Unit 1 Habitable Worlds

Learning objectives:

- 3 things needed for life
- 2 Types of organisms (producers and consumers)
- Most important elements for life

Habitable World Video Notes

Essential question:

What makes a good environment for life?

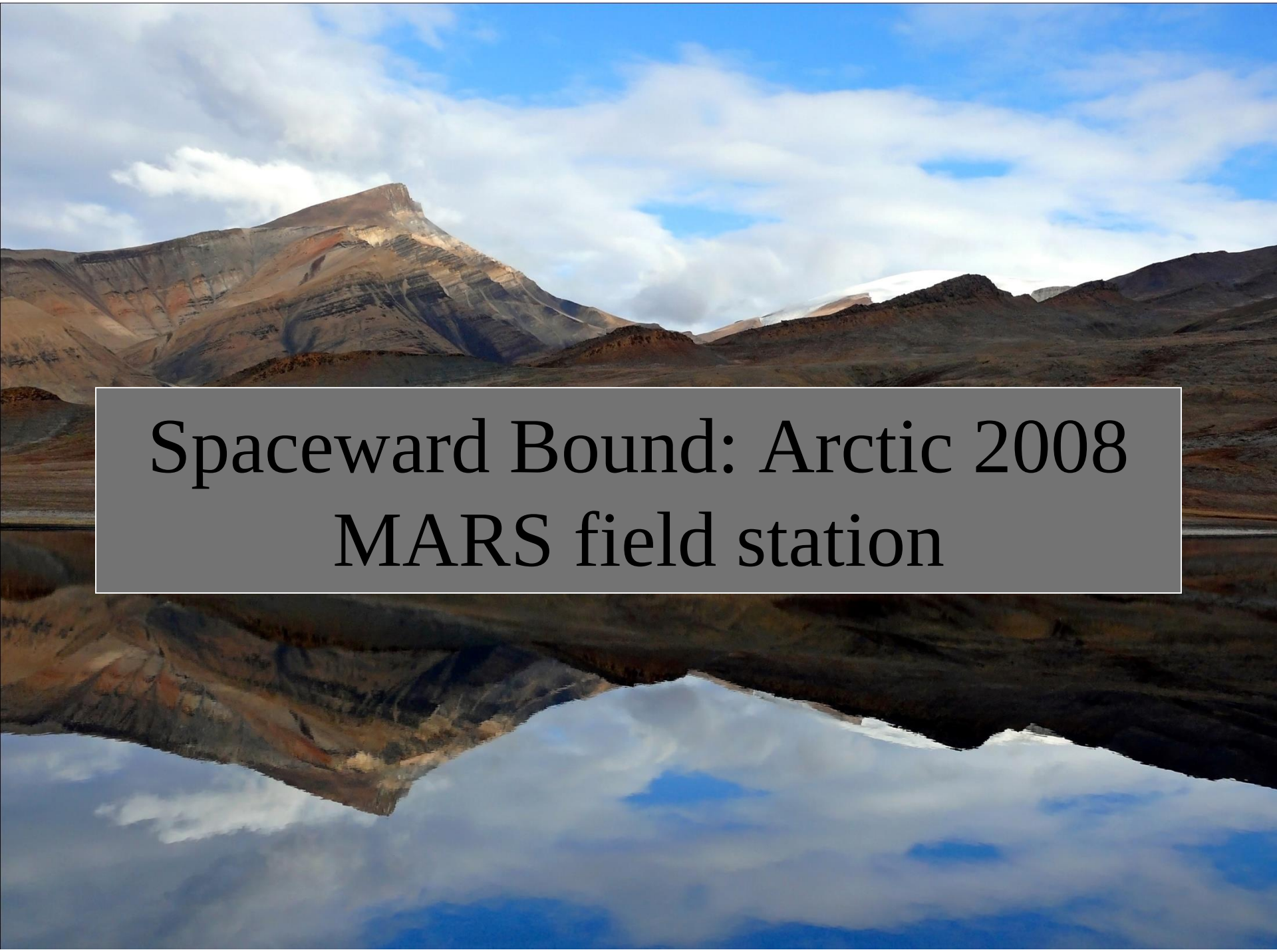
Define habitable:

