Erosional processes, ages and stratigraphic sequence in the Hydraotes Chaos Region, Mars: Observations of the HRSC Camera aboard Mars Express

R. Wagner[2],
B. Schreiner[1],
S. van Gasselt[1],
G. Neukum[1],
and the HRSC Co-I Team

[1]Institute of Geosciences, Freie Universitaet, Berlin, Germany
[2]Institute of Planetary Research, DLR Berlin, Germany

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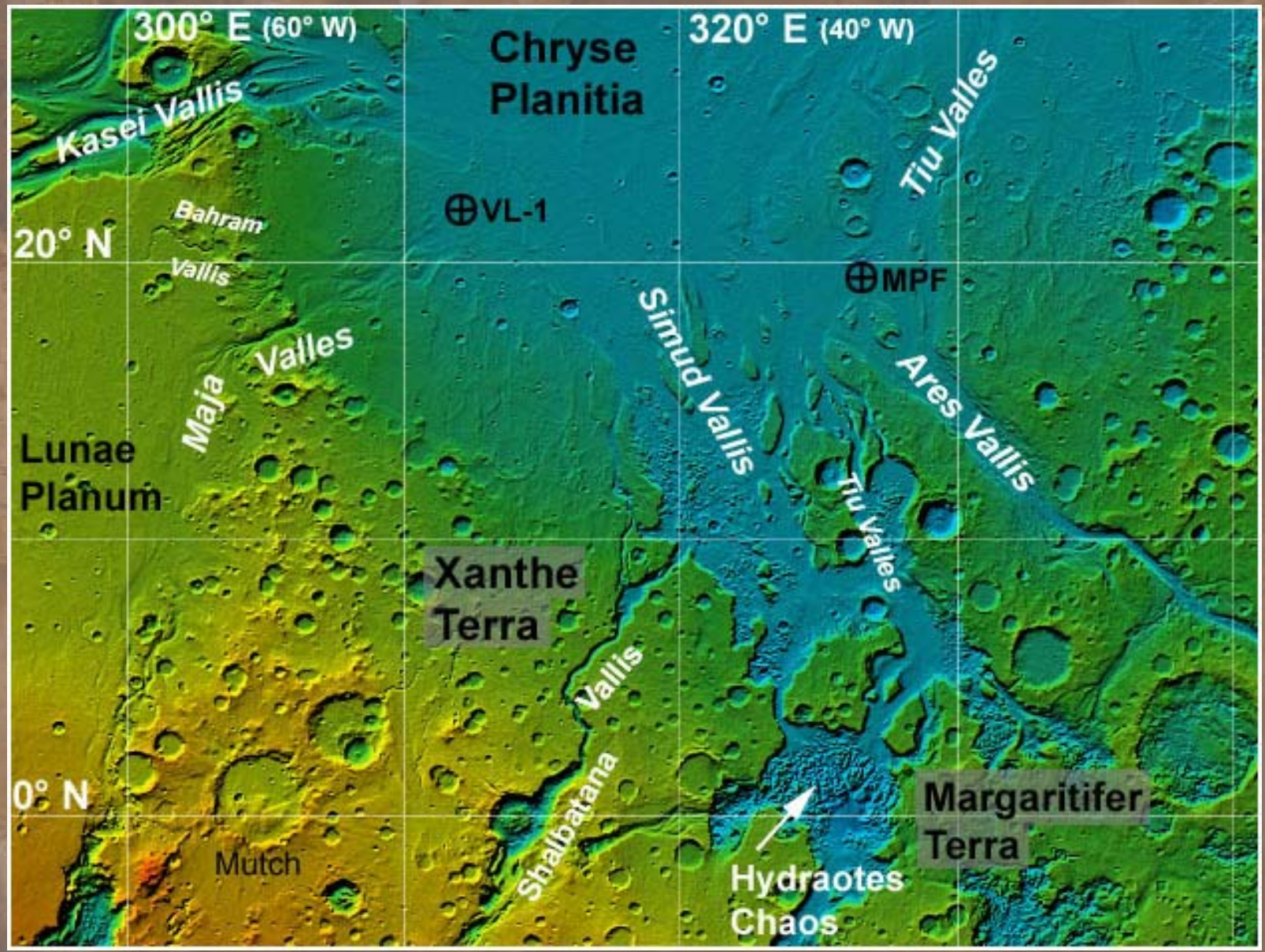
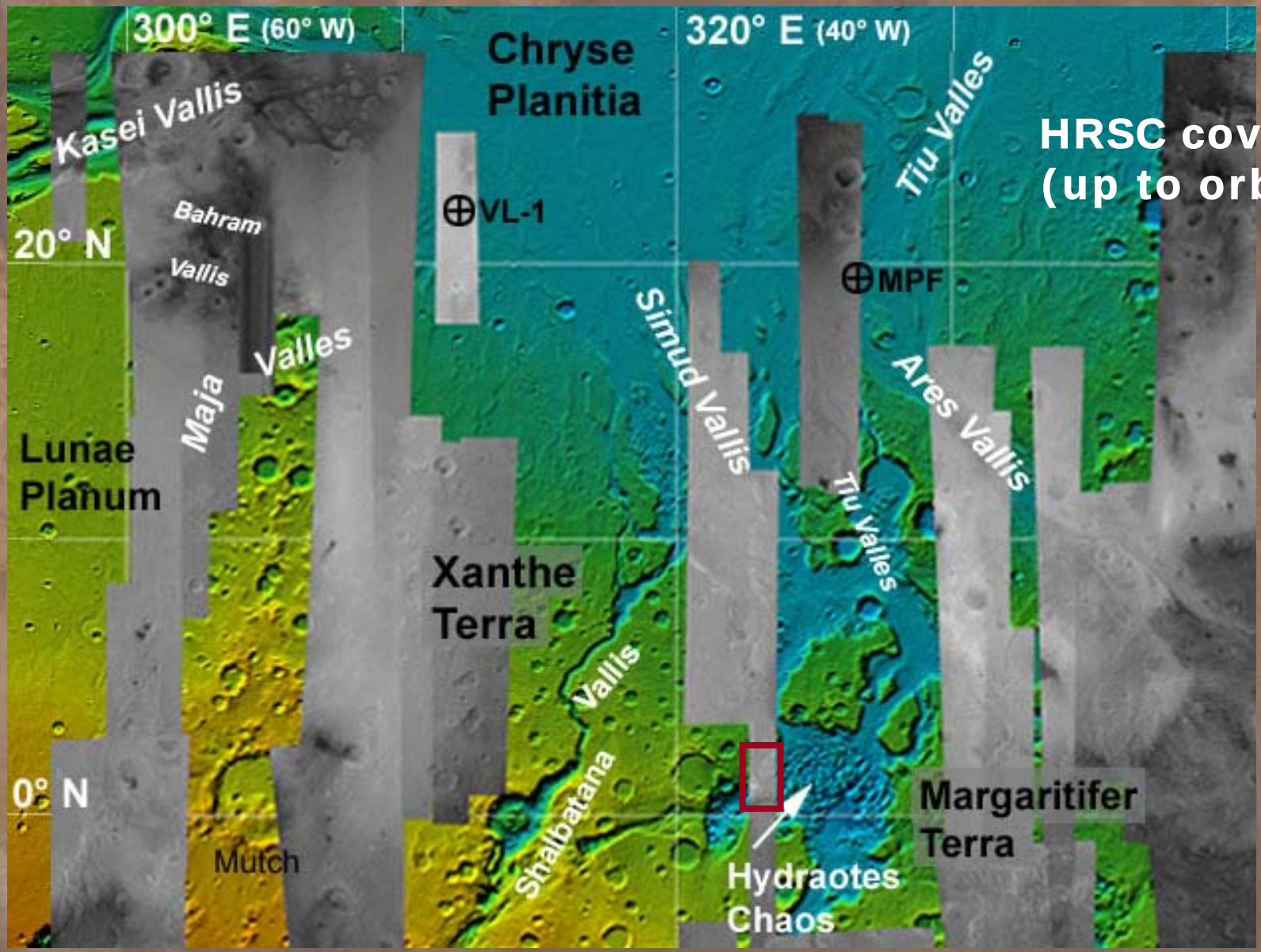
Regional setting: topography and geology

