A Glimpse into the Past: Yardangs on Mars

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Presentation Outline

• Background
  – Gale Crater
  – Medusae Fossae Formation (MFF)

• What do we already know?
  – What is a yardang?

• What questions have yet to be answered?
  – Gale and the surrounding region
Curiosity Rover @MarsCuriosity · Feb 6
I'm over the moon that I'm over the dune! I successfully crossed the "Dingo Gap" sand dune on Mars.
Candidate Landing Sites
Overall MSL science goal:
Assess a region of the Martian surface that could serve as a potential habitat for life, whether past or present
UM – upper mound, younger
LM – lower mound, older
What is a yardang?

- undercut by wind abrasion
- direction of prevailing wind
- less-resistant rock
- trough

Qaidam Basin, China, Earth
Yardangs in Gale Crater
How do yardangs in Gale Crater relate to those in the Medusae Fossae Formation (MFF)?
Yardangs Inside Gale Crater

(lower mound, older)
Yardangs Inside Gale Crater

(*upper mound, younger*)
Yardangs in the MFF

HiRISE: ESP_028717_1795
Implications and Contributions

Potential correlation between Gale & MFF sediment erosion histories!
Why should we care about yardangs?
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QUESTIONS?
References

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• Bridges et al. (2007) *GRL*, 34, L23205
• *Edgett, K. S. 4th MSL Landing Site Workshop*, 27–29 September 2010
• Goudie (2007) *Geography Compass*, 1/1, 65-81
• Milliken et al. (2010) *GRL*, 37, L040201
• Thomson et al. (2011) *Icarus*, 214, 413-432
BACK UP SLIDES
Milliken et al. 2010, GRL
Figure 4. Interpreted stratigraphic column for a section of the Gale Crater mound. Where marked, bed thicknesses are measured from HiRISE DTMs. Mineralogical interpretations are based on CRISM data, though not all individual beds observed in HiRISE images are resolved in CRISM images. A group of thin (<7 m) recessive beds in the lower member contains clays (green), whereas the middle member exhibits sulfate and very weak clay signatures (orange). Sulfate-bearing beds (blue) are generally thicker than clay-bearing beds and are found throughout the upper member. Gray and white beds in the morphology column are qualitative indicators of general changes in albedo.

Milliken et al. 2010, GRL
Thomson et al., 2011 yardang units = Immr2, ume1-4, umle, Immr2
Pyroclastic Eruptions

Mayon Volcano, Philippines (September 1984)

Source: USGS
Additional MSL Science Goal

Information

The MSL mission has four primary science objectives to meet the overall habitability assessment goal:

• The first is to assess the biological potential of at least one target environment by determining the nature and inventory of organic carbon compounds, searching for the chemical building blocks of life, and identifying features that may record the actions of biologically relevant processes.

• The second objective is to characterize the geology of the landing region at all appropriate spatial scales by investigating the chemical, isotopic, and mineralogical composition of surface and near-surface materials, and interpreting the processes that have formed rocks and soils.

• The third objective is to investigate planetary processes of relevance to past habitability (including the role of water) by assessing the long timescale atmospheric evolution and determining the present state, distribution, and cycling of water and carbon dioxide.

• The fourth objective is to characterize the broad spectrum of surface radiation, including galactic cosmic radiation, solar proton events, and secondary neutrons.
Mars Geologic Time Scale

Arrows represent age of Gale Crater