



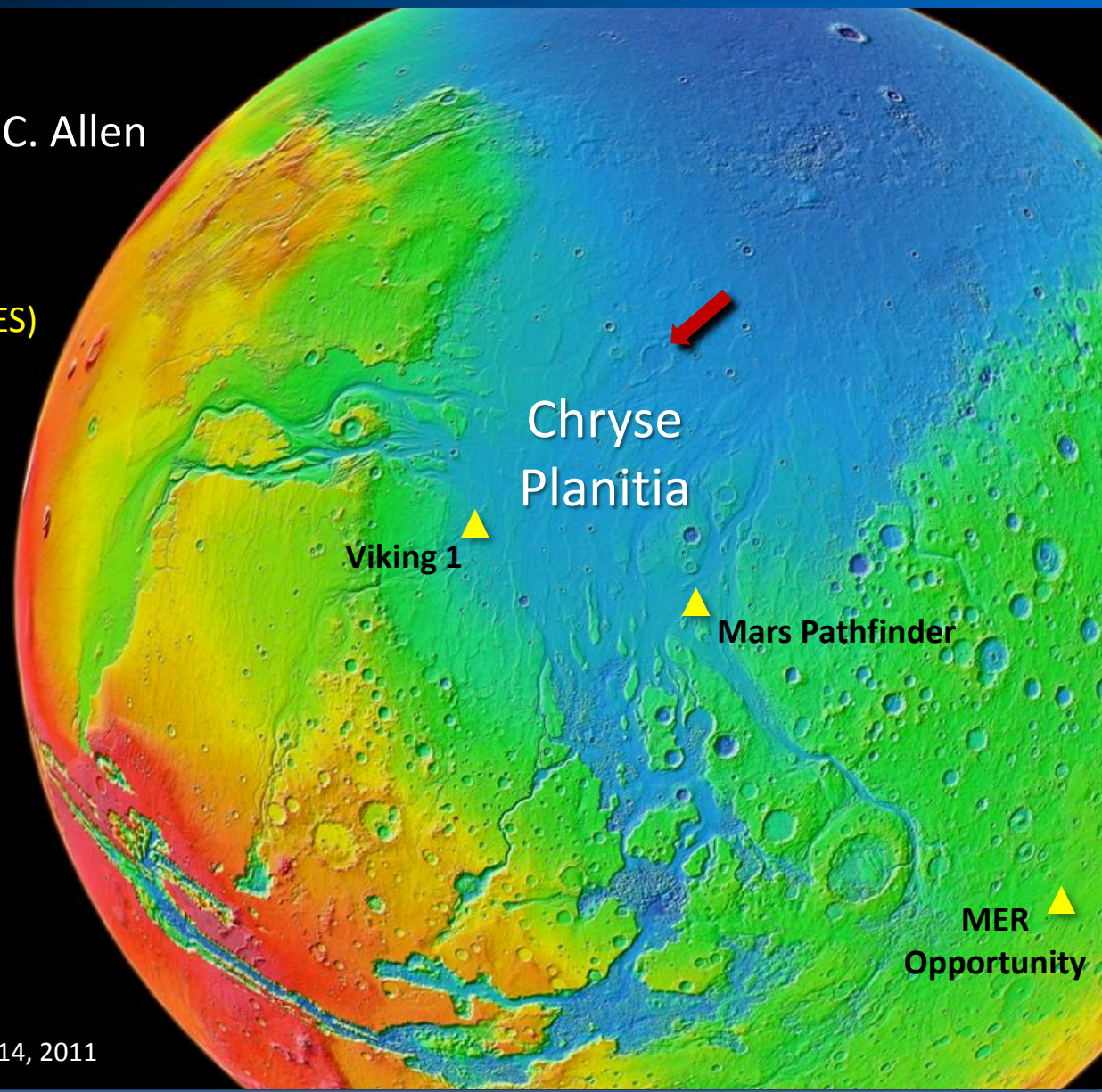
Habitability of a Large Ghost Crater in Chryse Planitia, Mars

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HABITABILITY - GEOLOGIC CONTEXT

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

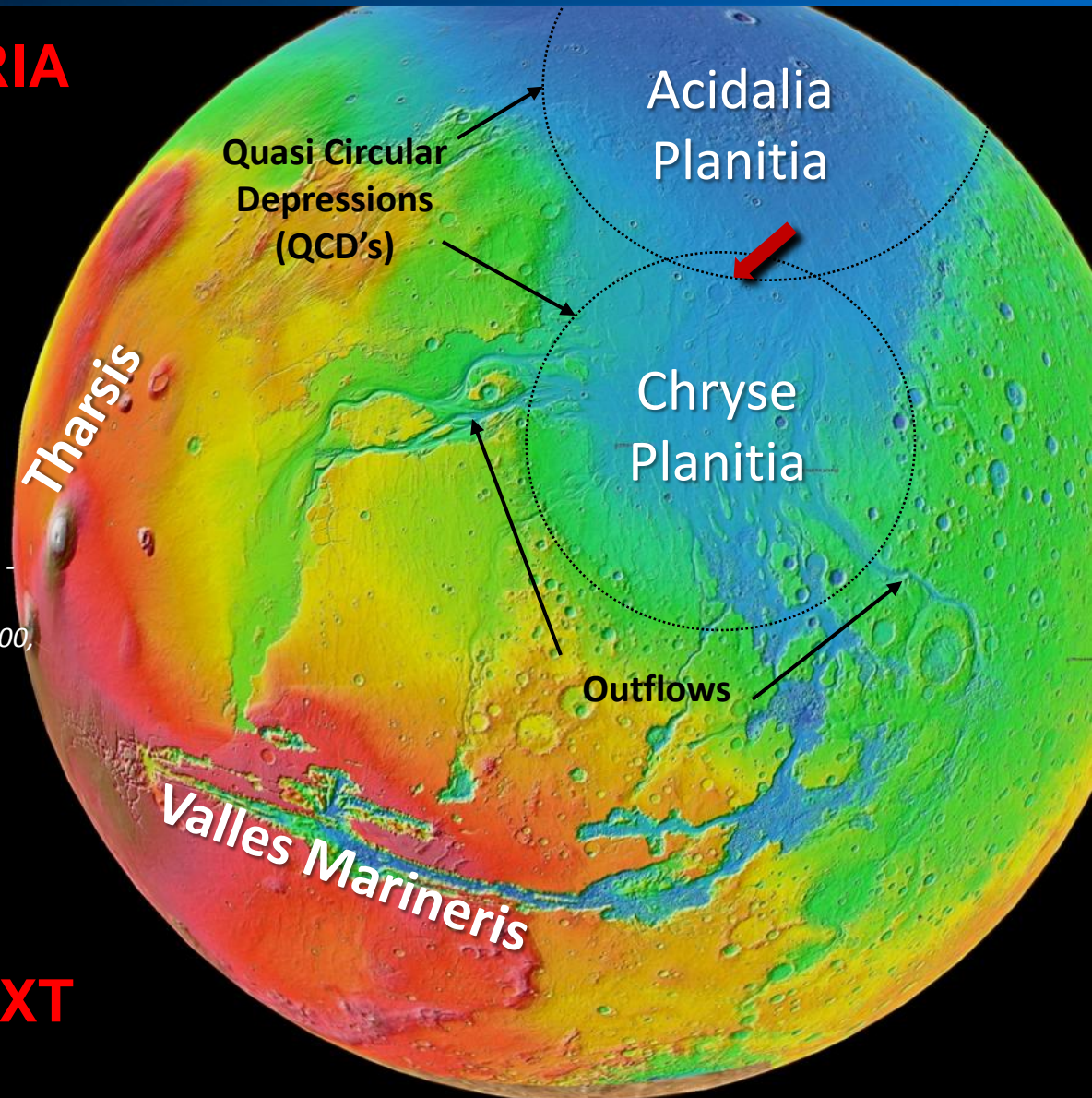
*Impact-related hydrothermal circulation -
craters > 100 km*