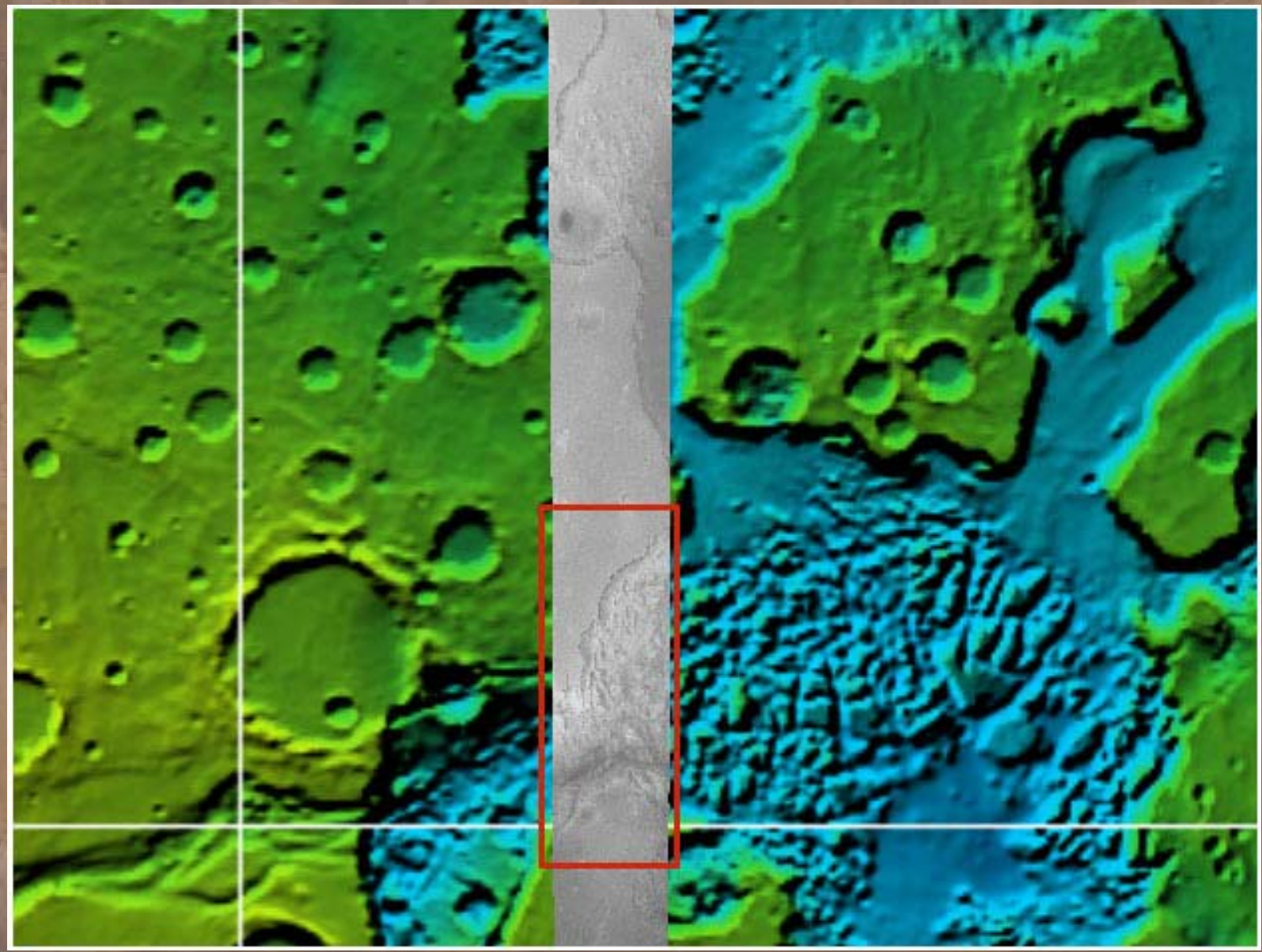


Regional setting: topography and geology



HRSC coverage (up to orbit 1394)