http://www.youtube.com/watch?v=p4OqZtojqUQ&feature=plcp

Habitable = Livable =
Ability to support life

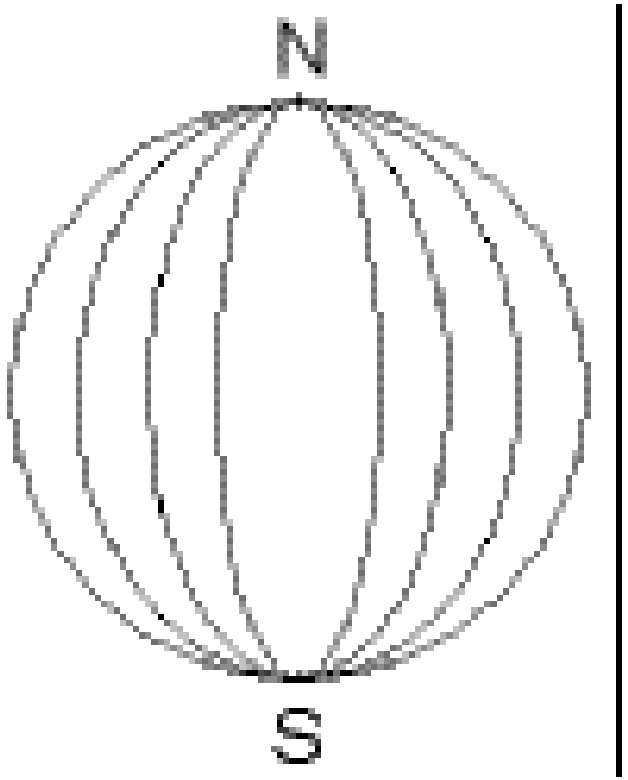
Living Things Require

- Liquid water
- Building blocks =Nutrients (CHNOPS)
- Energy Source

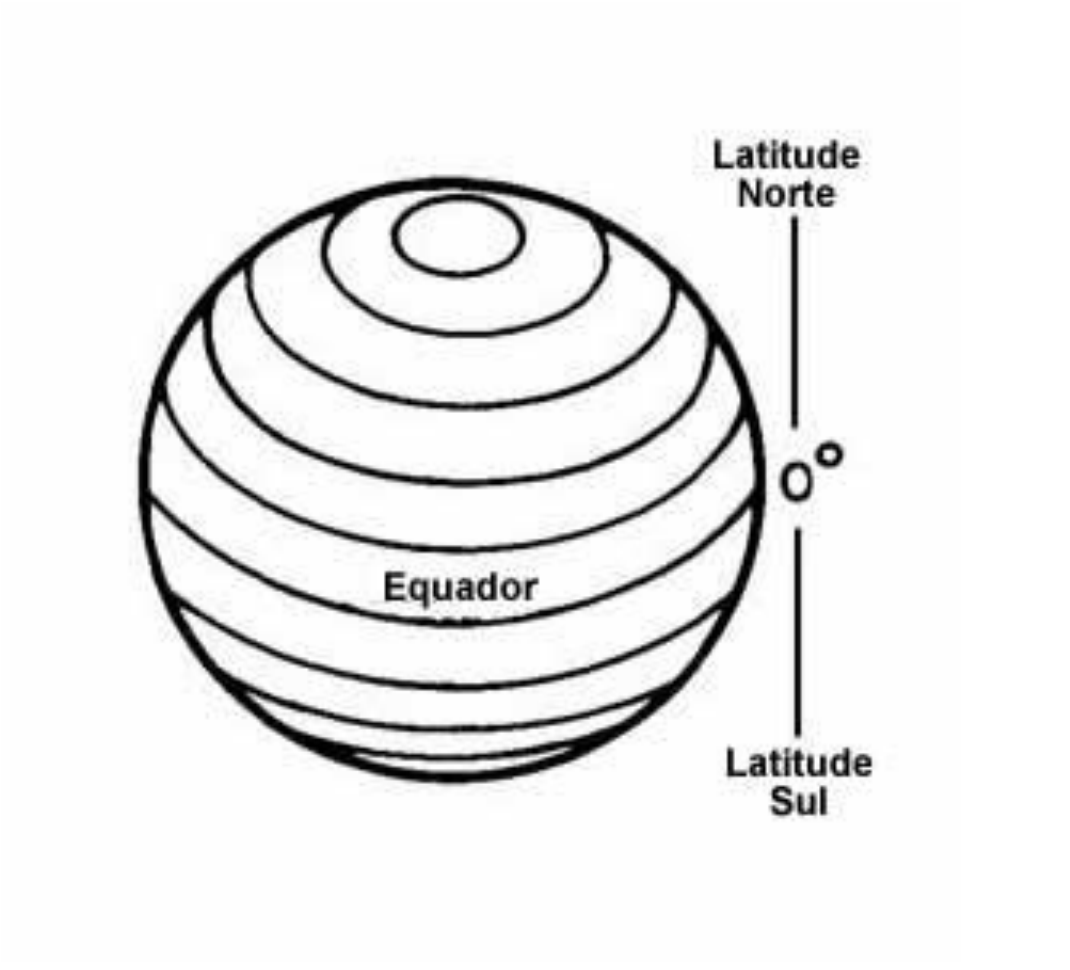


Spaceward Bound: Arctic 2008 MARS field station

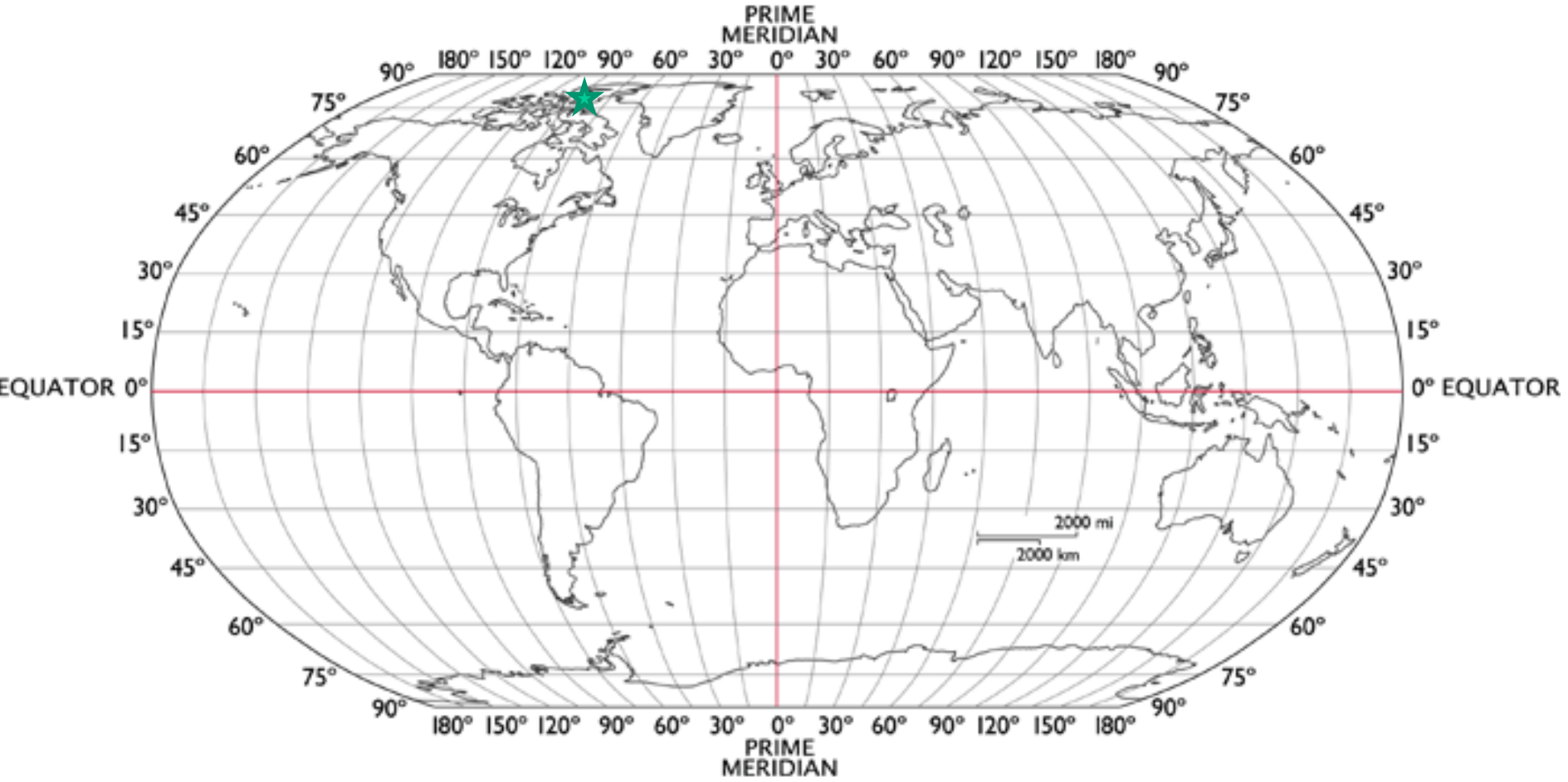
Draw lines of longitude on the globe below