*(Newsom et al. 2001; Pope et al. 2000,
2006; Abramov & Kring 2005;
Schwenzer et al. 2009; Ivanov &
Pierazzo 2011)*

Renewing Nutrients

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

GEOLOGIC CONTEXT

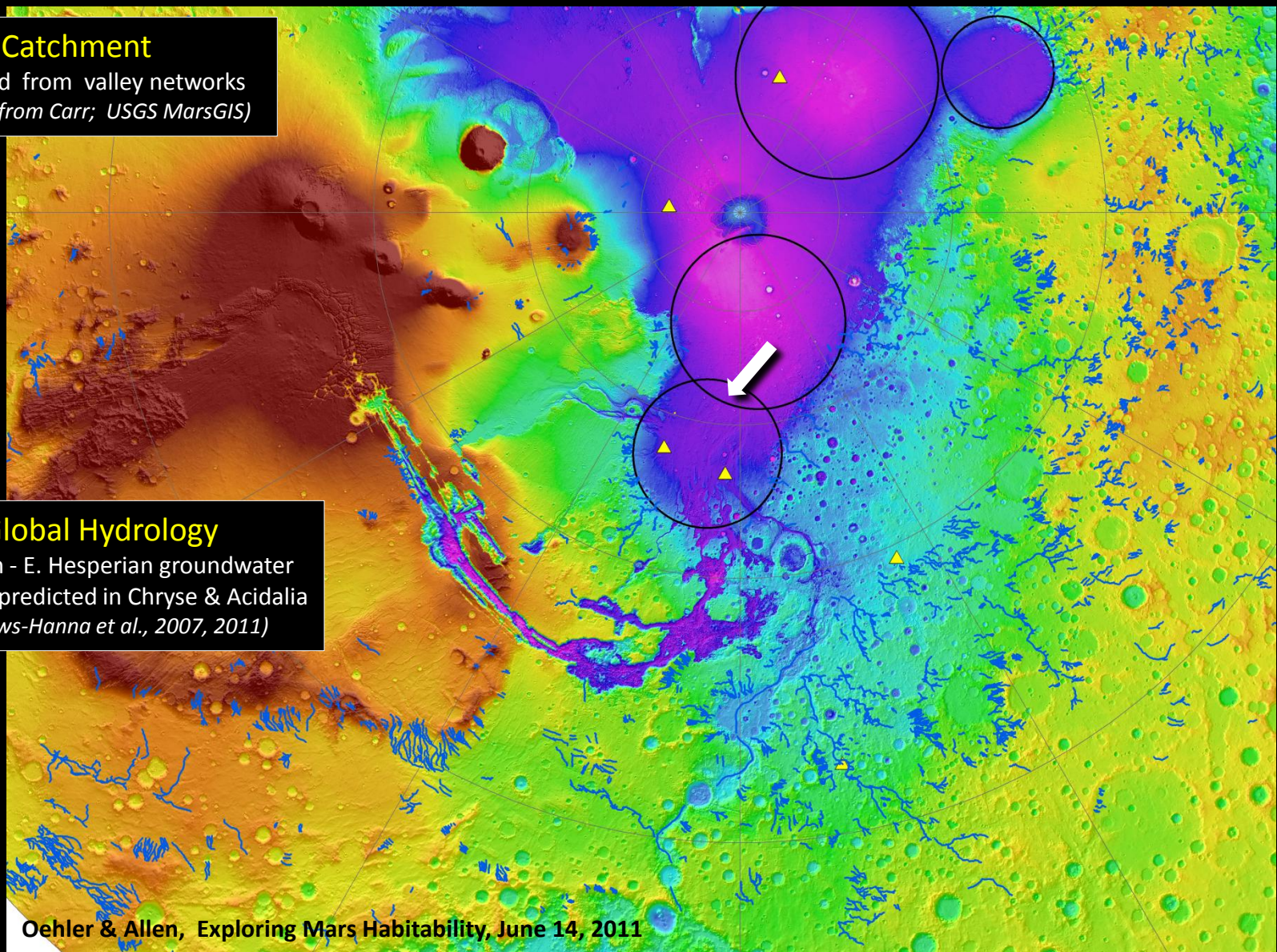




GEOLOGIC CONTEXT: Drainage - Upwelling

Catchment

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

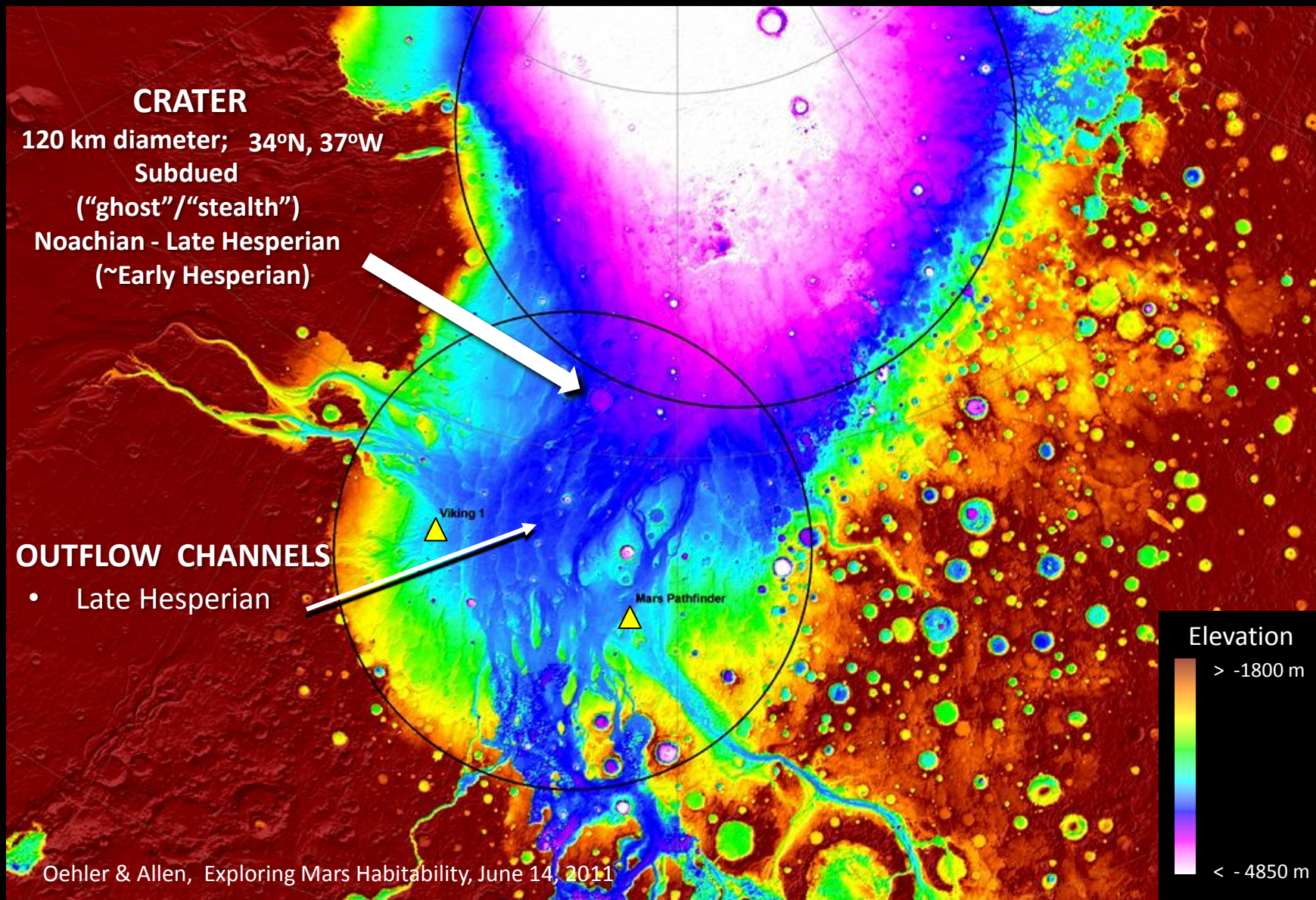


Global Hydrology

Noachian - E. Hesperian groundwater
upwelling predicted in Chryse & Acidalia
(Andrews-Hanna et al., 2007, 2011)