Regional setting: topography and geology



Procedure

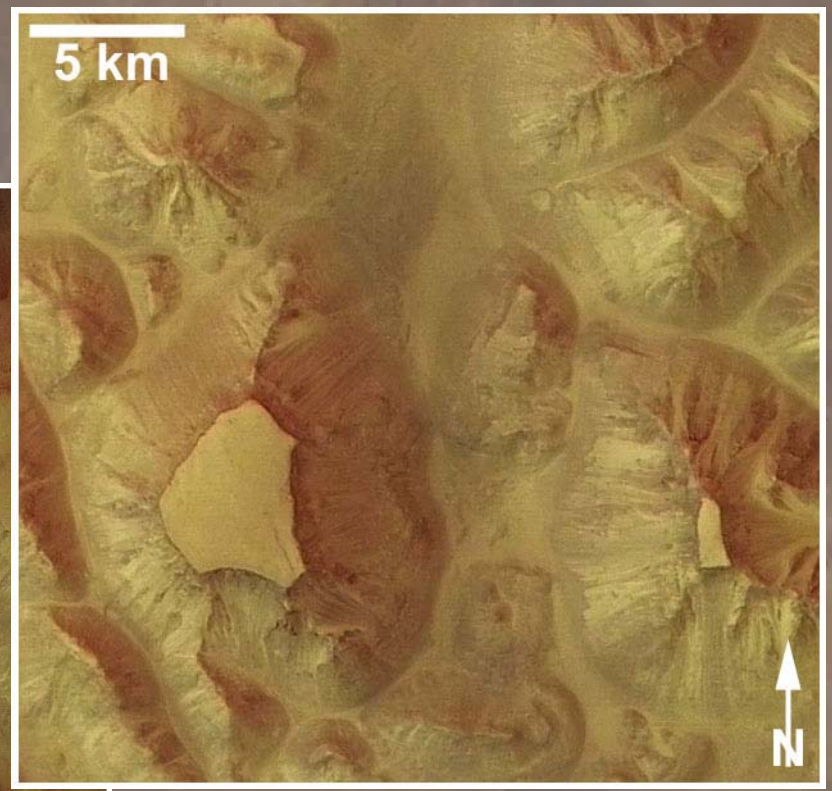
- Identify and map geologic / morphologic units
- Determine heights of morphologic units
- Crater counts on geologic / morphologic units:

  --> derive stratigraphic sequence
- Application of the cratering chronology model by Hartmann and Neukum (2001)

