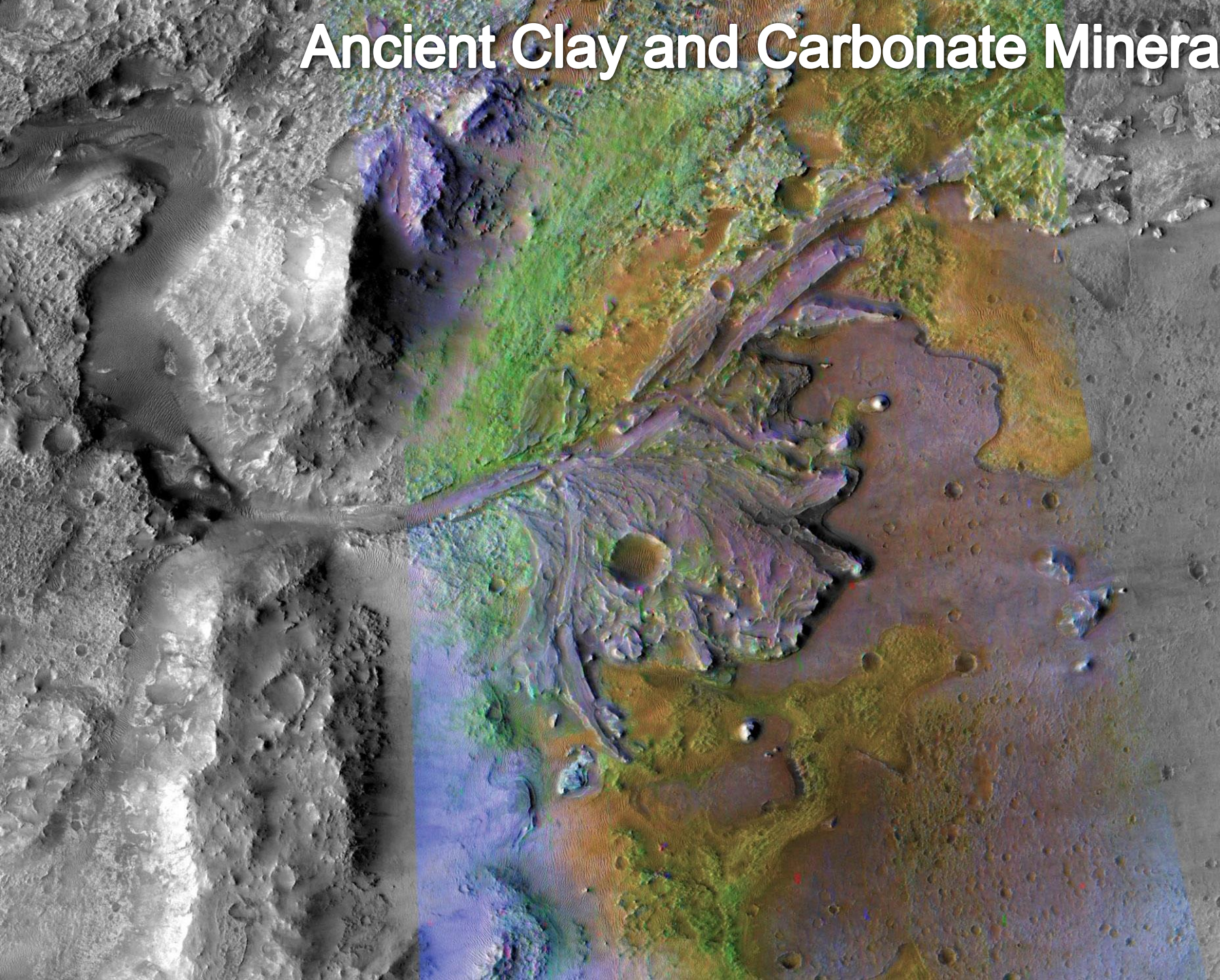
First single-celled  
organisms





# Ancient Clay and Carbonate Minerals in Jezero Crater, Mars

Courtesy NASA/JPL/JHUAPL  
MSSS/Brown University