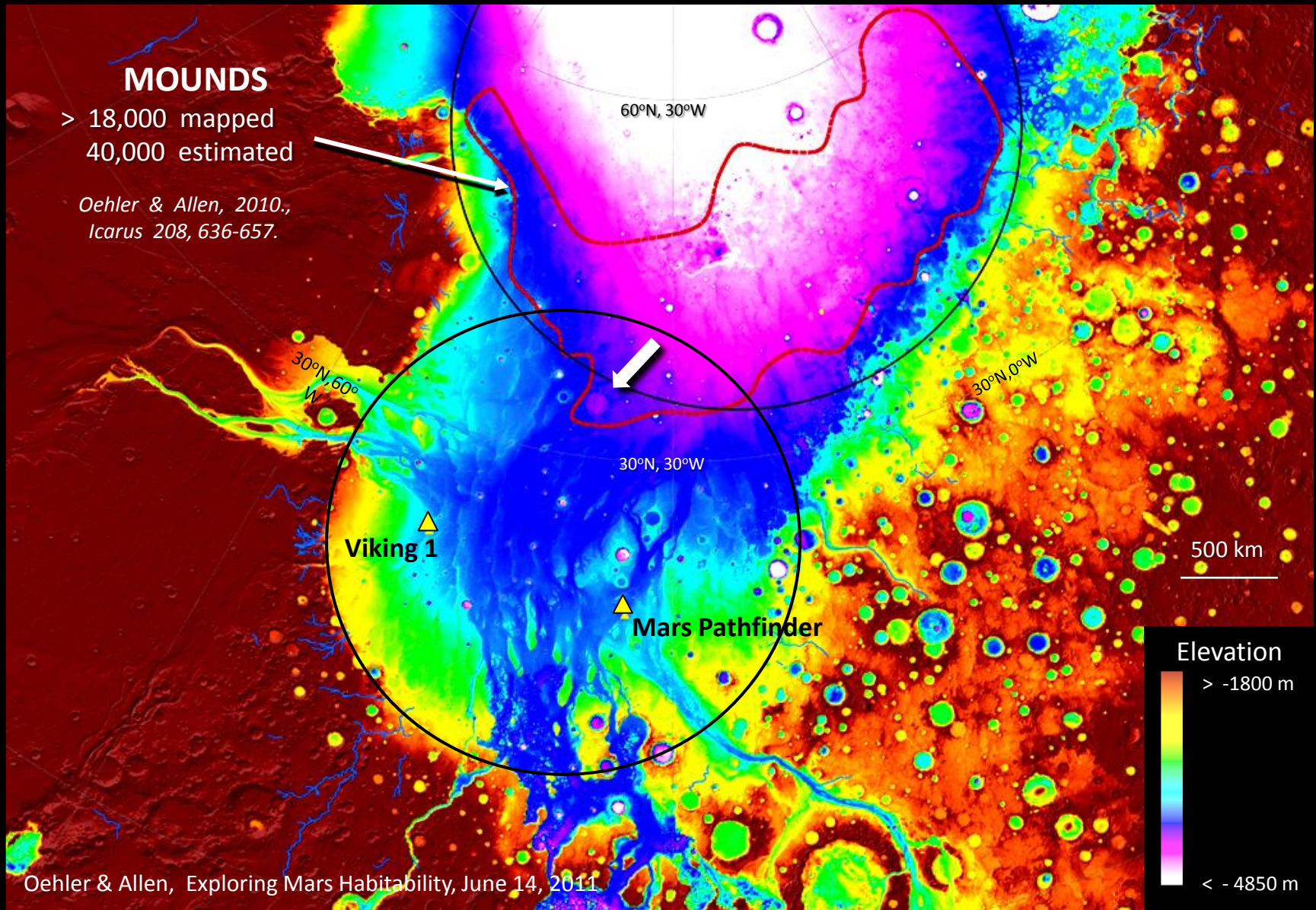


GEOLOGIC CONTEXT - Setting of Ghost Crater



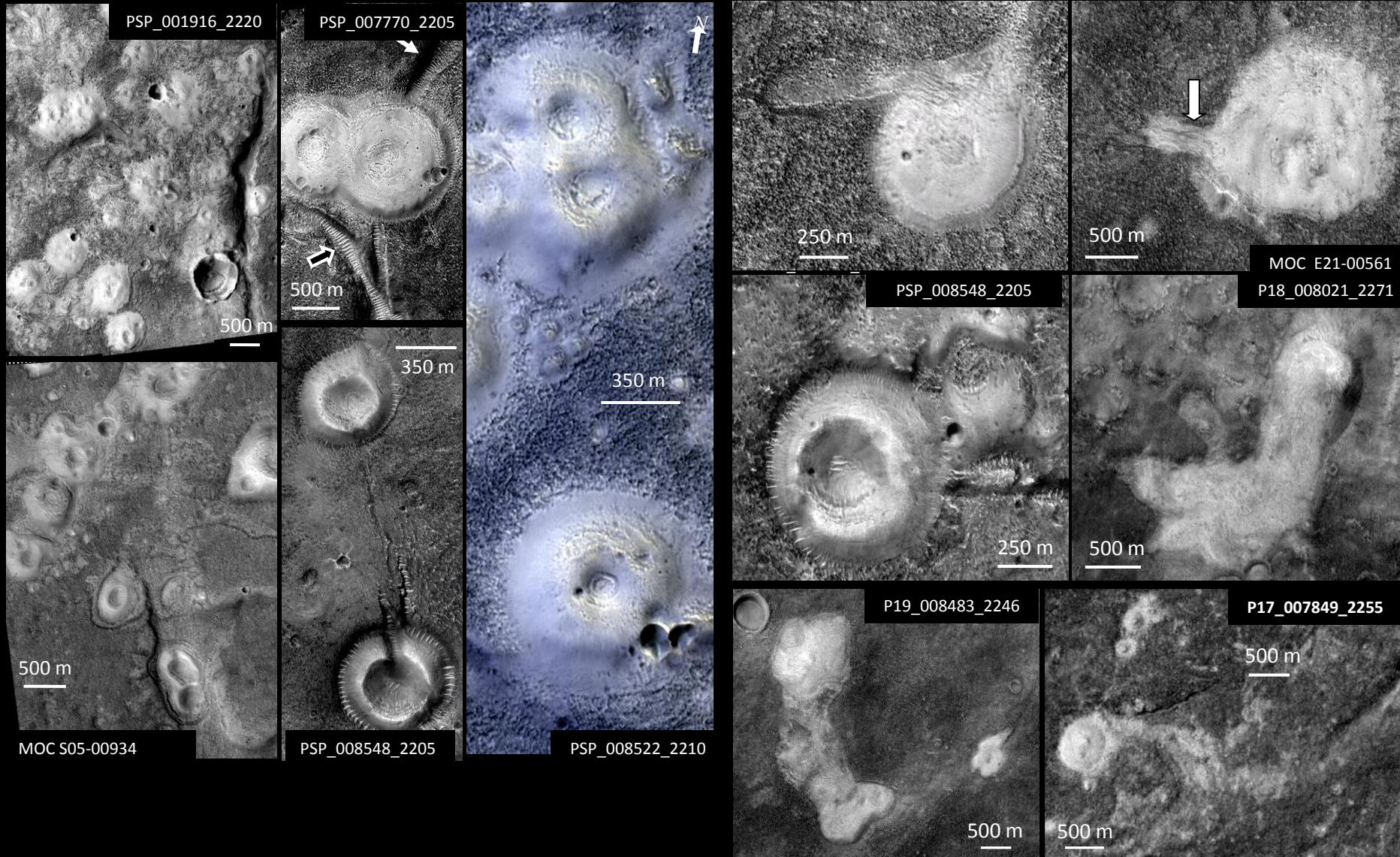


GEOLOGIC CONTEXT - Setting of Ghost Crater