  --> absolute time scales; duration of processes

Geologic units

Hydraotes Chaos:
Mesas / Medium level



Xanthe Terra: plains
Top level

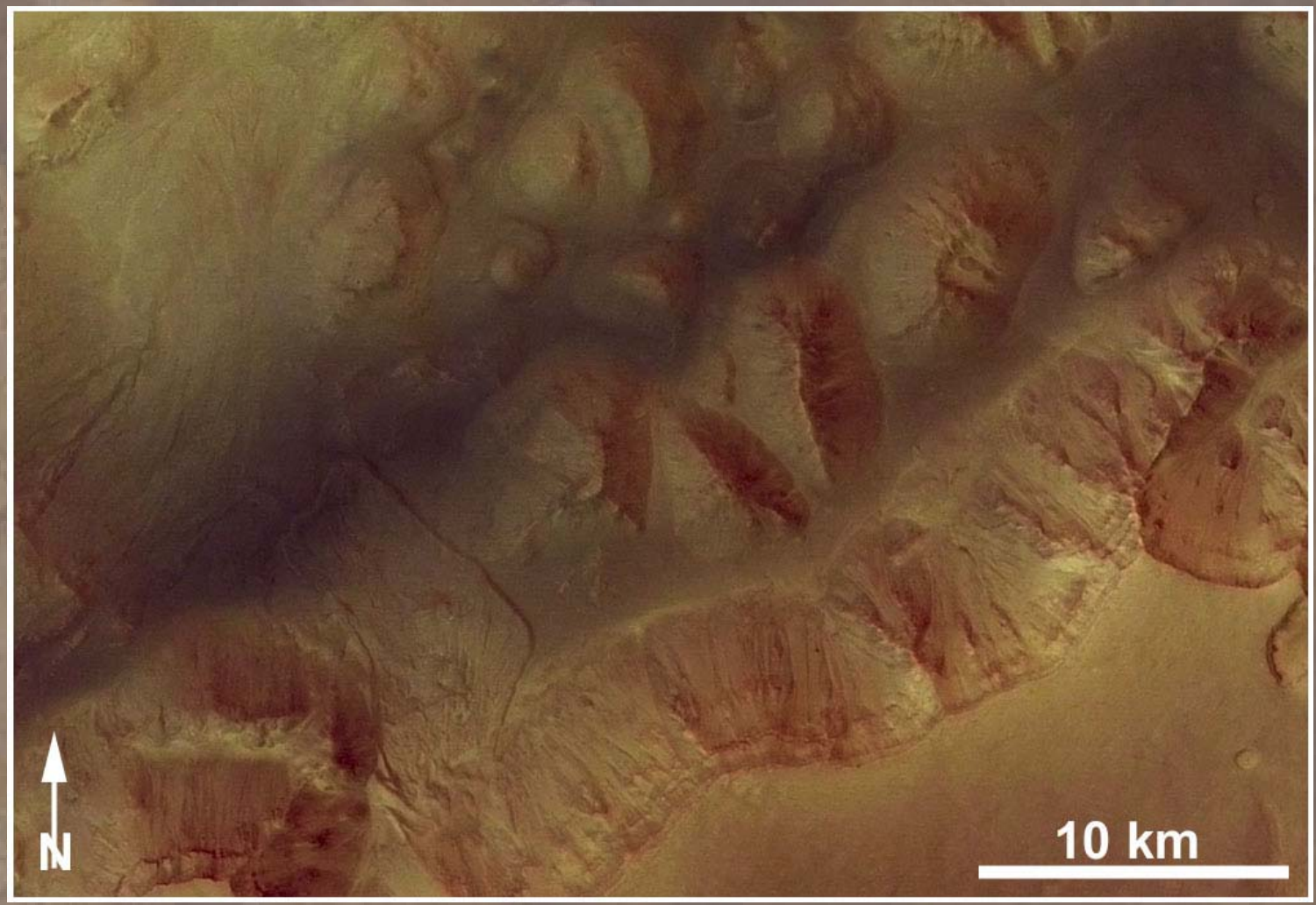
Geologic units

Hydraotes Chaos: Mesas & valley floor / Lowest level