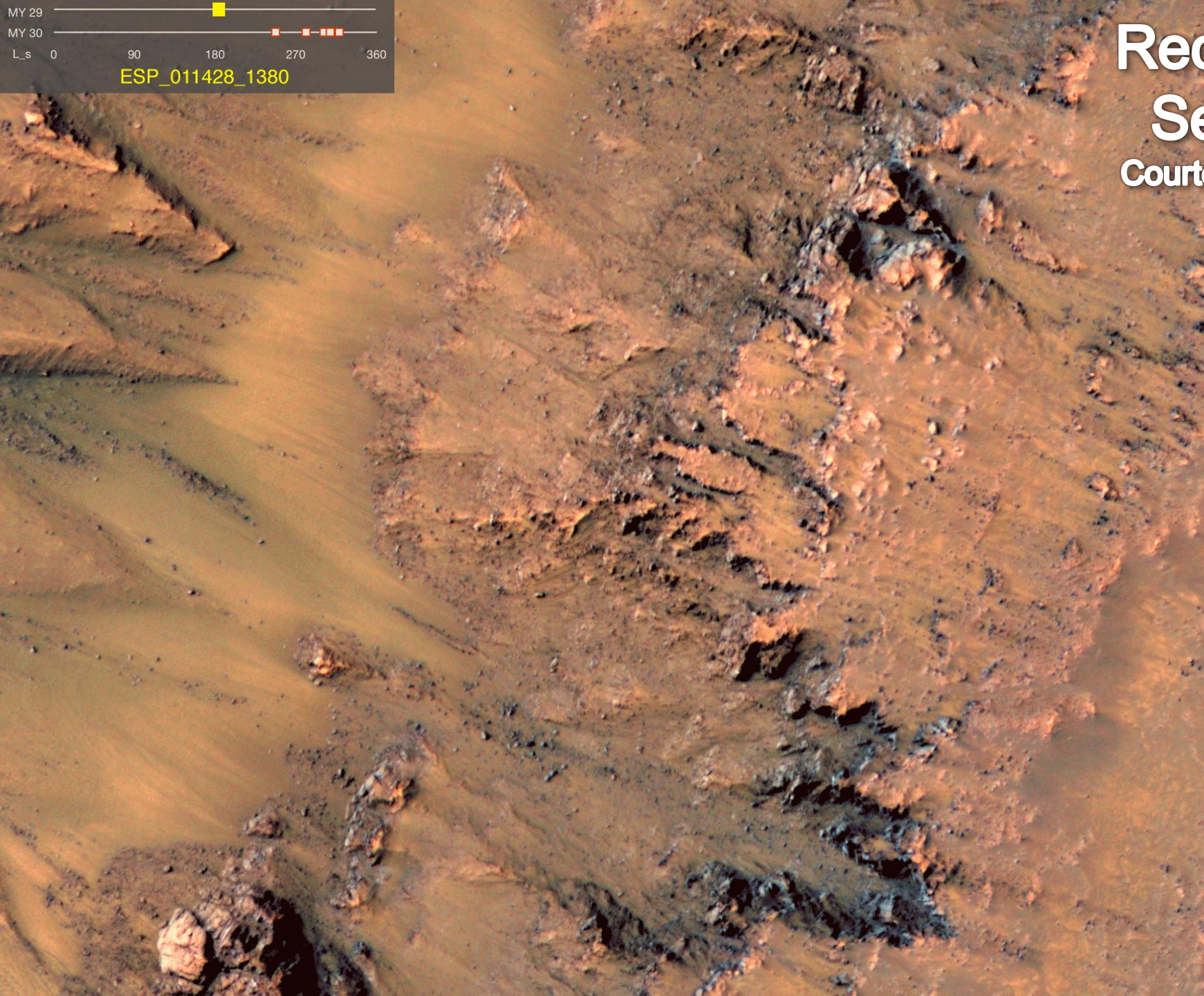




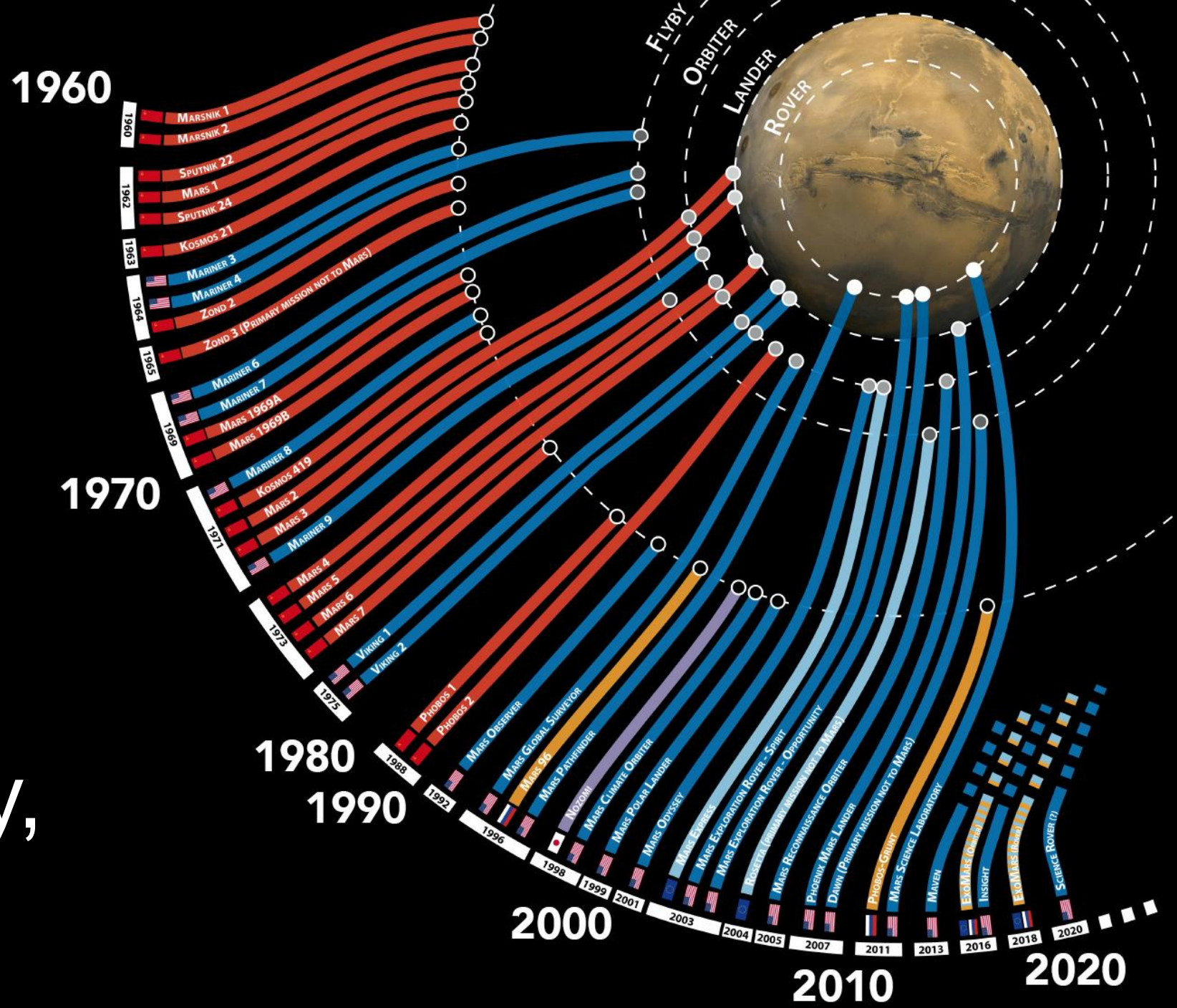
# Recurring Slope Lineae

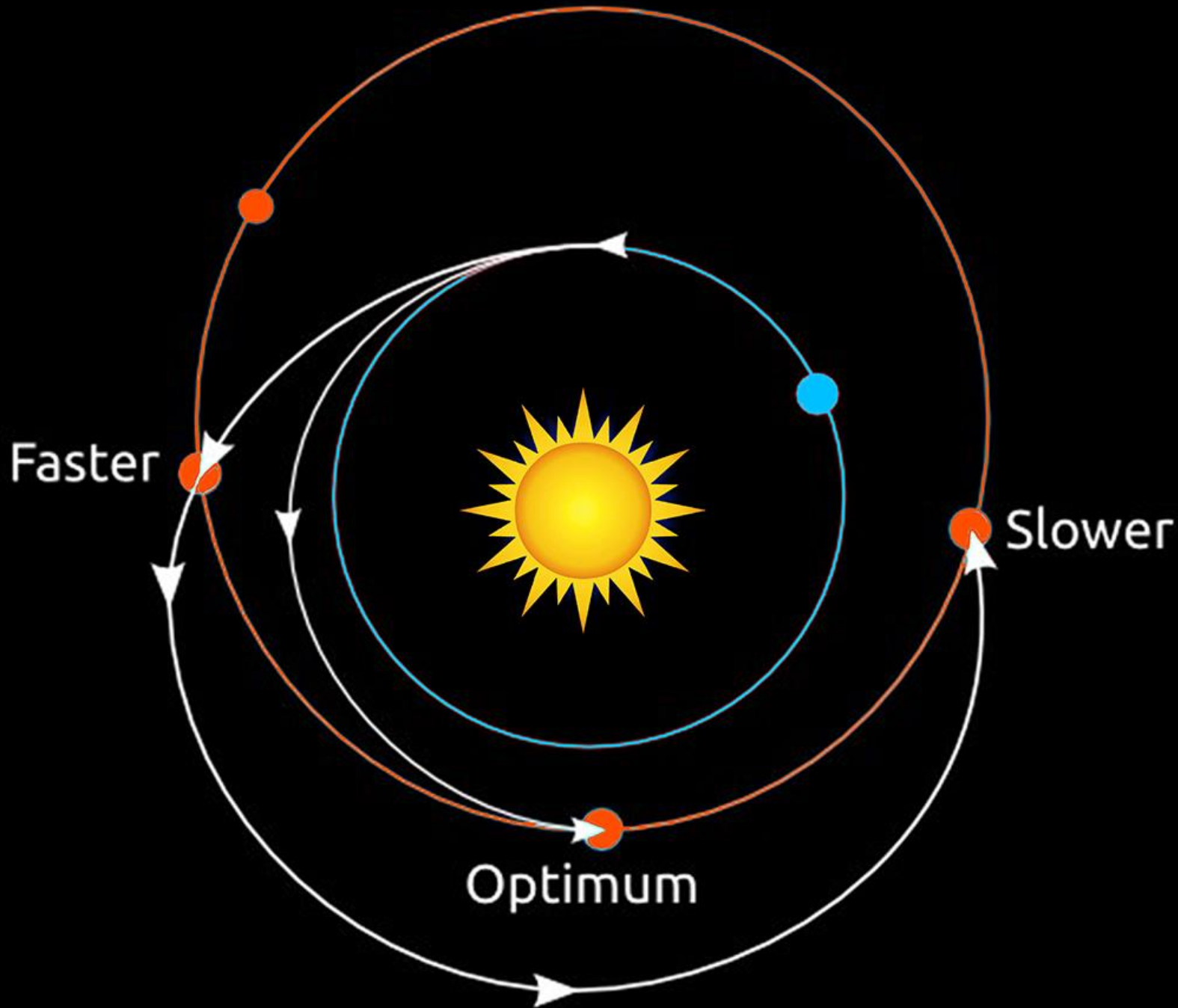
## Seasonal, Salty Flows

Courtesy NASA/JPL/University of Arizona



Getting to Mars is really, really, really hard.





Getting to Mars isn't so hard – stopping is.

“I'd like to die on Mars...just not on impact”