Draw lines of latitude on the globe in your notes



Put a star at 80°N 90°W



McGill Arctic Research Station

Time Lapse photos of Sun

noon midnight

1. Why does the sun look like it moves across the sky?

2. Why is it still light out in the Arctic at midnight?

3. Predict what happens to daylight in the winter on Axel?

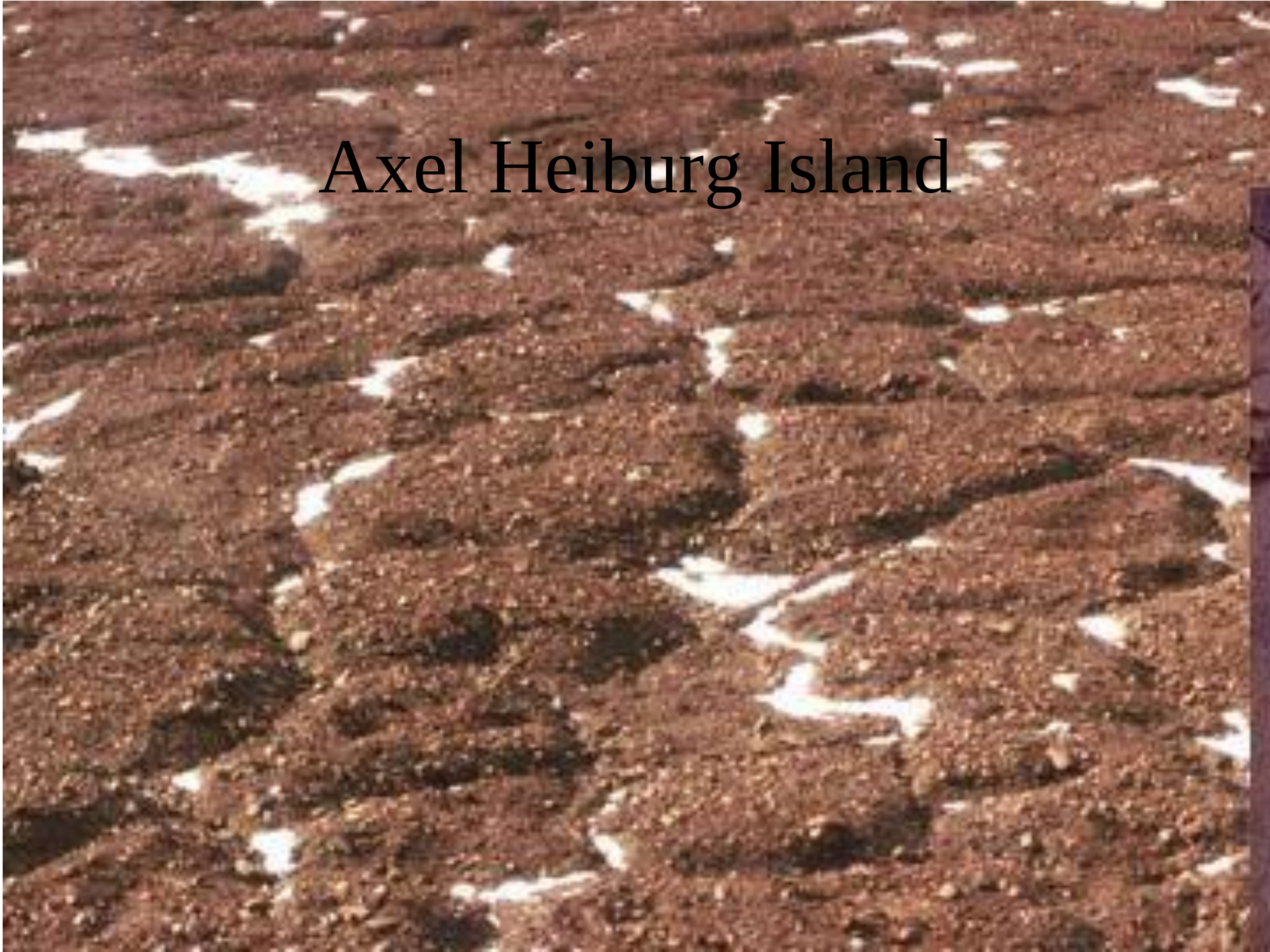
Meet the Team

The Mission

- Prepare for human exploration on Mars by studying life in extreme environments on Earth

Extreme Environments

- Mars = Phoenix rover landing site
  - (-28°F to -100°F)
- Axel = Average temps in February
  - (-31°F to -49°F)


Axel Heiburg Island

Phoenix rover landing site

Chris McKay

Planetary Scientist

Space Science Division
NASA Ames Research Center
Expedition Lead

https://www.youtube.com/watch?v=xlIj-BtYWn4 up to 5:00

What does life need???

Define metabolism

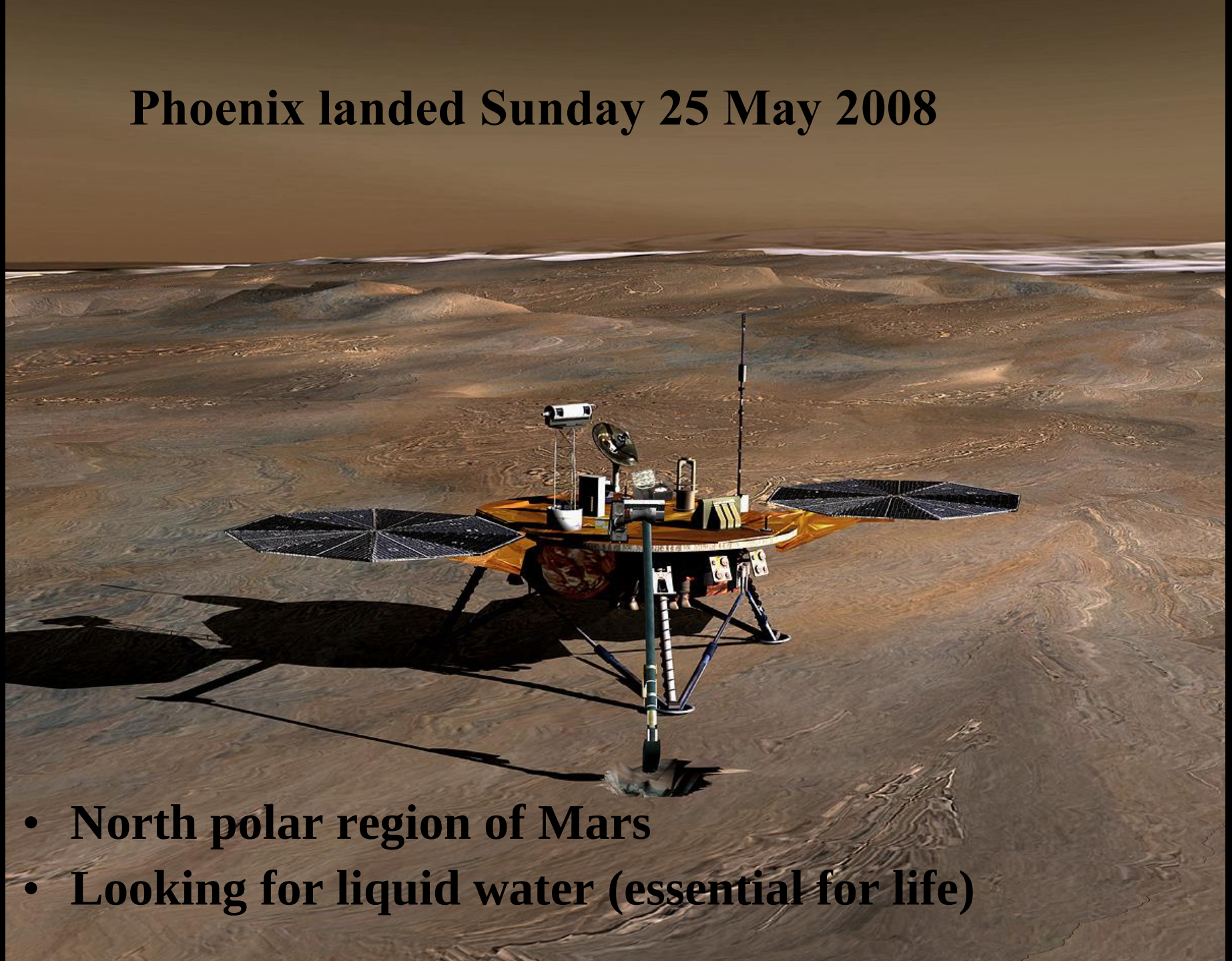
- All the chemical reactions needed to live
- Required for life

- Ex: eating, digesting, growing

Sci Fri
“Tiny Animals Survive Exposure to Space”