Hydraotes Chaos: Bright floor

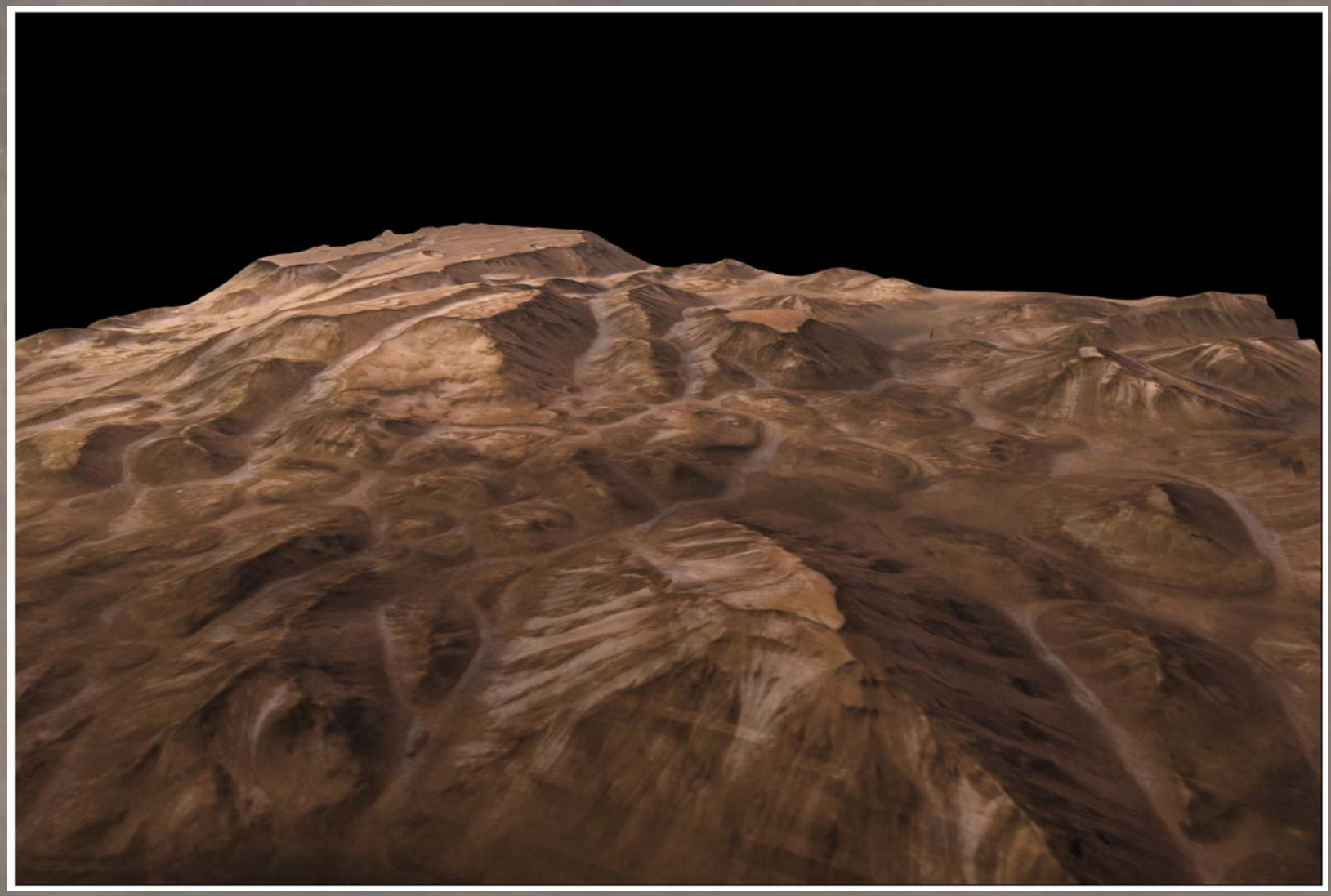
Geologic units

Hydraotes Chaos: Dark floor

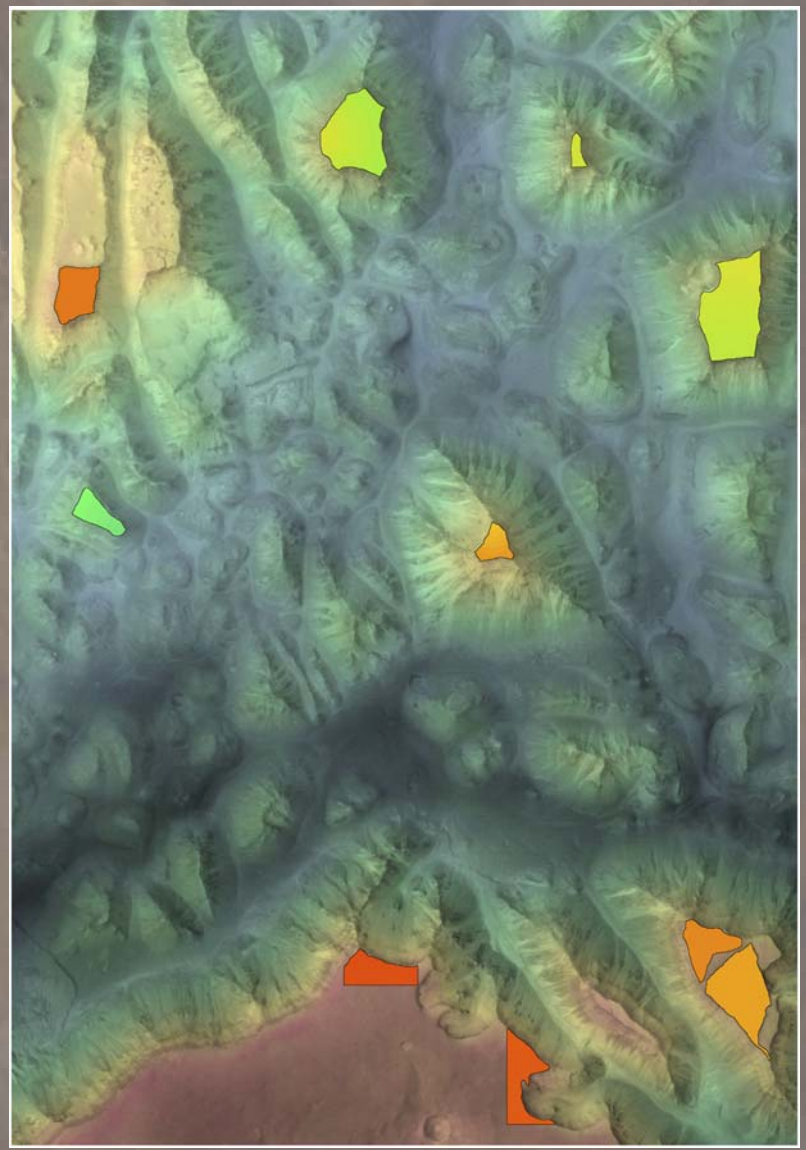


Determination of heights

Hydraotes Chaos: Perspective view



Determination of heights