-Elon Musk



**“Mars Direct”**  
Courtesy Ken Ramsleys



J03\_046129\_1800\_XN\_00S006W\_160529

200 m



Resting place of the ESA  
Schiaparelli Lander

1,000 m



# Pick a safe place to land

Equatorial

Not too high  
or low

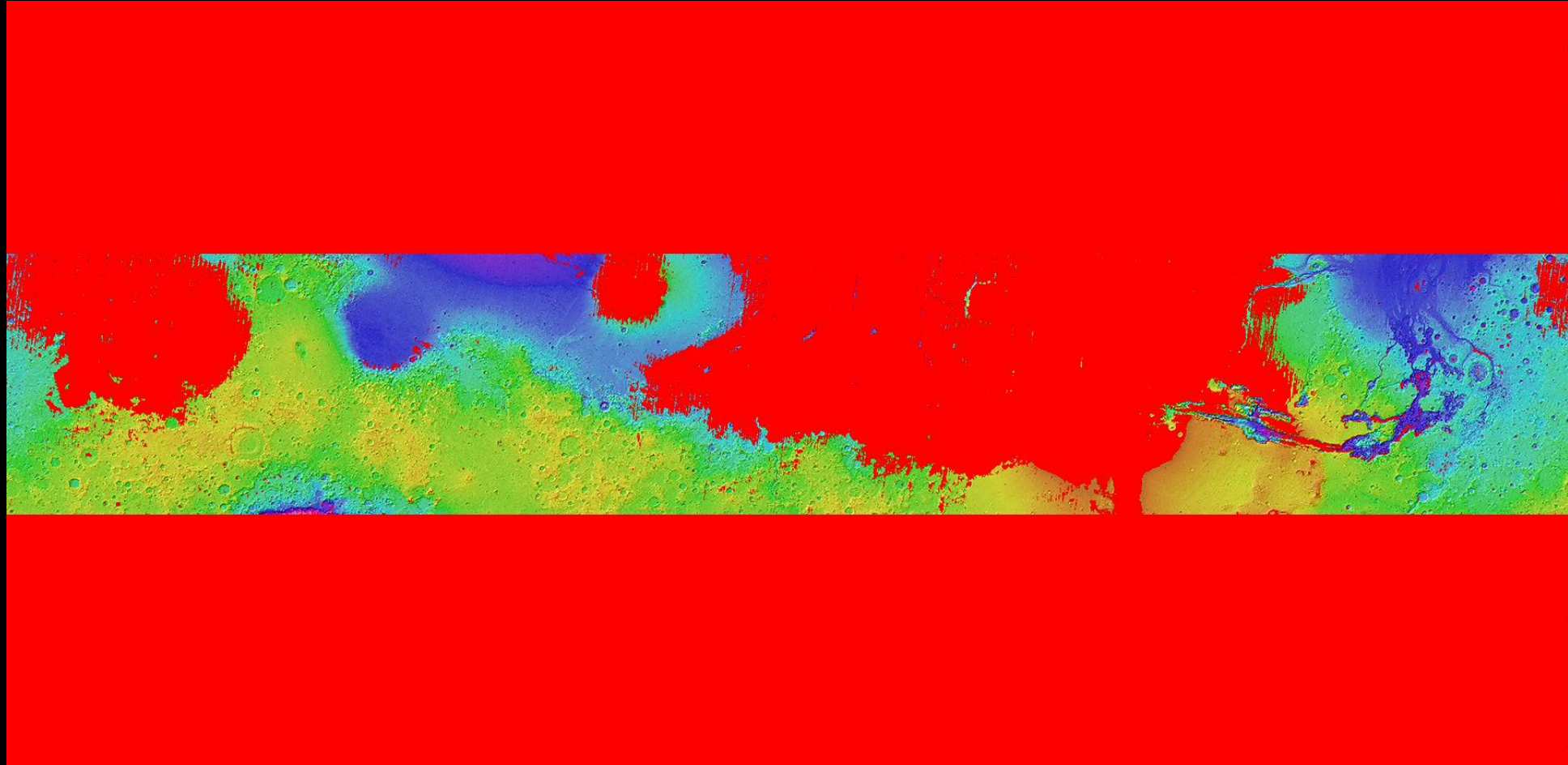
Not too steep

Not too dusty

Not too rocky

Not too shiny

Not too dull



# Red Dragon Concept Art

Courtesy SpaceX



We made it! Um, now what?