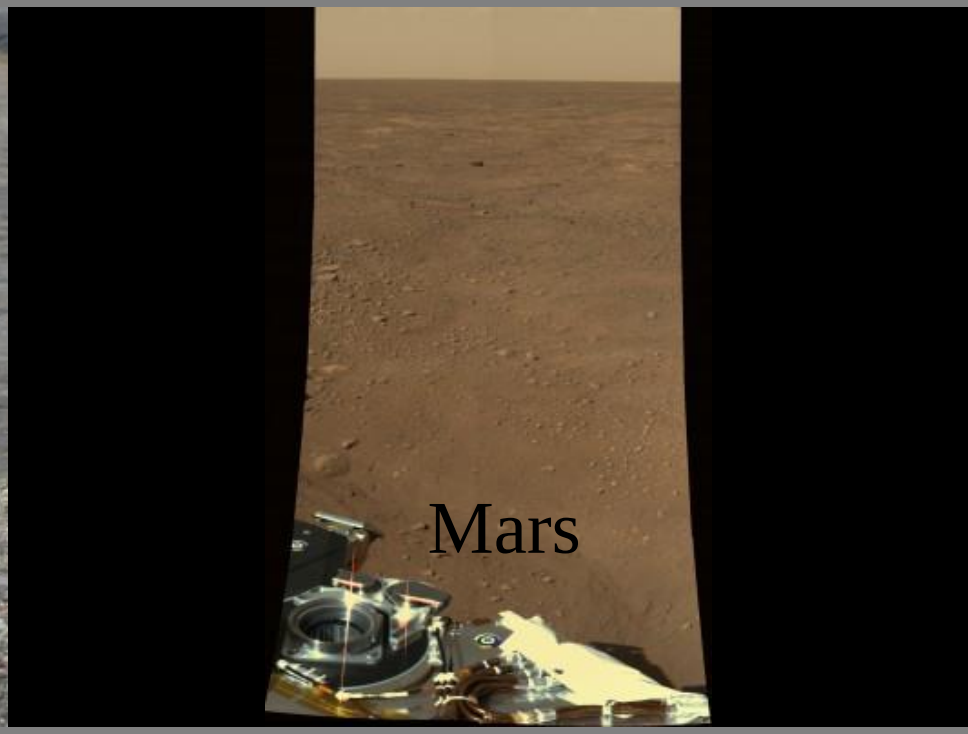
Search for Life on Mars

Phoenix landed Sunday 25 May 2008

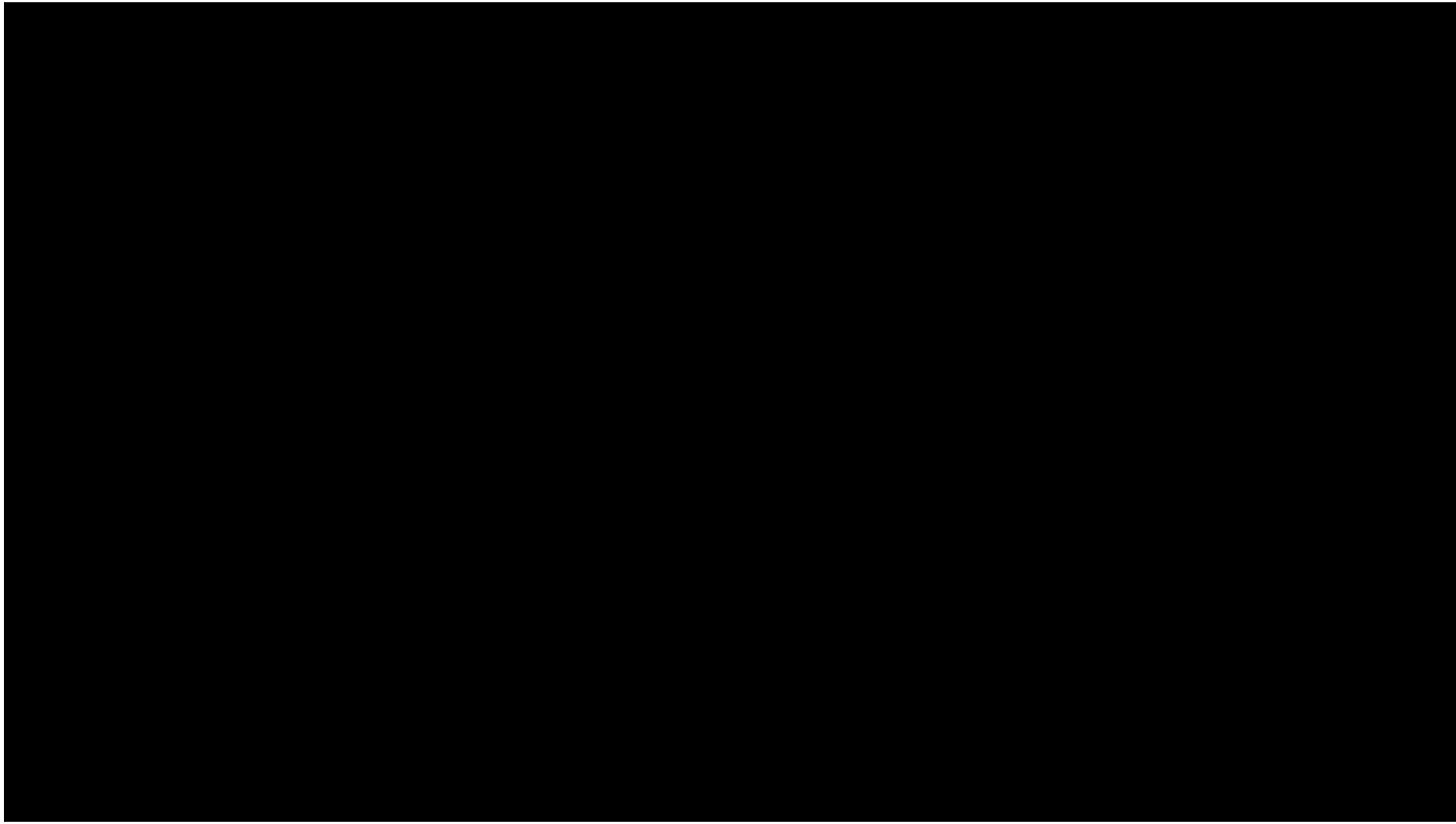


- North polar region of Mars
- Looking for liquid water (essential for life)

