

MSL SITE SELECTION FOR ASTROBIOLOGICAL SIGNIFICANCE

Group 3

Astrobiological Indicators

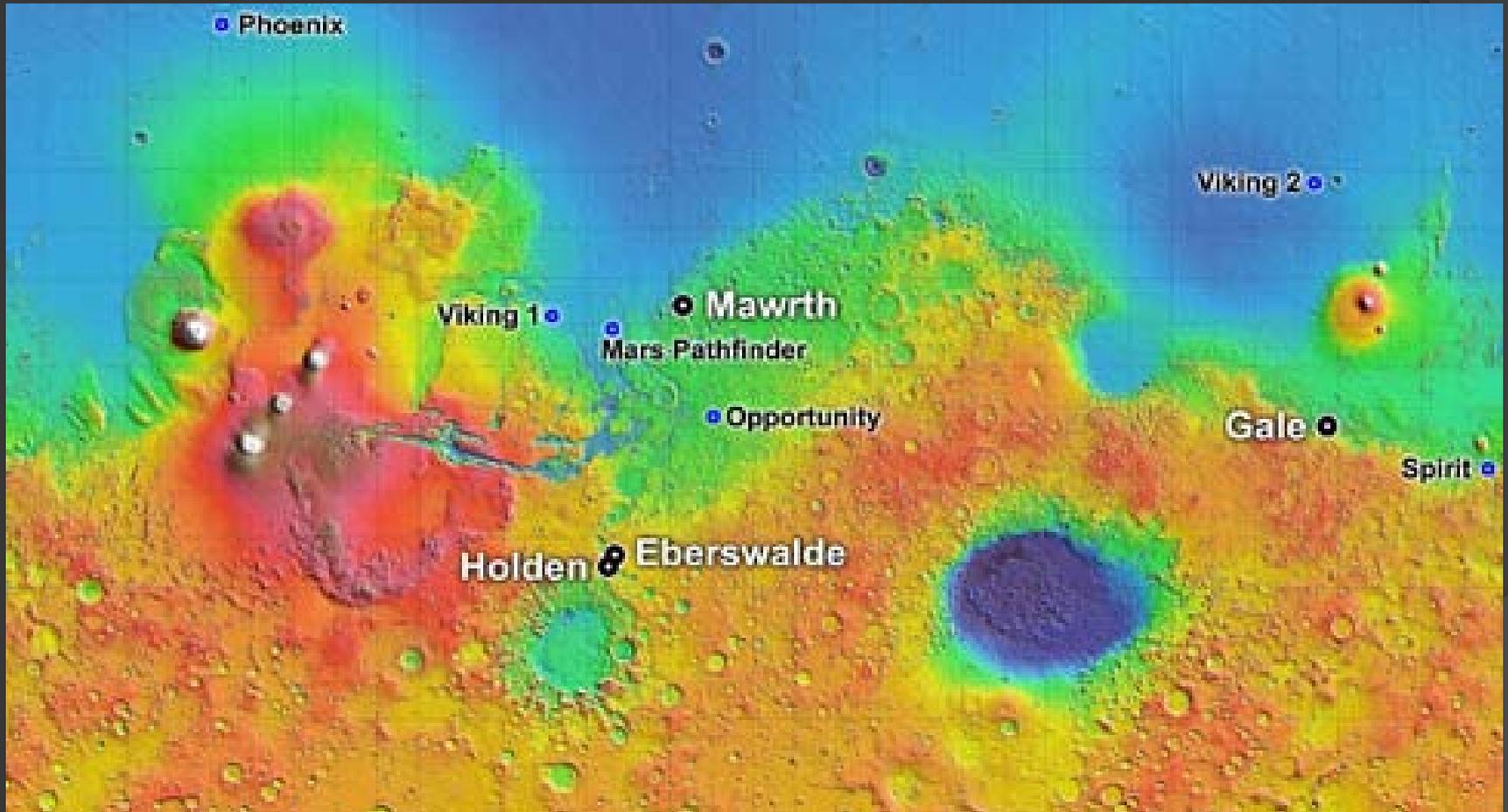
Biological objectives of MSL:

1. Determine the nature and inventory of organic carbon compounds
2. Inventory the chemical building blocks of life (carbon, hydrogen, nitrogen, oxygen, phosphorous, and sulfur)
3. Identify features that may represent the effects of biological processes

How to achieve:

1. Mineralogy: phyllosilicates and clays
2. Diverse mineralogy and geology
3. Water laden environments

Potential Sites



Mawrth Vallis

Diversity:

A period almost unrecorded on Earth

Multiple emplacement processes

May span the Noachian-Hesperian gap

Hydrated minerals:

Strongest spectral signature of clays anywhere on Mars

Majority composition: Phyllosilicates

Preserves both phyllosilicates and sulfates

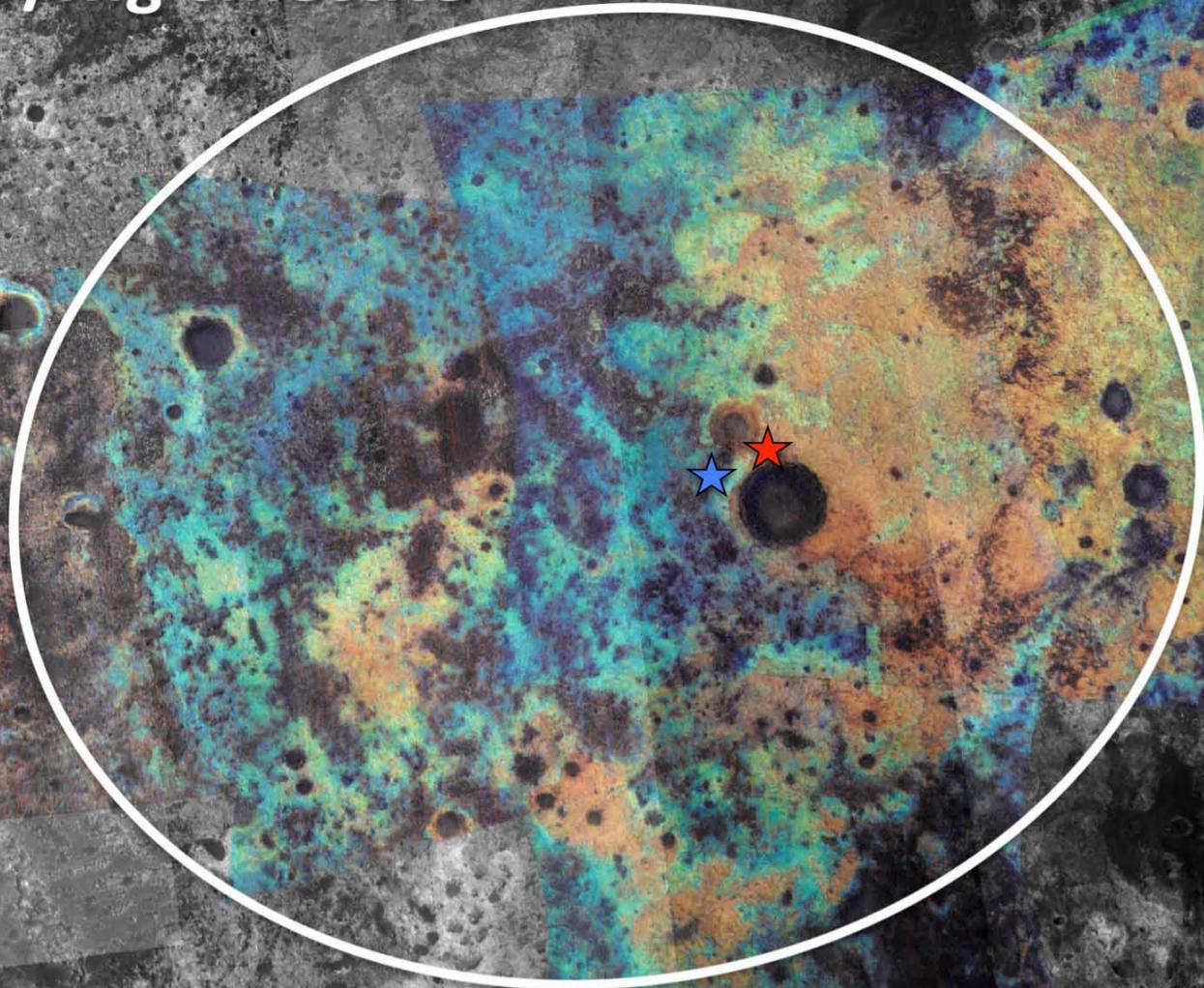
Global context:

Mineralogically representative of Noachian Mars

Captures many detected forms of hydrated minerals

- Al-phyllsilicate/Si-OH
- Fe²⁺ material
- Fe³⁺/Mg-smectite

Example study sites
at Mawrth Vallis



Mawrth represents:

The highest concentration and diversity of hydrated minerals on the Martian surface.

A record of the warmest and wettest portion of Martian history.

Our best chance for understanding the nature of mineral hydration on Mars.

The best preserved example of a potentially widespread habitable environment found only in the Noachian.

Gale Crater

PROS

- Multiple hydrous minerals
- Age range

CONS

- Presence of iron oxides may comprise organic preservation
- Lack of depositional and stratigraphic context for mound
- Source of water uncertain



Holden Crater

PROS

- ⦿ Intense fluvial activity
- ⦿ Fine sediments indicate a long-lived calm lake in the crater
- ⦿ It has some of the best-exposed lake deposits (clays)
- ⦿ Largest alluvial fan
- ⦿ Late Noachian-Late Hesperian
- ⦿ Uzboi Vallis enters it (Noachian): numerous valleys with younger sediments

CONS

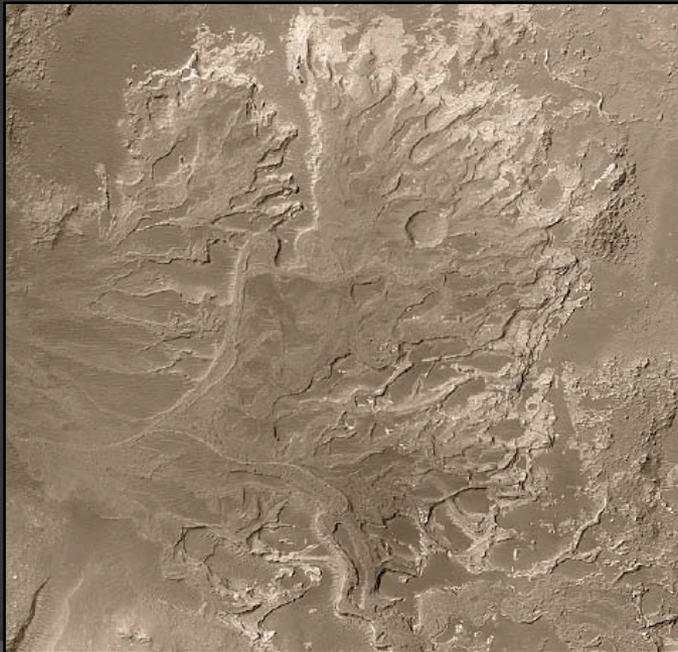
- ⦿ Landing site is around 12 miles far from the deposits.
- ⦿ The environment during which the deposits formed is not well understood arising an uncertainty on its diversity.



Eberswalde

PROS

- Delta system
- Lots of clays



CONS

- One primary geologic feature
- Environment is known
- Limited phyllosilicates
- Iron oxides
- Minimal spectral

Conclusions

- From an astrobiological perspective, the Noachian crust at Mawrth Vallis provides the most probable and greatest diversity in habitat for past life
- Old rocks constrain the conditions of Mars formation, thus its potential for prebiotic chemistry
- Elucidates the missing chapter in Earth history
- High preservation potential of organics in clays
- Advantages of other sites are largely encompassed by Mawrth Vallis