Chryse-Acidalia Mounds: Mud Volcano Analog

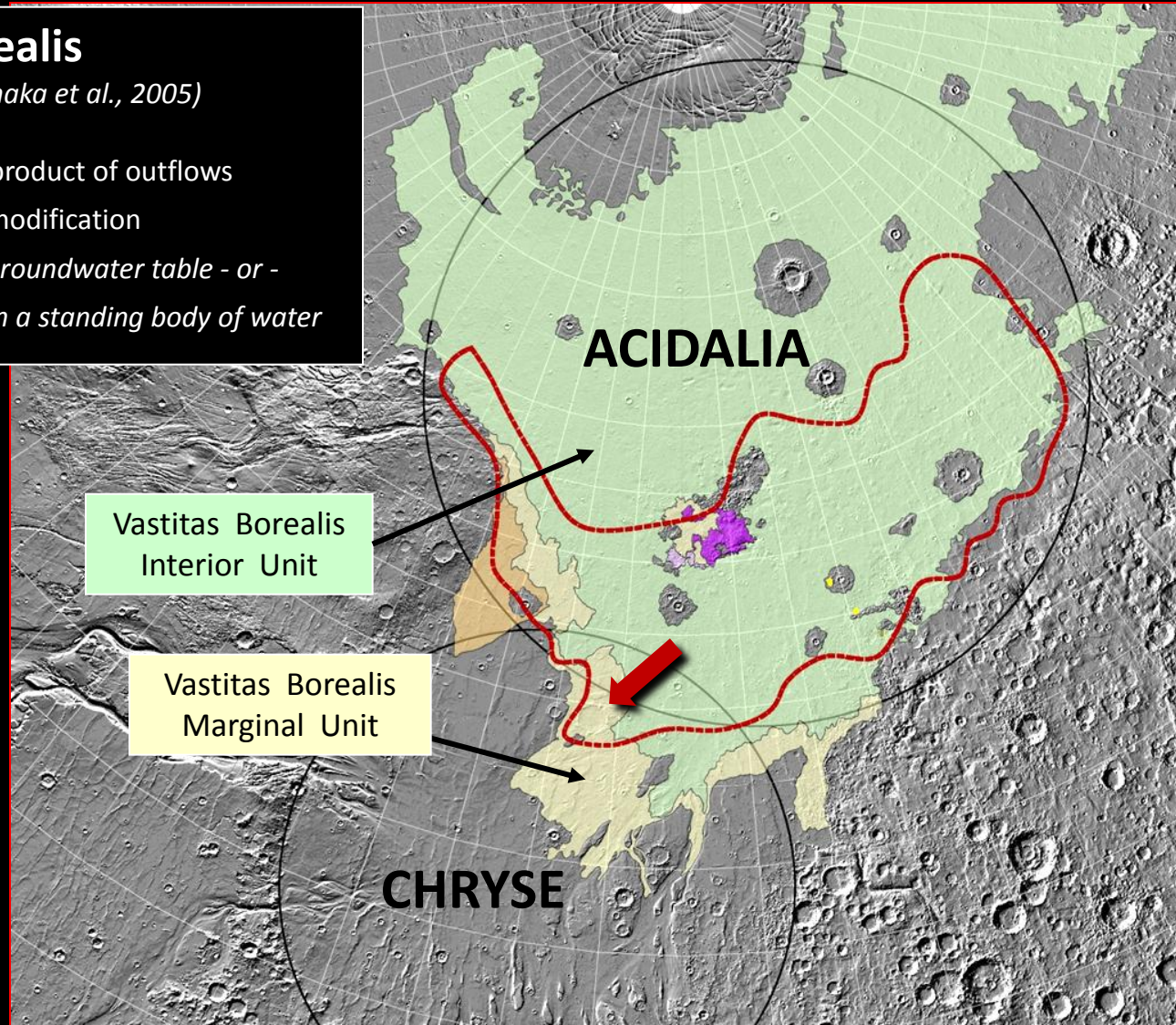


Geologic Units

Vastitas Borealis

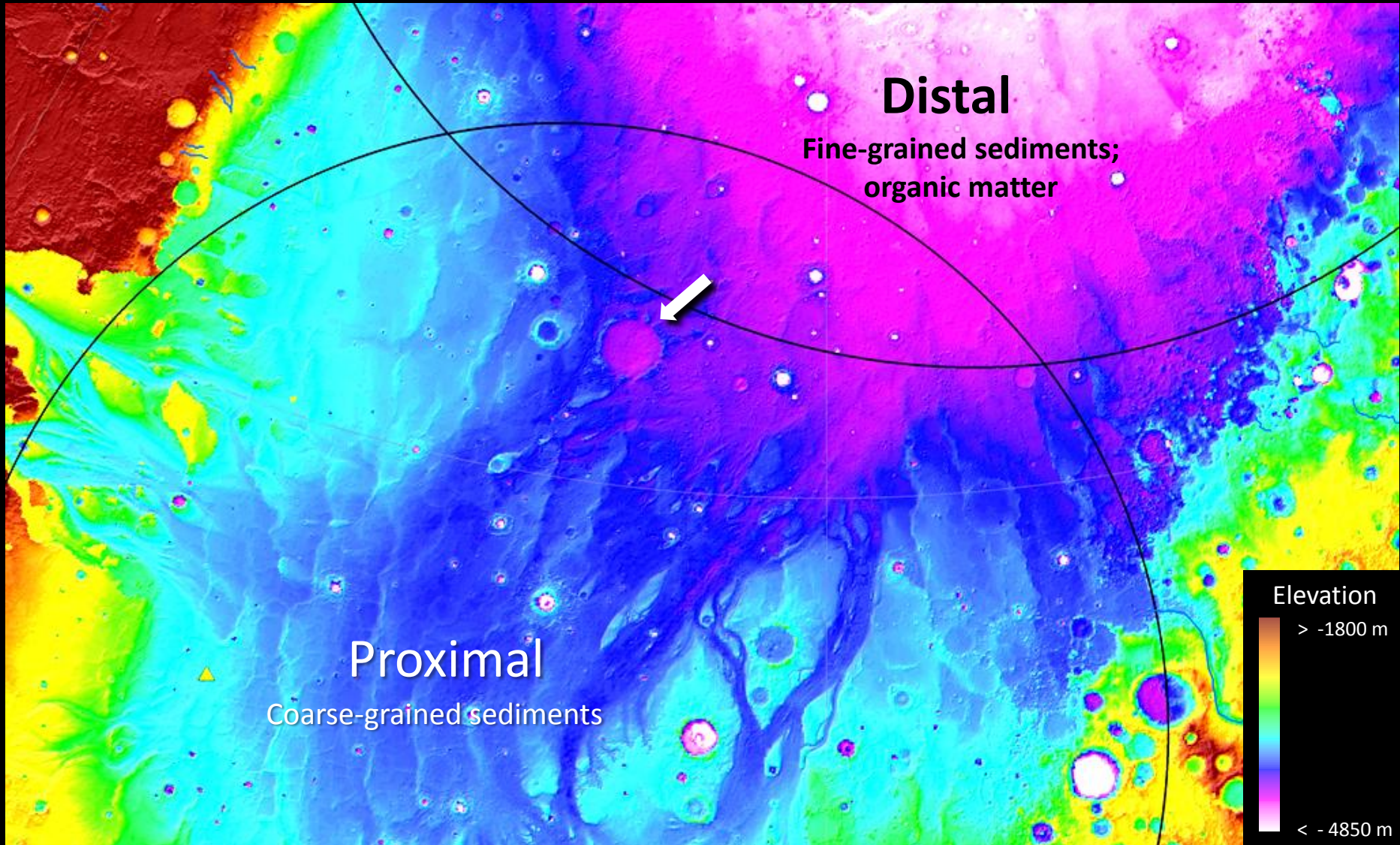
(Kreslavsky & Head, 2002; Tanaka et al., 2005)