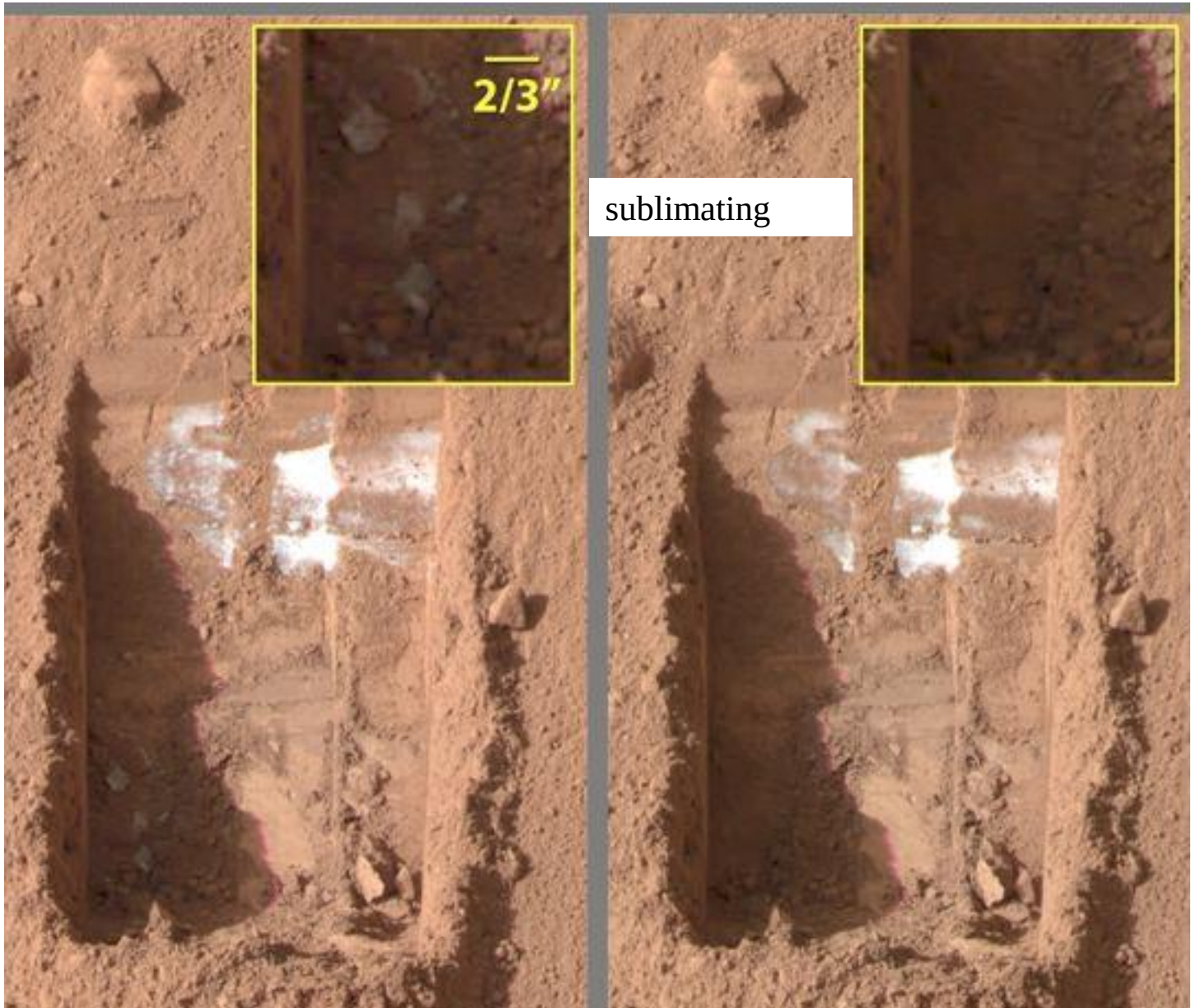
Freeze thaw cycles → Polygon patterns in in polar dry deserts



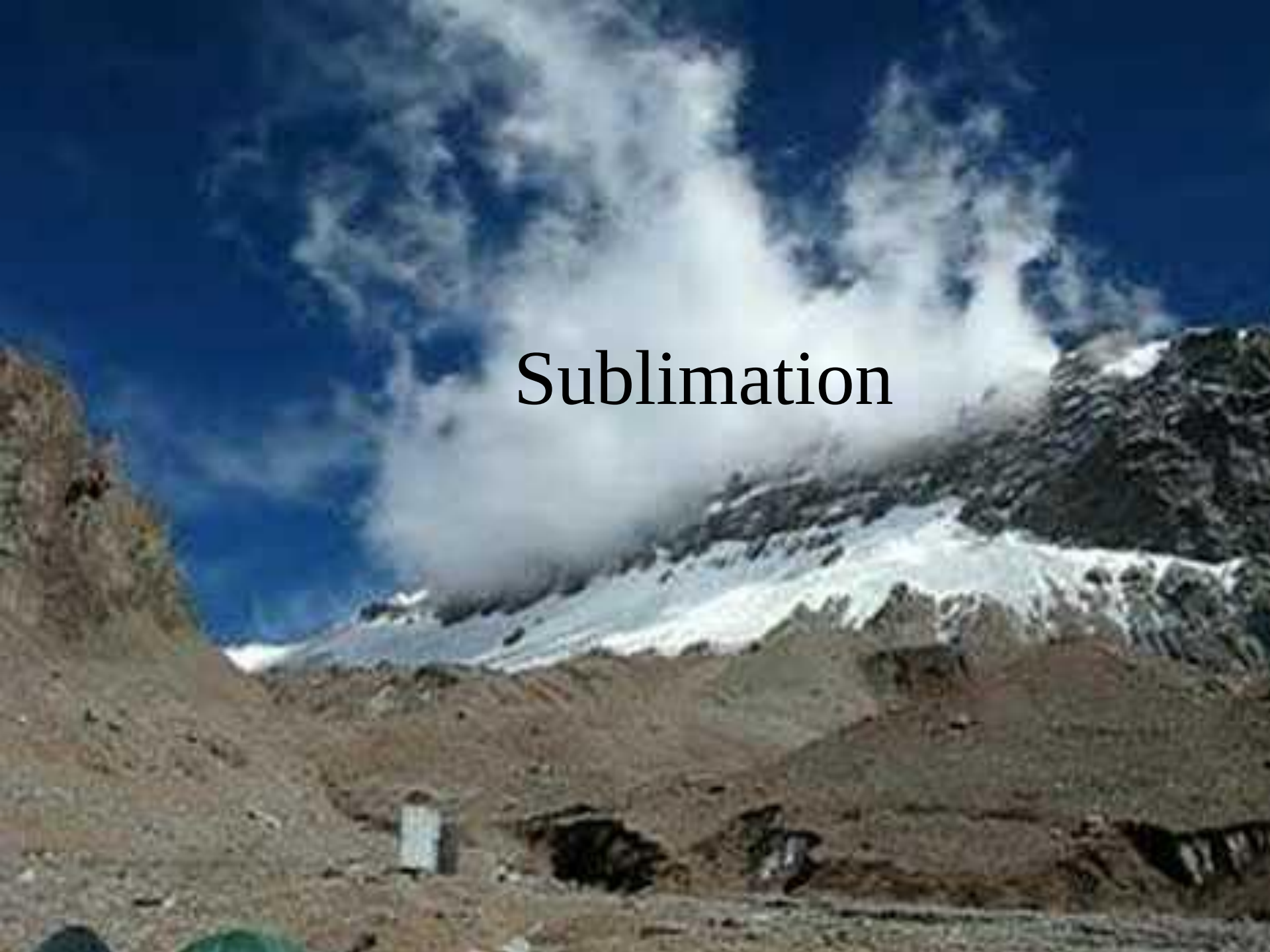
Tribute to Phoenix



How do we know this isn't a white rock?