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- Political will

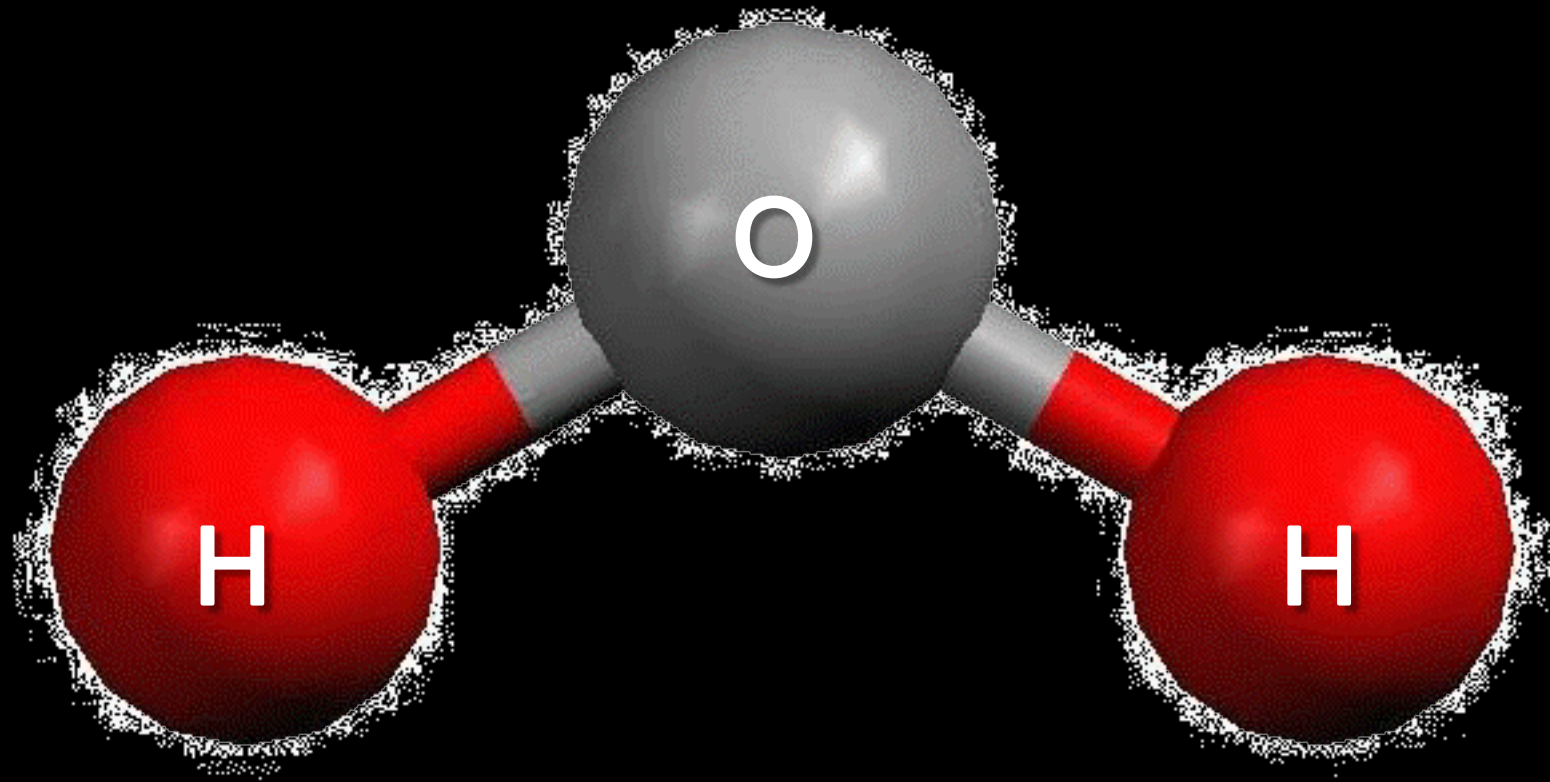


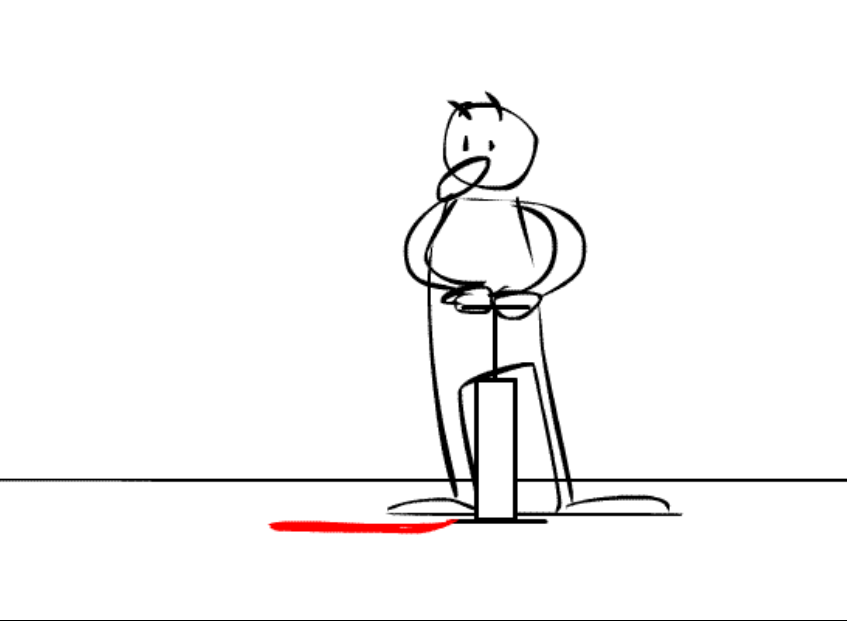
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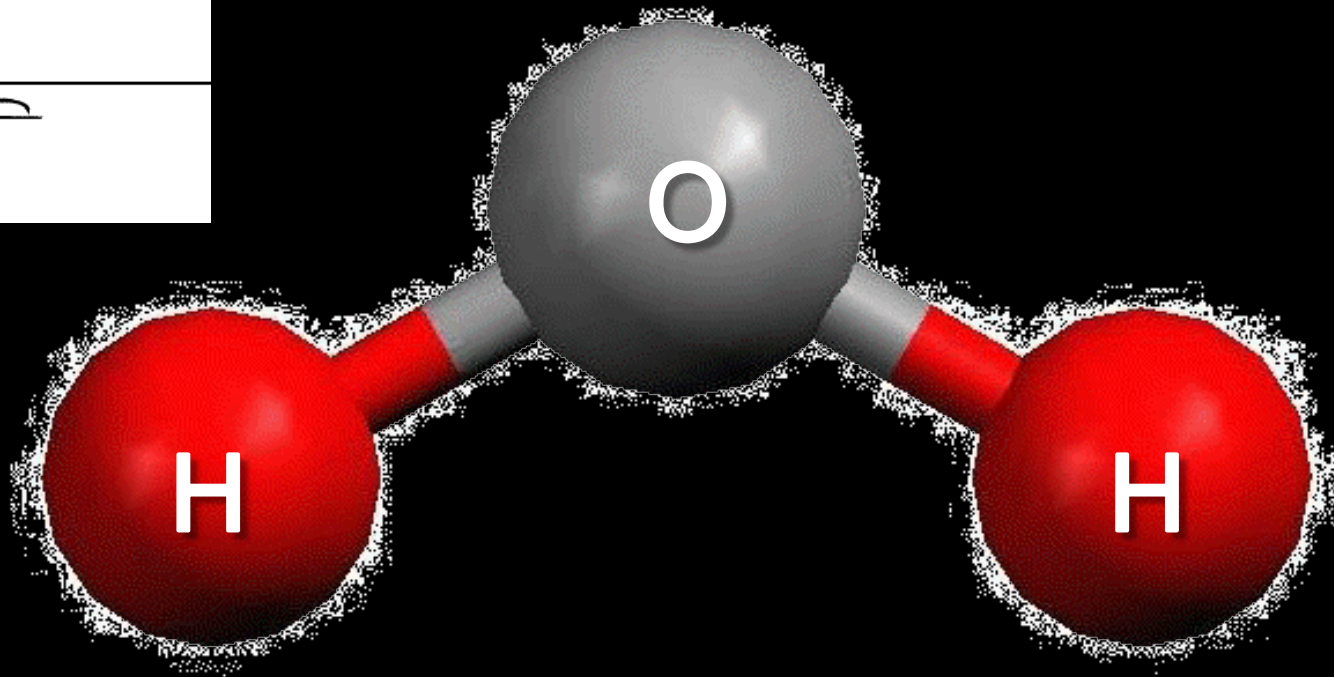