- 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*





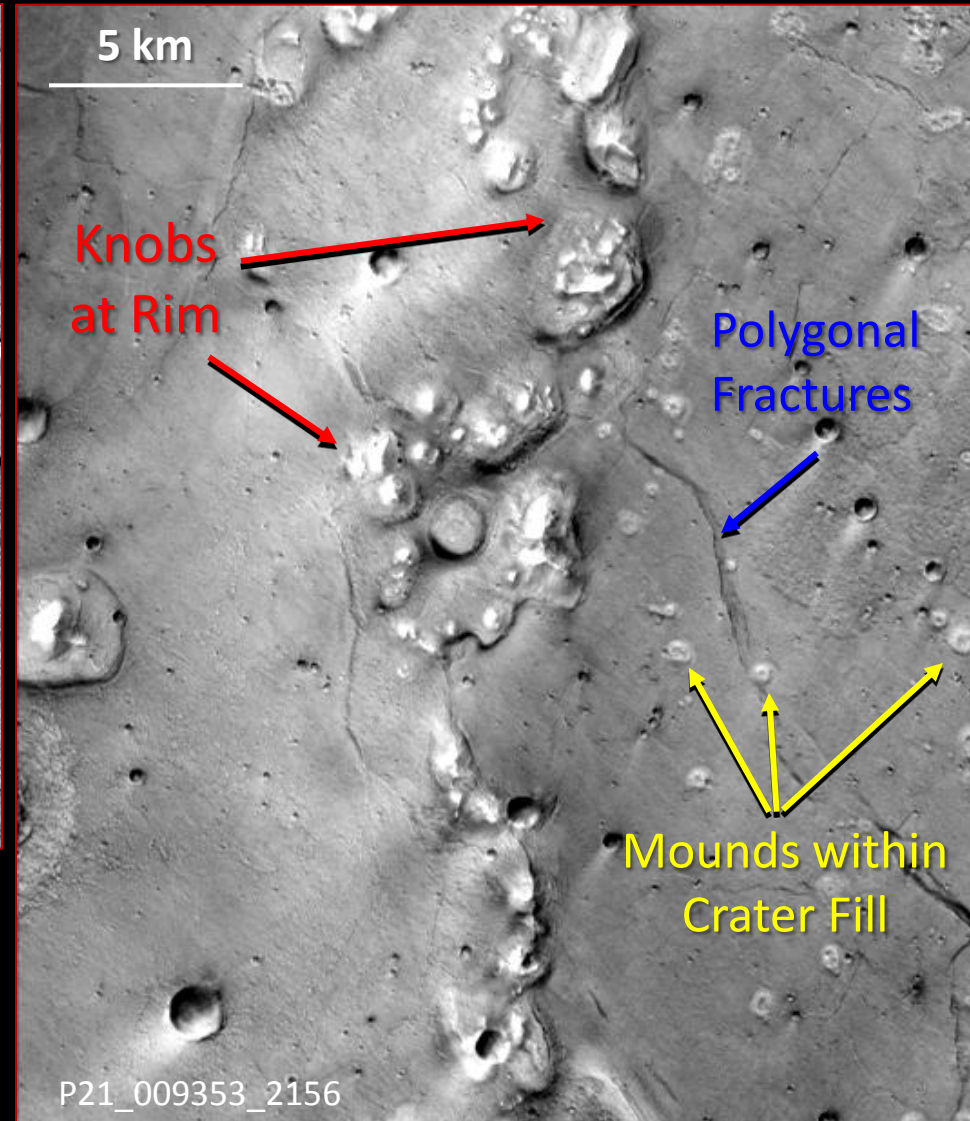
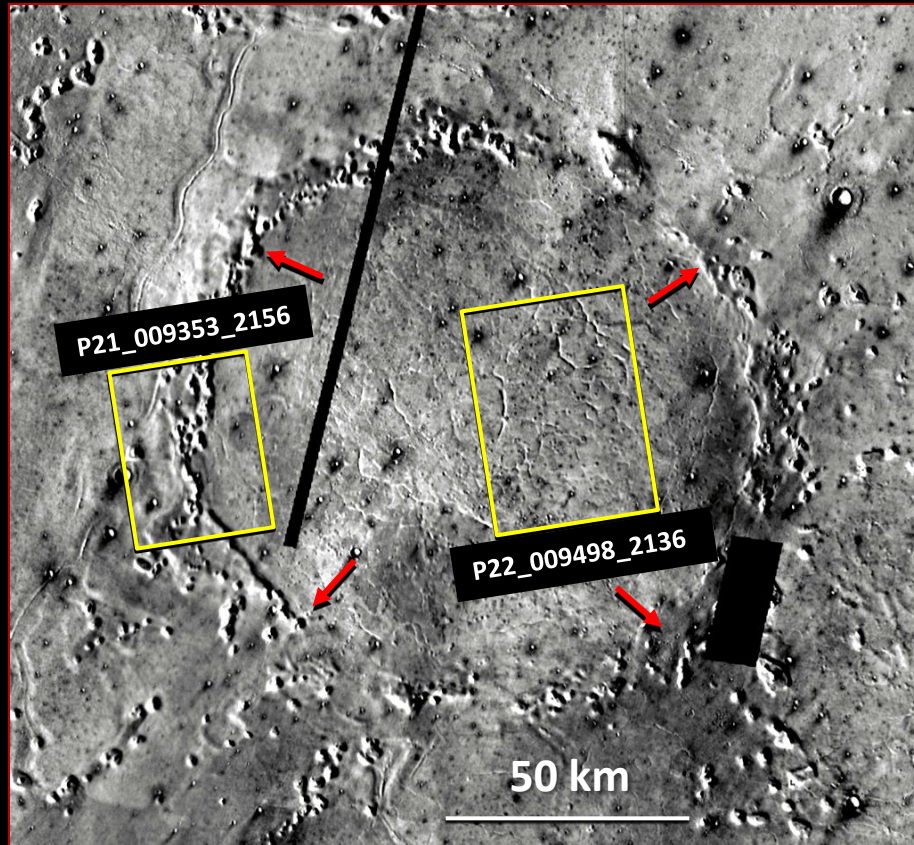
FACIES