Evaporation


Sublimation

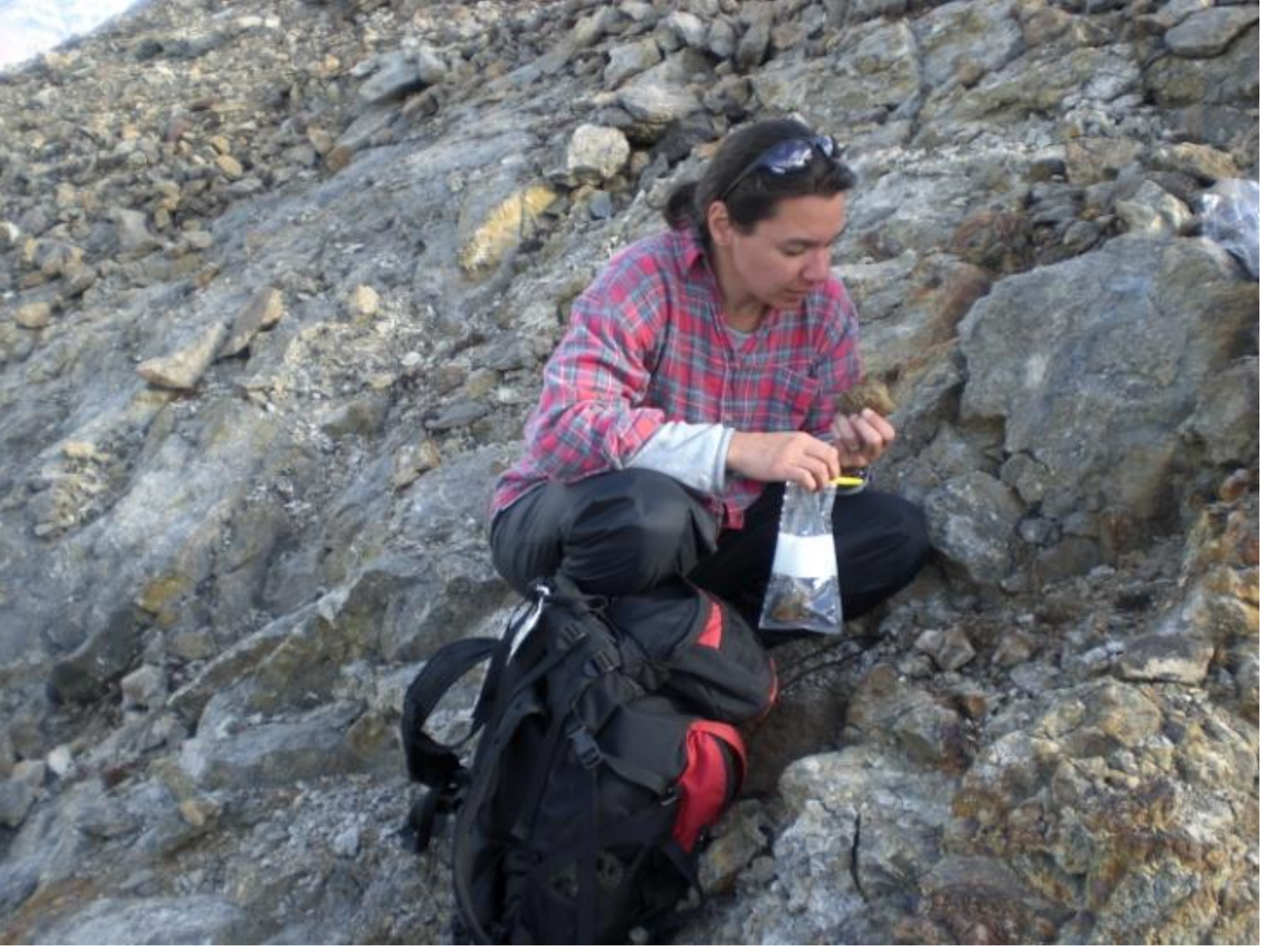
Search for Life

- 1st find water
- 2nd look for building blocks of life
- Ex: Elements like CHNOPS and compounds that make up organisms

Building blocks of life =

- Compounds made of Carbon atoms bound to other atoms
- Ex: carbonates, DNA, proteins and sugars