Water or Ice is the ultimate consumable





Courtesy Alex Langenstein





# Mars 0.4 to 2.1 Million Years Ago

Courtesy NASA/JPL/Brown University



Ice-Free

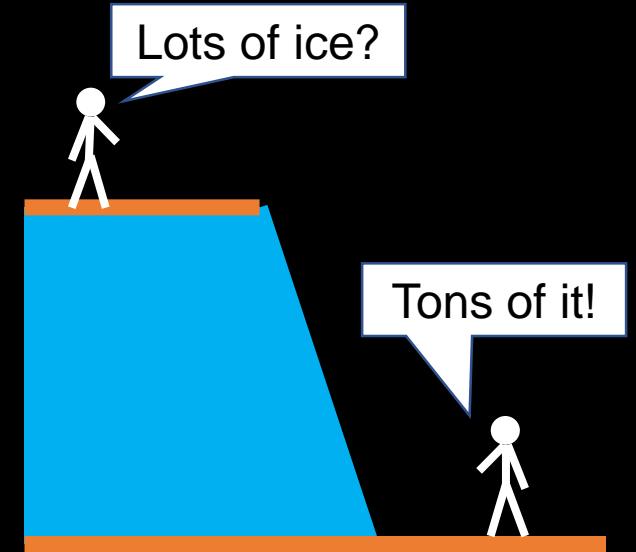
Ice Covers the Surface

Debris Covered Upper Plains

Cliff Showing Buried Ice

Debris Covered Lower Plains

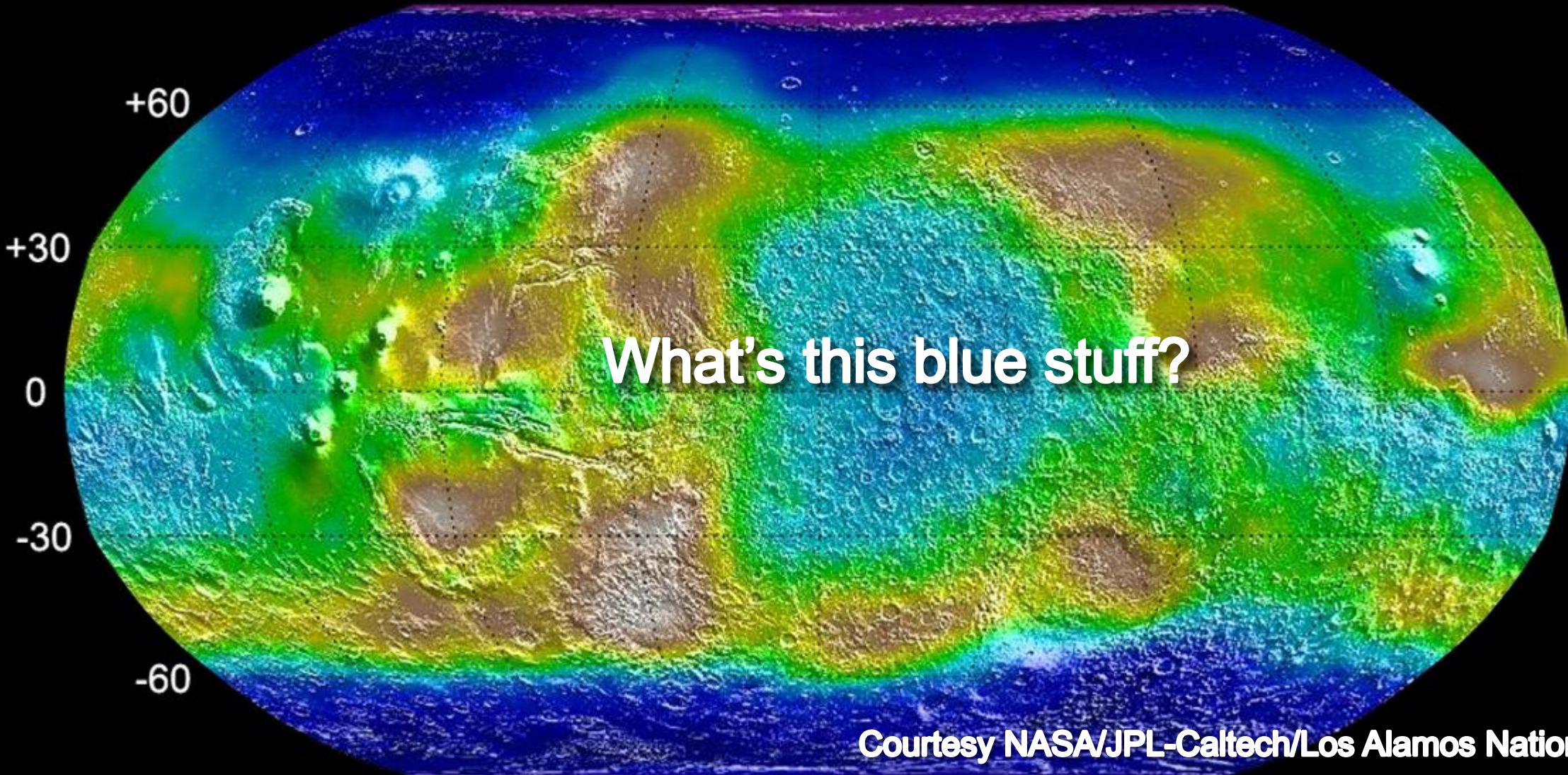
An ice sandwich on dirt  
Courtesy NASA/JPL-Caltech/UA/USGS