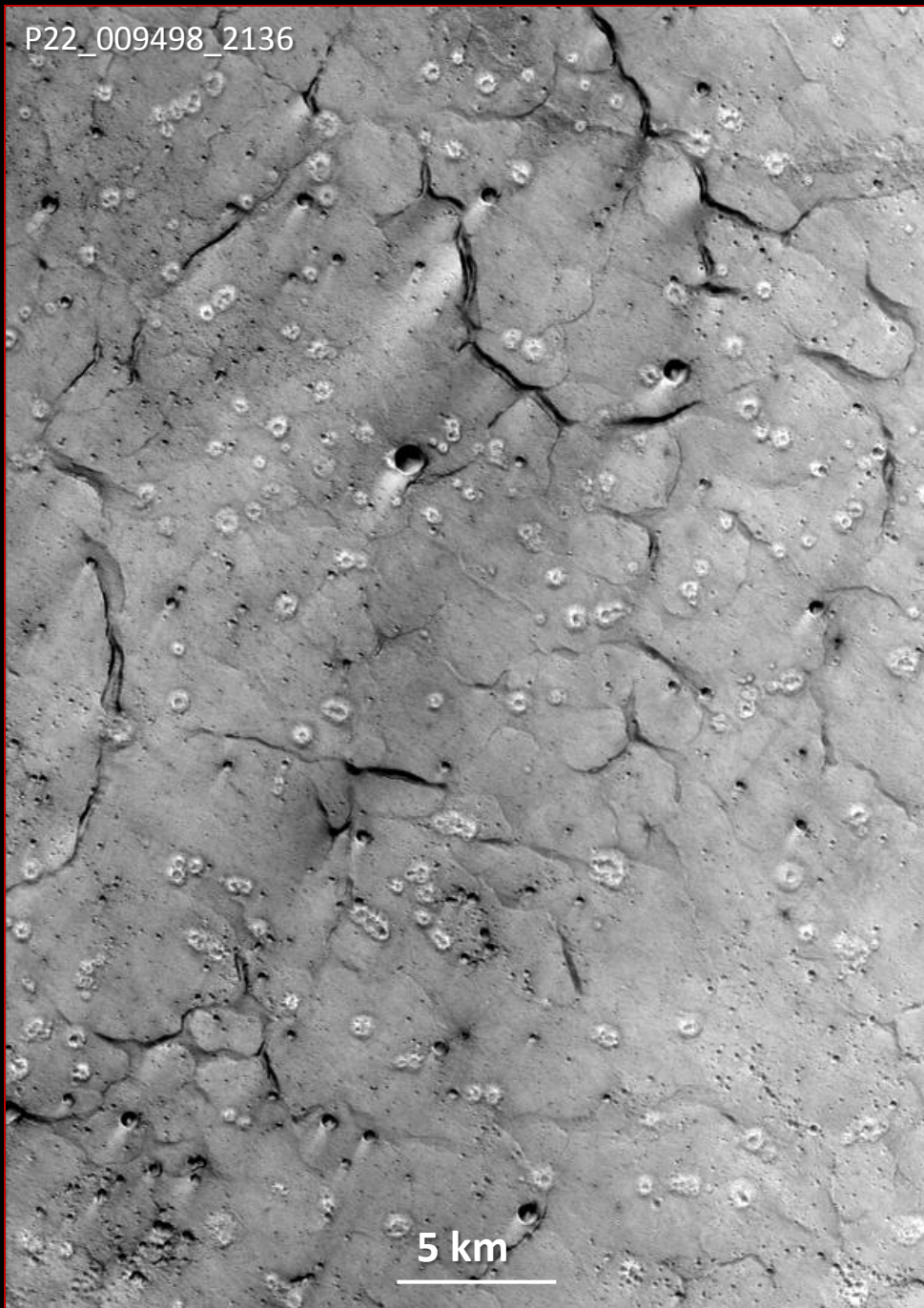
GHOST CRATER

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

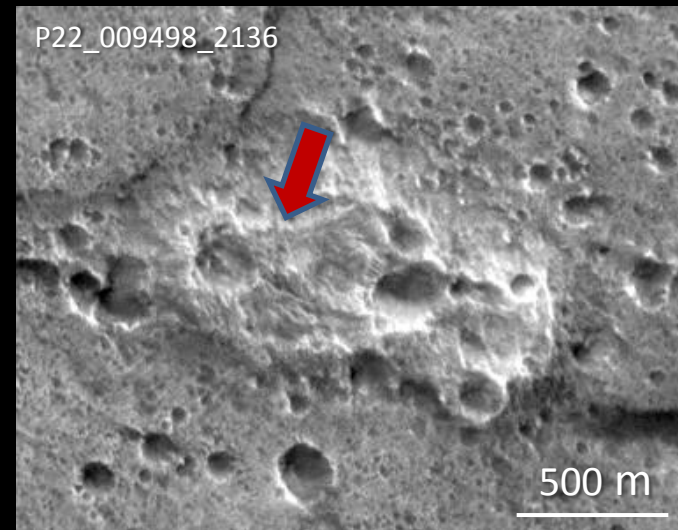