Collecting microbial fossils at Relic Springs



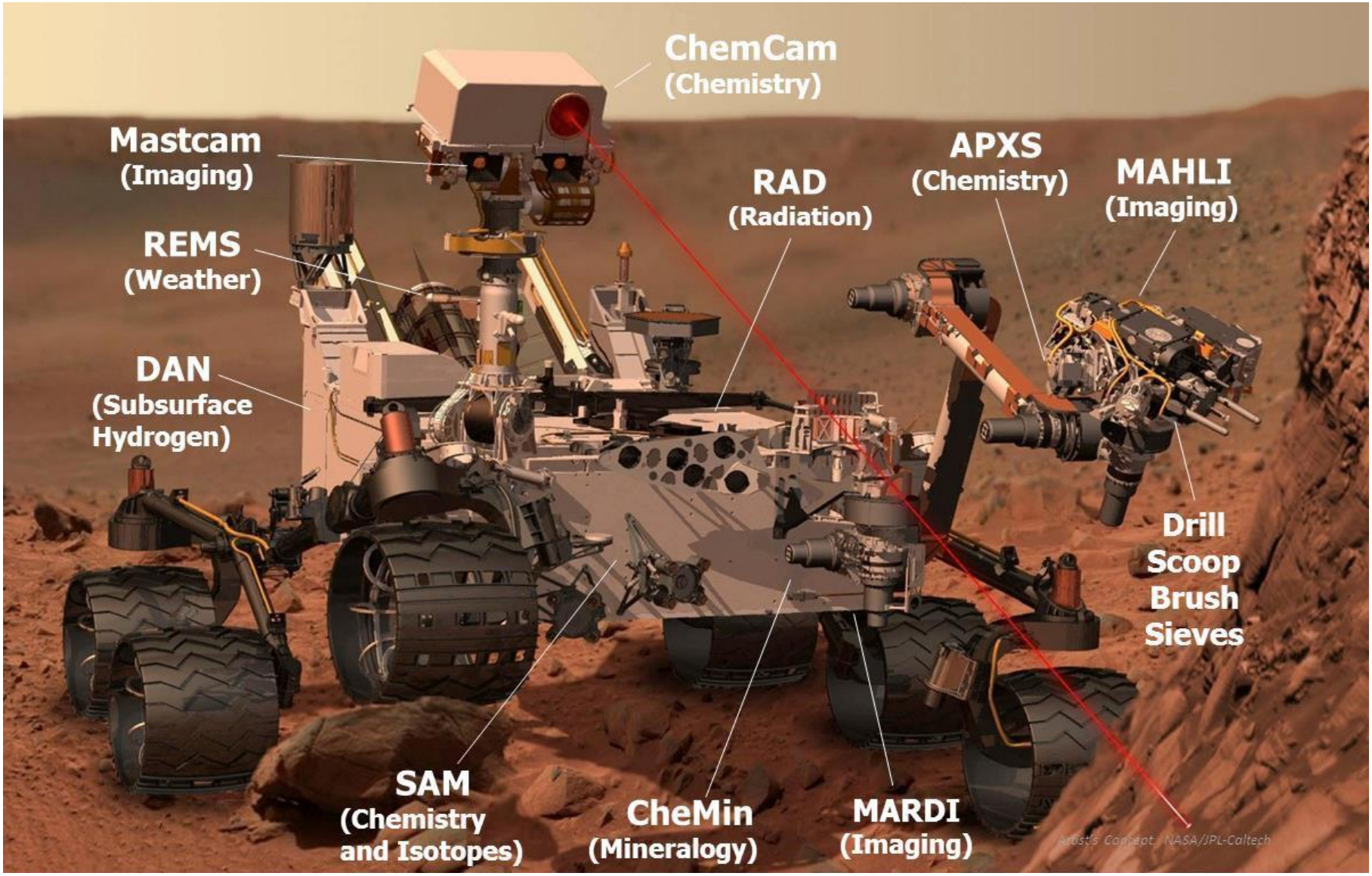
Vinegar test

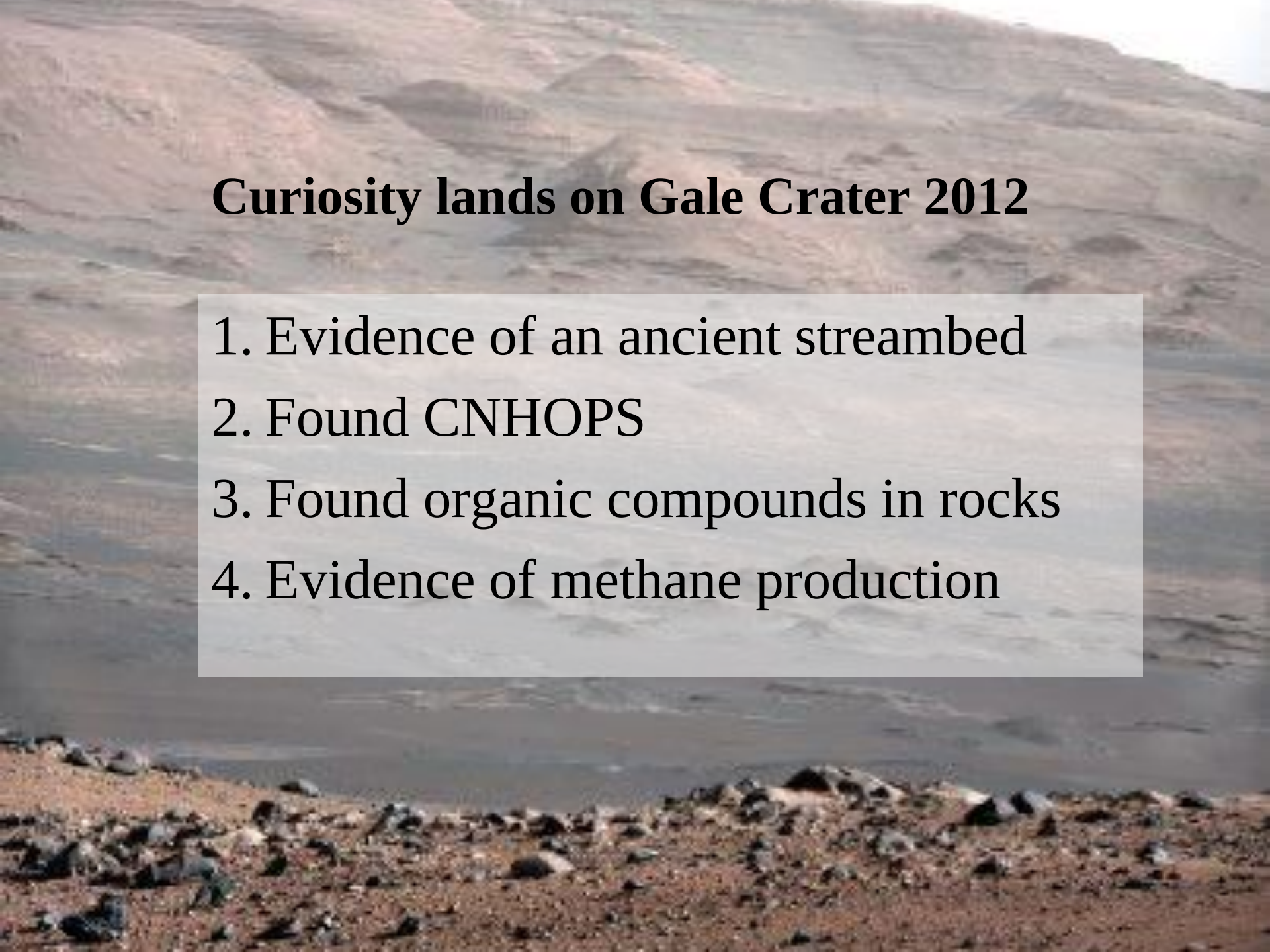
- Drop rock samples into vinegar.
- If gas bubbles form, then the rock contains carbonates (building blocks of life)

Why did we look for carbonates in the rocks?

Max

Curiosity Rover landed in 2012

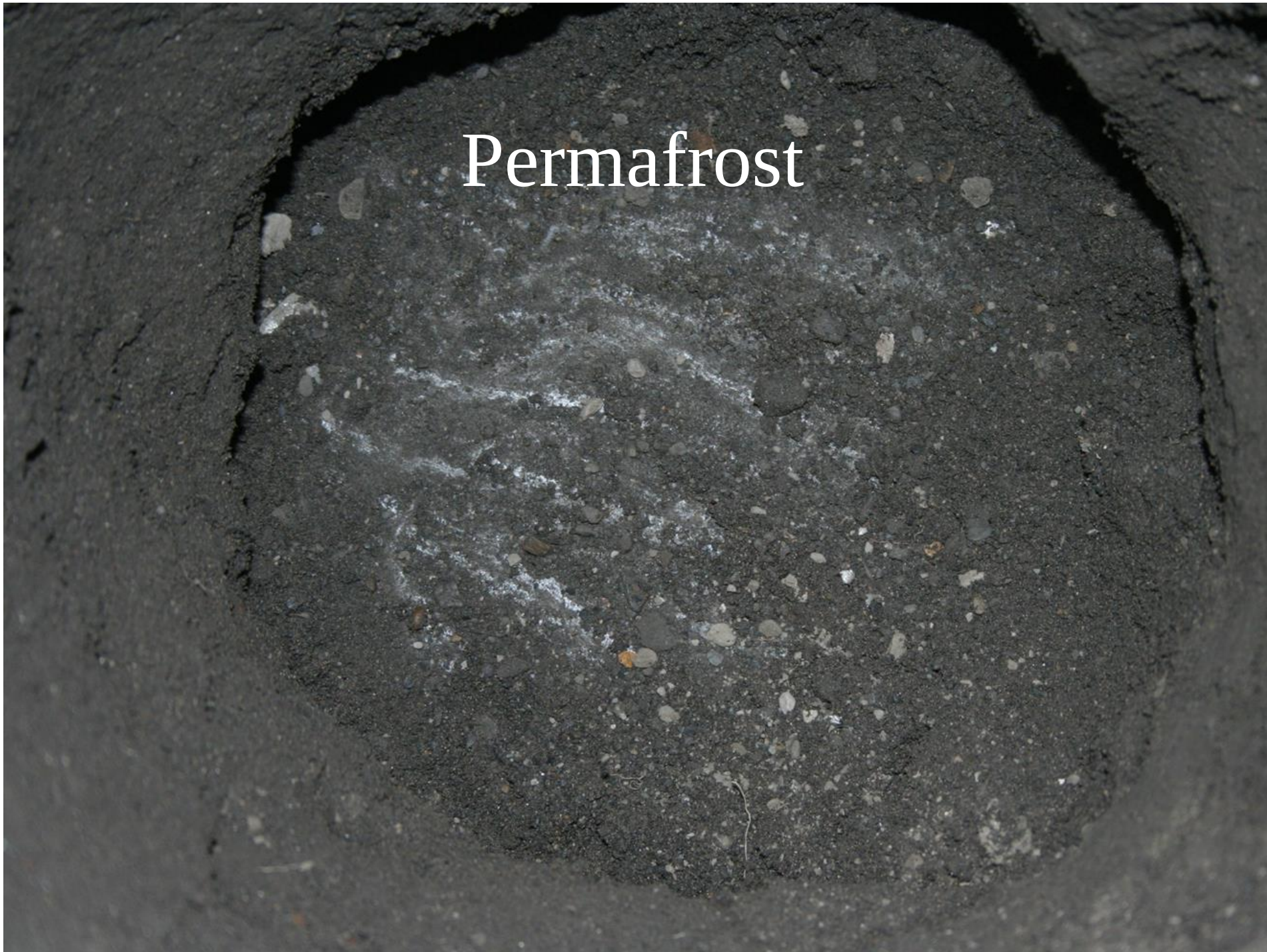




Curiosity lands on Gale Crater 2012

1. Evidence of an ancient streambed
2. Found CNHOPS
3. Found organic compounds in rocks
4. Evidence of methane production