2% 4% 8% 16% 32% > 64%



**% water within  
1m of the surface**

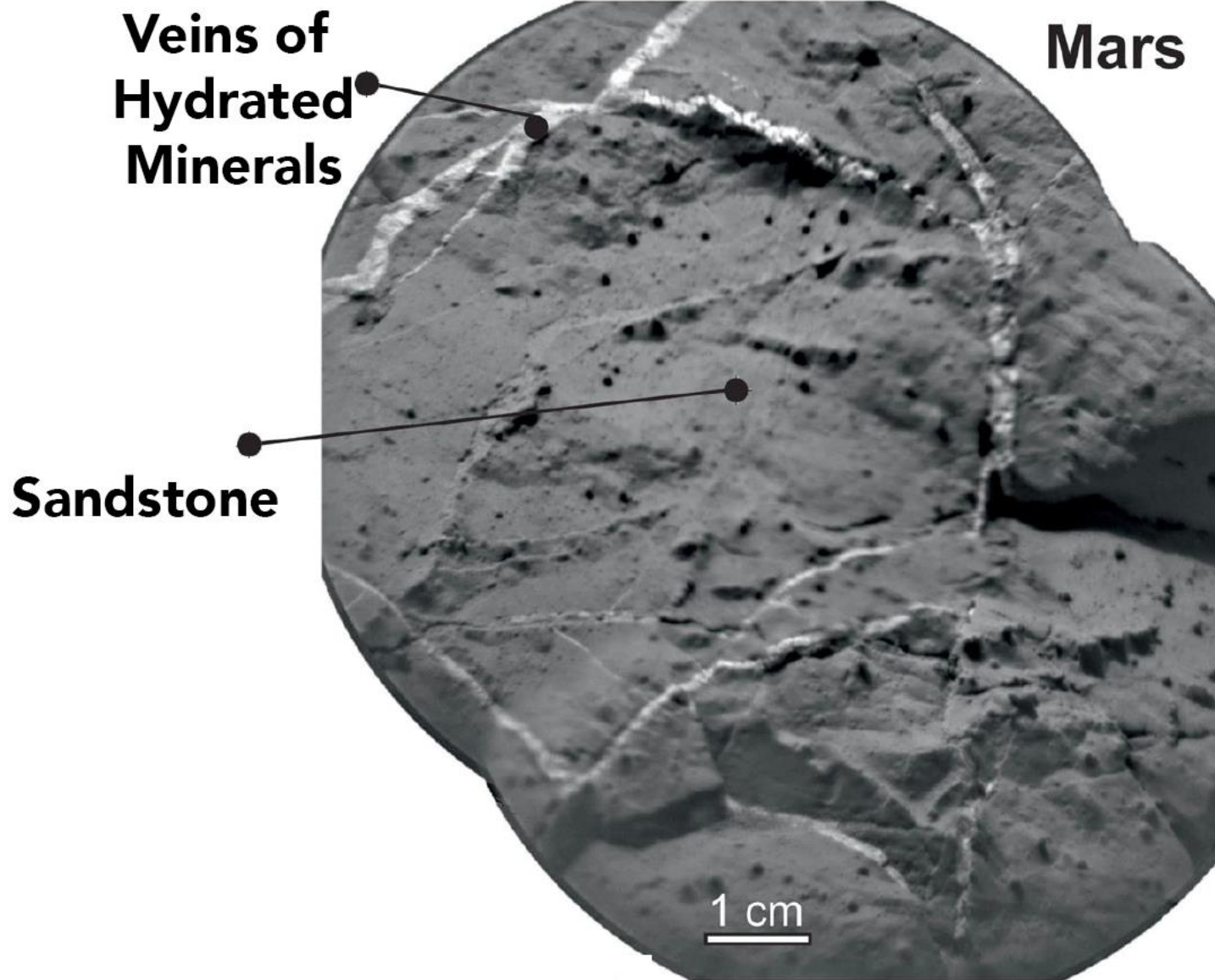


**What's this blue stuff?**

**Courtesy NASA/JPL-Caltech/Los Alamos National Laboratory**

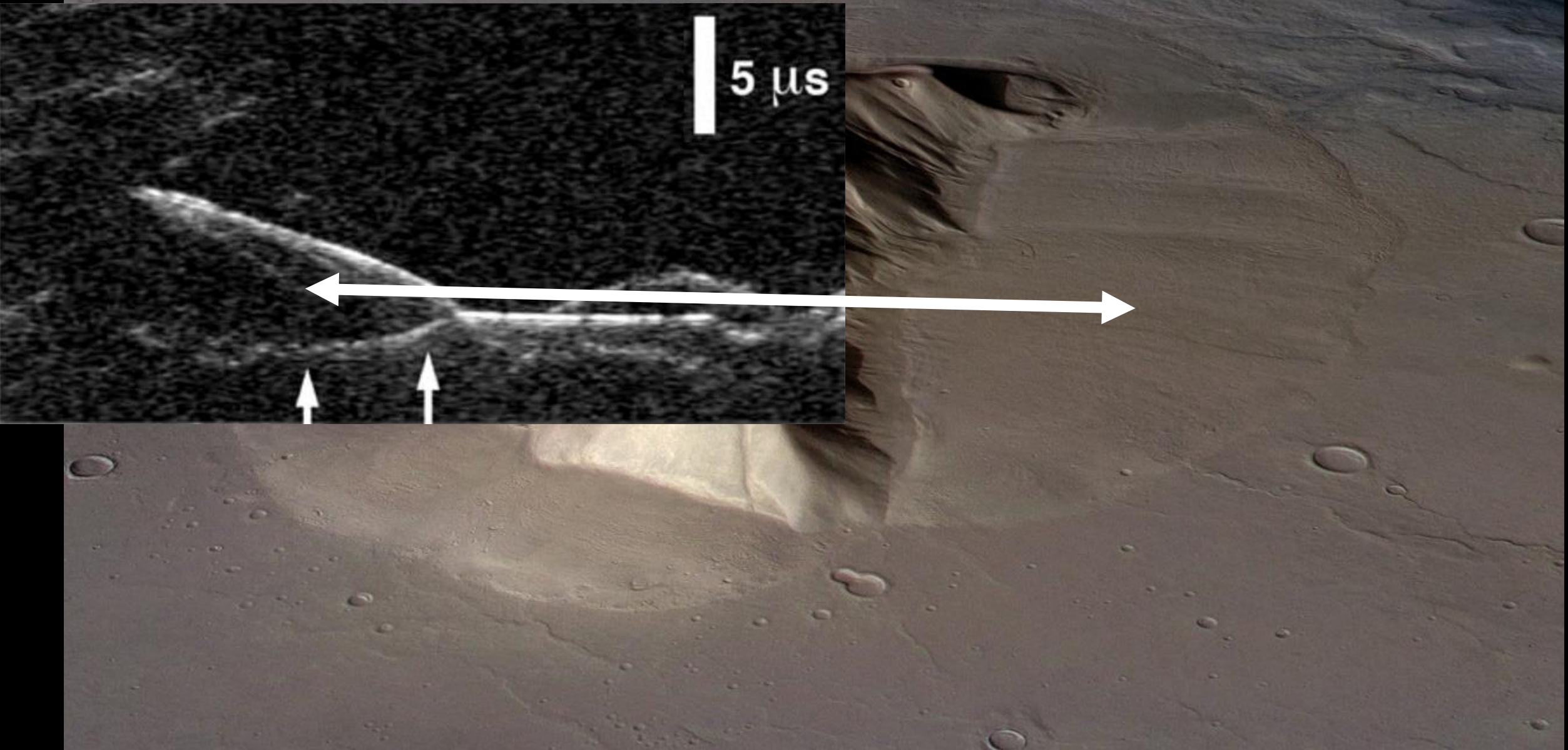
# Drink the rocks: hydrated sulfates

Courtesy NASA/JPL-Caltech/LANL/CNES/IRAP/LPGNantes/CNRS; Earth image: LGLyon)



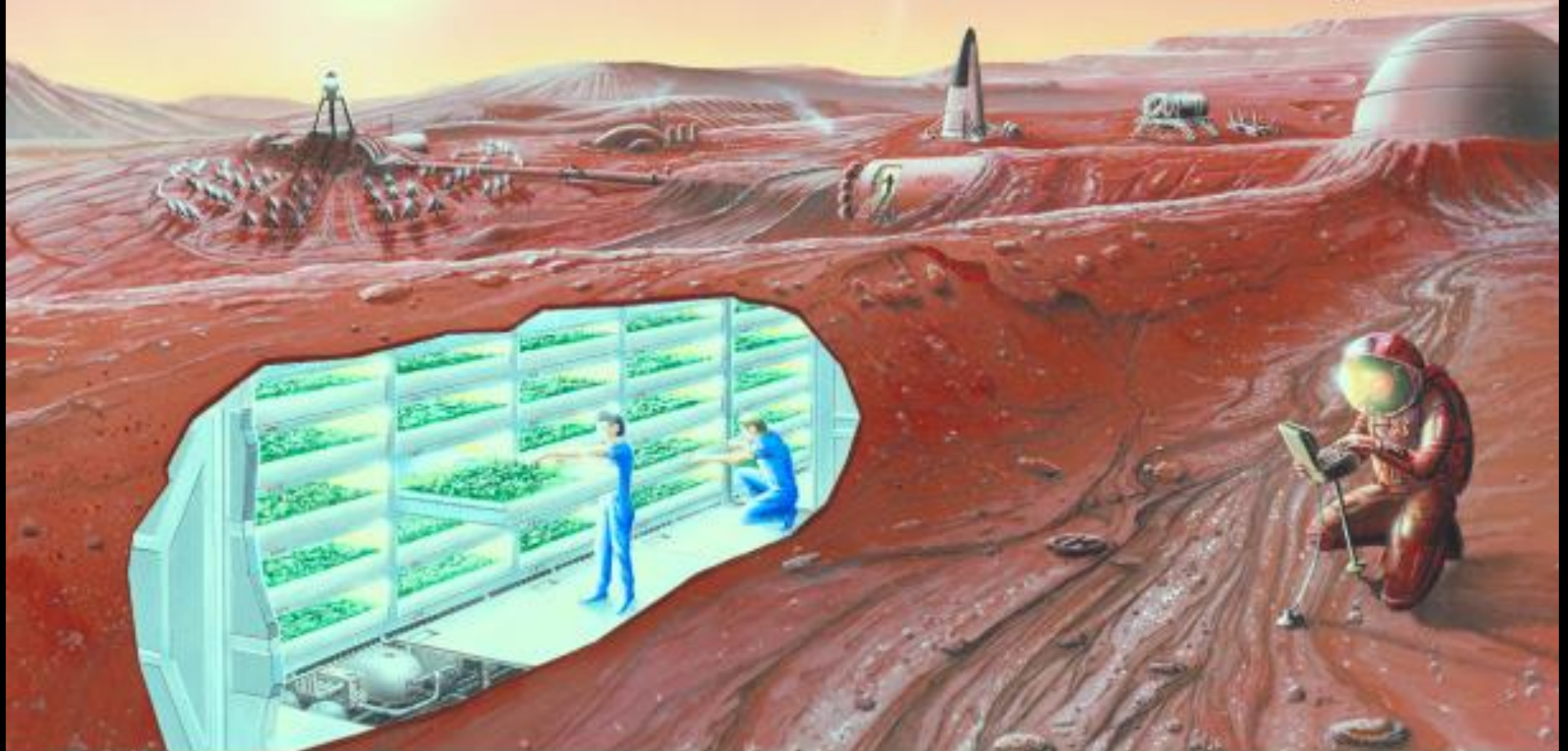
# On the rocks: Debris-Covered Glaciers

Courtesy PSI, Plaut et al., 2009



Ice is the ultimate consumable

# Radiation Threat to Humans in Space



ASTRONAUTS LIVING ON MARS MIGHT BURY THEIR HABITAT MODULES UNDER THE SOIL FOR PROTECTION (CREDIT: NASA)

# Why not live in the ice?

Courtesy Heiko Junge/EPA



Why not live in the ice?

Courtesy Sipa Press





# Why not live in the ice?

Courtesy Gloria Dickie



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- Hardware ✓

- Consumables ✓

- Political will



DESIGN SKETCH

EXPLORATION VEHICLE AND TRAILERS

JUNE 22, 2012

BRYAN VERSTEEG

SPACEHABS.COM

# Beacon Valley, Antarctica

Courtesy Prehensile Productions



# Unnamed Cirque, Antarctica



# Unnamed Cirque, Antarctica

Extremophile Algae



# McMurdo Station, Antarctica

Courtesy James Walker