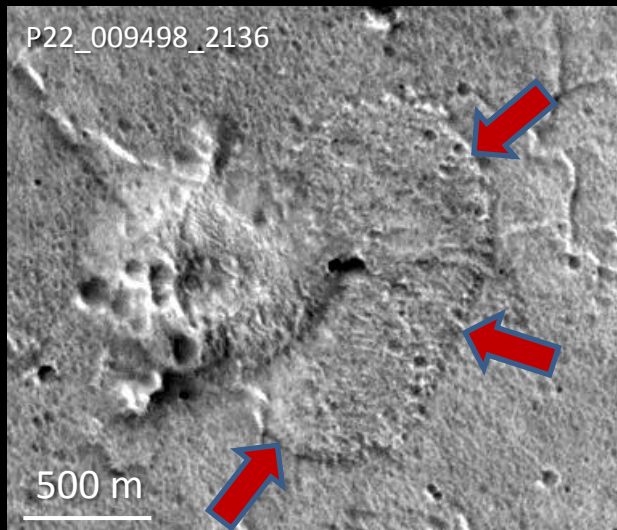
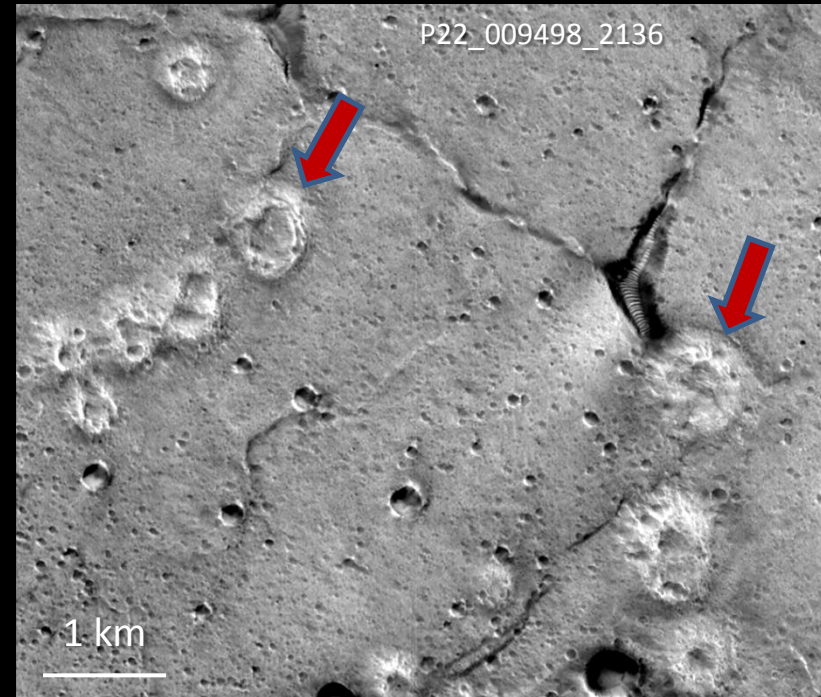
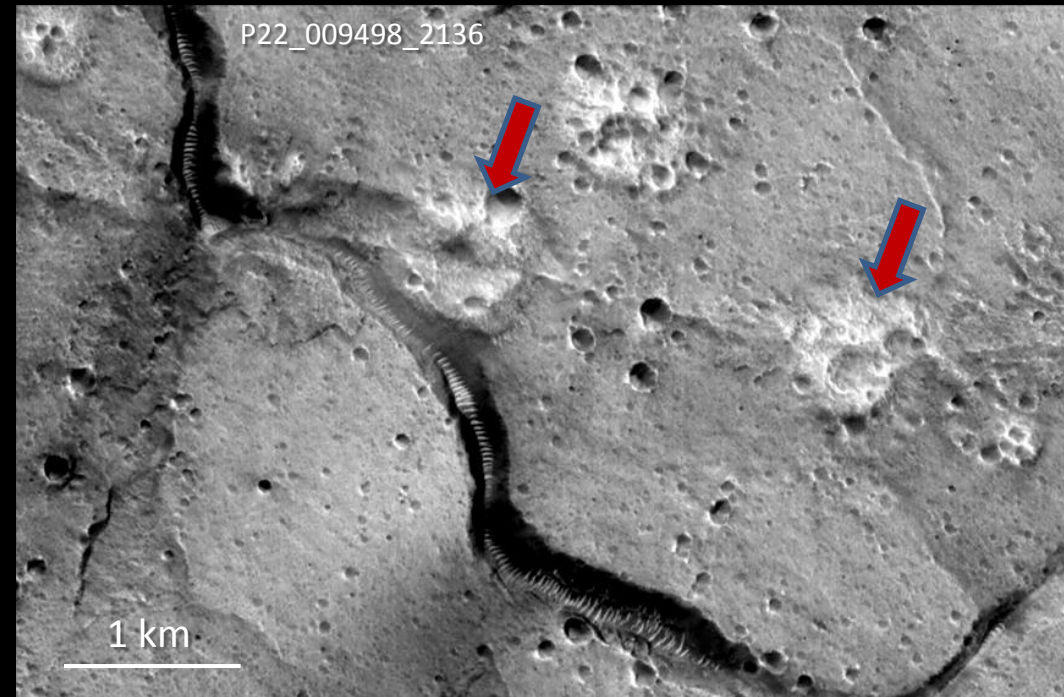
GIANT POLYGONS: 1-10 km