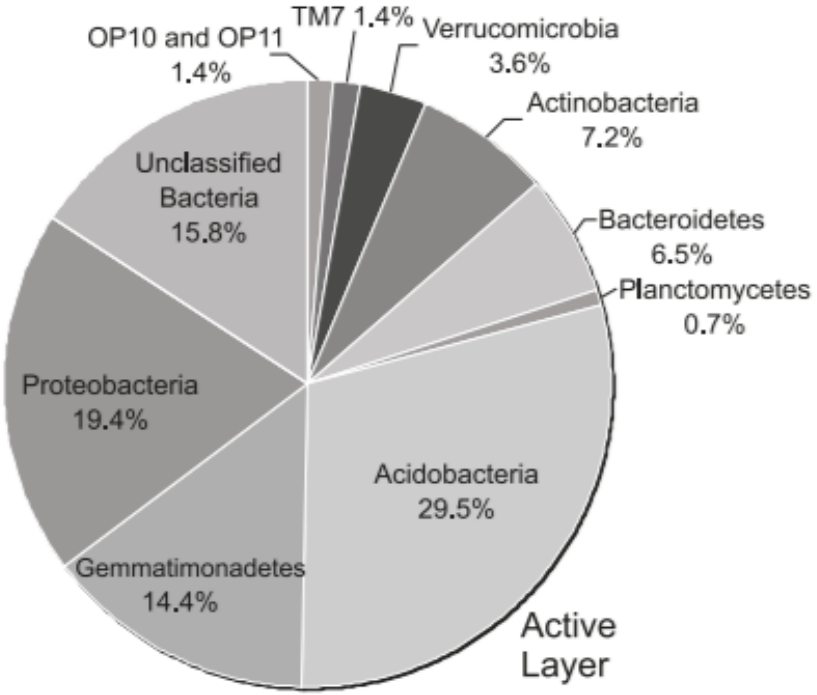
Identifying Life in the Extremes

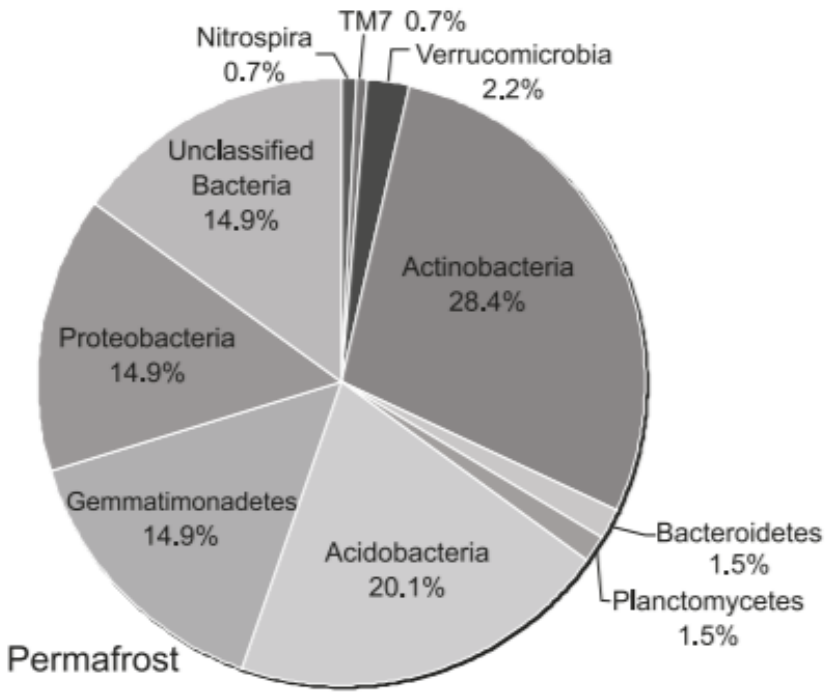

Permafrost

Results

Describe 2 difference between bacteria above and inside permafrost

Fig. 1. Distribution of phyla derived from 16S rRNA bacterial clone sequences in the active layer (left) and permafrost (right), as classified by the Ribosomal Database Project. The percentage corresponds to the total number of sequences in the active layer (n = 139) and permafrost (n = 134).





Above the permafrost

Inside the permafrost

Life in Extreme Cold

http://spacewardboundarctic2008.blogspot.com/

- "*Is there life in Gypsum Springs*" **video questions**
- Why are the rocks grey?
- They're covered in bacteria (biofilms)

- How do sulfur reducing bacteria survive?
- They use sulfur compounds → metabolism

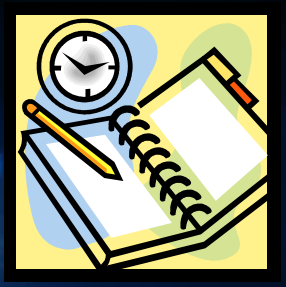
https://www.youtube.com/watch?v=X9vOoXU56KI

KEY IDEA:
Living World Depends on Non-Living World

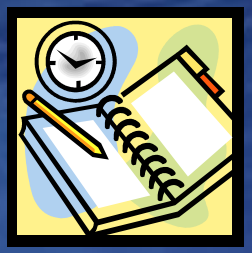
Living things require

1. An Energy Source
2. Liquid Water
3. Raw Materials / Building Blocks

ENERGY



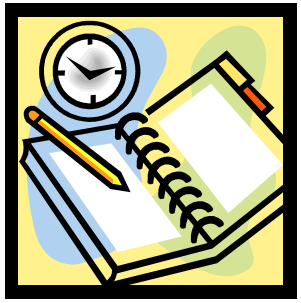
- Producers use light or chemical energy → food
  - (ex: plants)
- Consumers get energy from eating living things
  - (ex: animals and decomposers)



Liquid Water

- Dissolves and moves things
- Helps maintain homeostasis
  - Homeostasis = maintaining balances
    - Balances temperature
    - Balances concentrations of dissolved things

Raw materials



- = nutrients
- Most important elements for life = CHNOPS
  - Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, Sulfur

Habitable worlds in our solar system

- Except for Earth each planet and moon has major limitations
- If life exists on any of our planets or their moons it is most likely small and underground
- Europa, Mars, and Titan may have or have had habitable conditions

Quiz Questions

1. List 3 things needed for life
2. Define metabolism
3. Define each and give an example
   - Producer
   - Consumer
4. list the 6 most important elements for life (write them out - not just the symbols)
5. What is homeostasis?