Habitability of a Large Ghost Crater in Chryse Planitia, Mars

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HABITABILITY CRITERIA

**Long-Lived H₂O**
- Run-off or upwelling sources
- Container (basin or lake) to trap

**Liquid H₂O**
- Early Mars
- Enhanced heat flow
  - Regional (e.g. Tharsis)
  - Hydrothermal vents
  - Impact-related hydrothermal circulation - craters > 100 km

**Renewing Nutrients**
- Run-off -- catchment
- Upwelling (groundwater / hydrothermal)

GEOLOGIC CONTEXT

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GEOLOGIC CONTEXT: Drainage - Upwelling

Catchment
- Estimated from valley networks (channels from Carr; USGS MarsGIS)

Global Hydrology

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GEOLOGIC CONTEXT - Setting of Ghost Crater

CRATER
120 km diameter; 34°N, 37°W
Subdued
("ghost"/"stealth")
Noachian - Late Hesperian
(~Early Hesperian)

OUTFLOW CHANNELS
• Late Hesperian

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GEOLOGIC CONTEXT - Setting of Ghost Crater

MOUNDS
> 18,000 mapped
40,000 estimated


GEOLOGIC CONTEXT - Setting of Ghost Crater

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Chryse-Acidalia Mounds: Mud Volcano Analog

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Geologic Units

Vastitas Borealis
(Kreslavsky & Head, 2002; Tanaka et al., 2005)

- Late Hesperian/Early Amazonian - product of outflows
- Polygons, mounds, ghost craters - modification
- Outer margins constant elevation - groundwater table - or -
  emplacement in a standing body of water

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Proximal
Coarse-grained sediments

Distal
Fine-grained sediments; organic matter

FACIES

Elevation
> -1800 m
< -4850 m

Legend
mola_mud_volcanos
megt90n000eb.tif
Value
High : -1800
Low : -4850
mola_128deg_270e_hillshade.jp2
Value
High : 210
Low : 115
mola_128deg_090e_hillshade.jp2
Value
High : 255
Low : 0

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**GHOST CRATER**

**RIM:** Large knobs, irregularly shaped, lobate - possible hydrothermal circulation from impact

**INTERIOR:** ~1000’s m fill with giant polygons & smaller, circular mounds

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CRATER FILL

GIANT POLYGONS: 1-10 km

MOUNDS:
- 0.25-0.8 km diameter
- pitted
- central vents
- circular
- high albedo
- moats
- concentric form to crest
- possible flow structures

Similar to mounds in Acidalia.
Mud volcano analog.

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MOUNDS: Possible flow structures, concentric shape, younger than polygons

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Mud Volcanism

Mud volcanism creates microhabitats in the subsurface:

- fracturing sediments
- providing pathways for fluid migration

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CONCLUSION - High Potential for Habitability

WHY EXCEPTIONAL? Combination of LARGE SIZE and LOCATION (lowlands, outflows, distal facies)

HIGH EXPLORATION POTENTIAL
- Enhanced habitability
- Potential to include organics
- Potential of mud volcanoes to bring sediments from depth to the surface

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