MOUNDS:

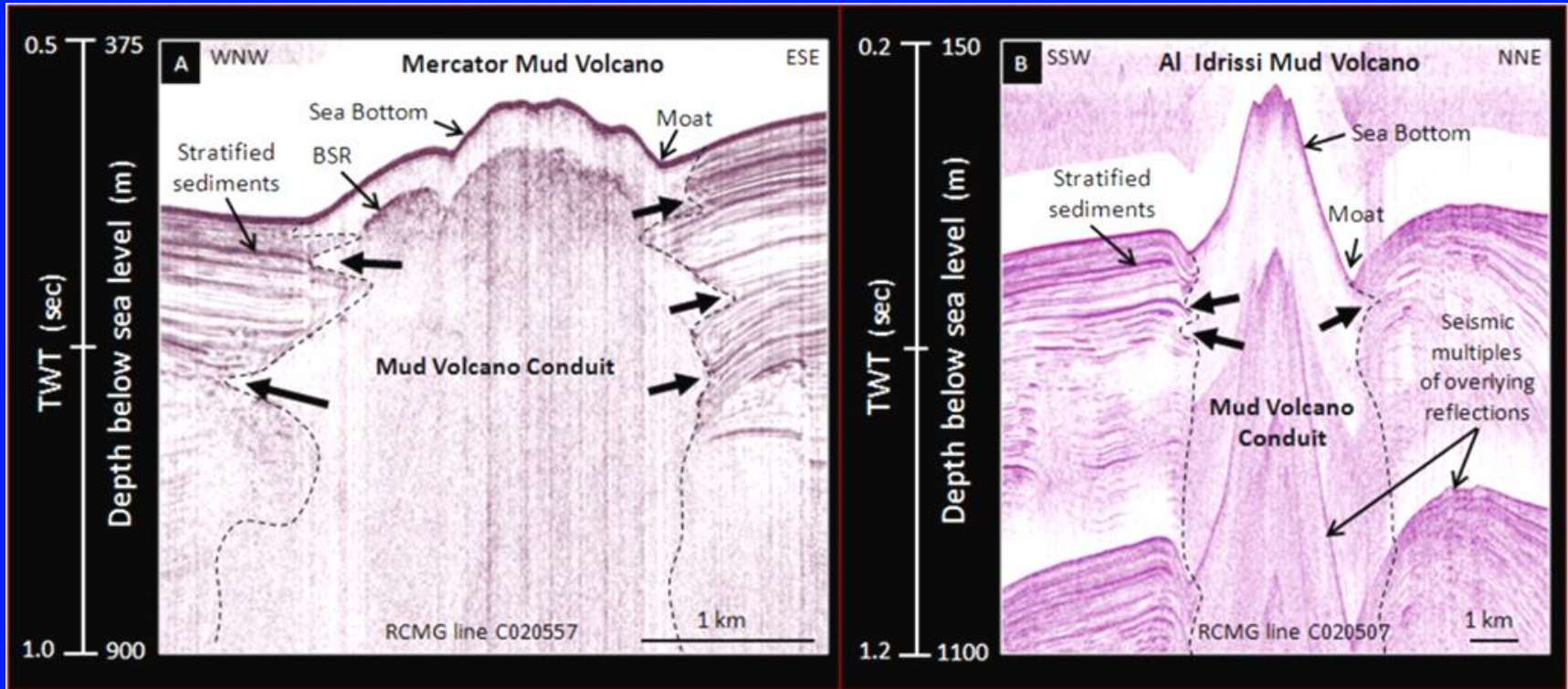
- 0.25- 0.8 km diameter
- pitted
- central vents
- circular
- high albedo
- moats
- concentric form to crest
- possible flow structures

Similar to mounds in Acidalia.
Mud volcano analog.

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



Mud Volcanism



Mud volcanism creates microhabitats in the subsurface:

- fracturing sediments
- providing pathways for fluid migration

CONCLUSION - High Potential for Habitability

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