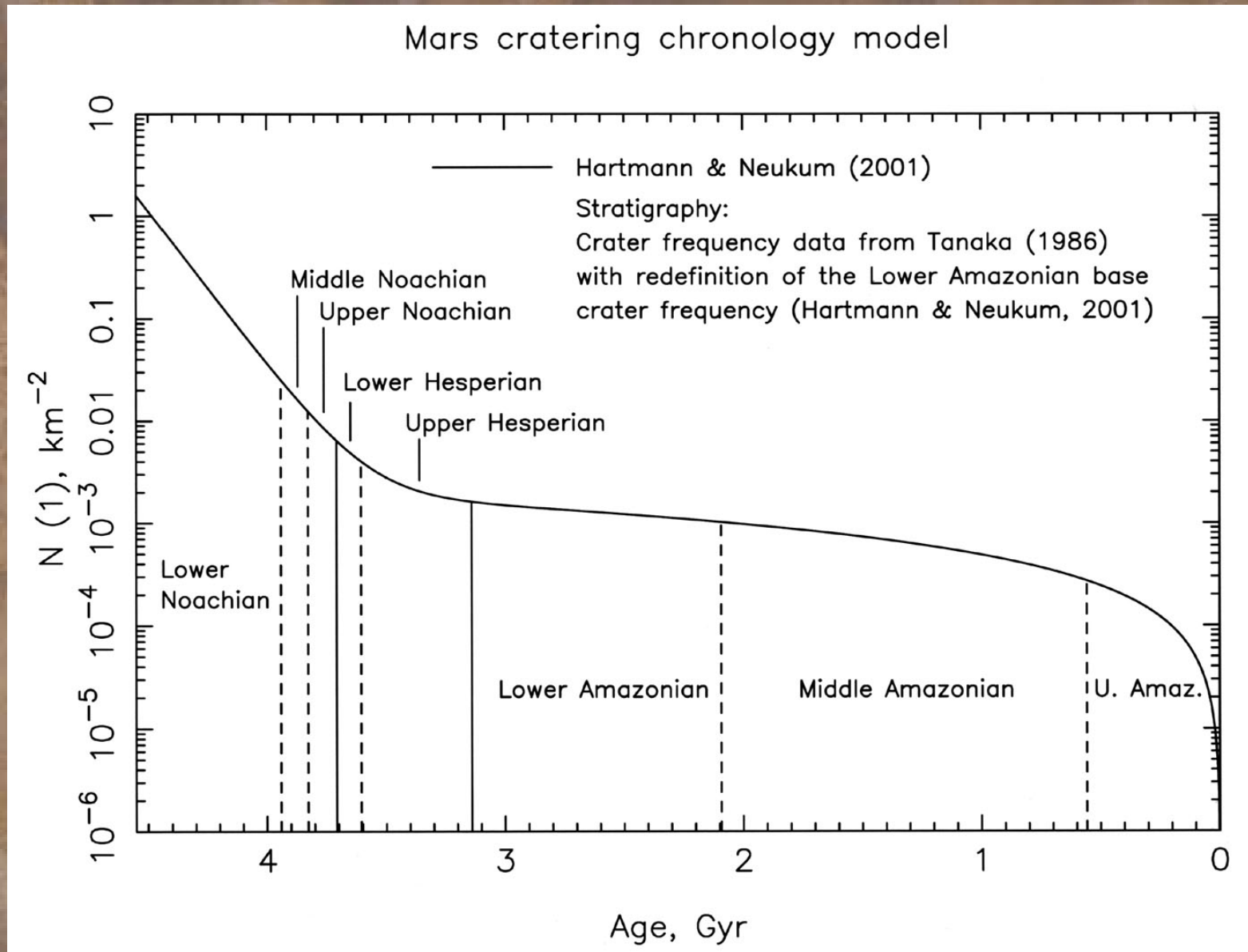
Heights of distinct mesas:
Parallax measurements between HRSC nadir and stereo channel

→Allows to find height values for small features below the spatial resolution

Absolute calibration of parallaxes with MOLA DTM

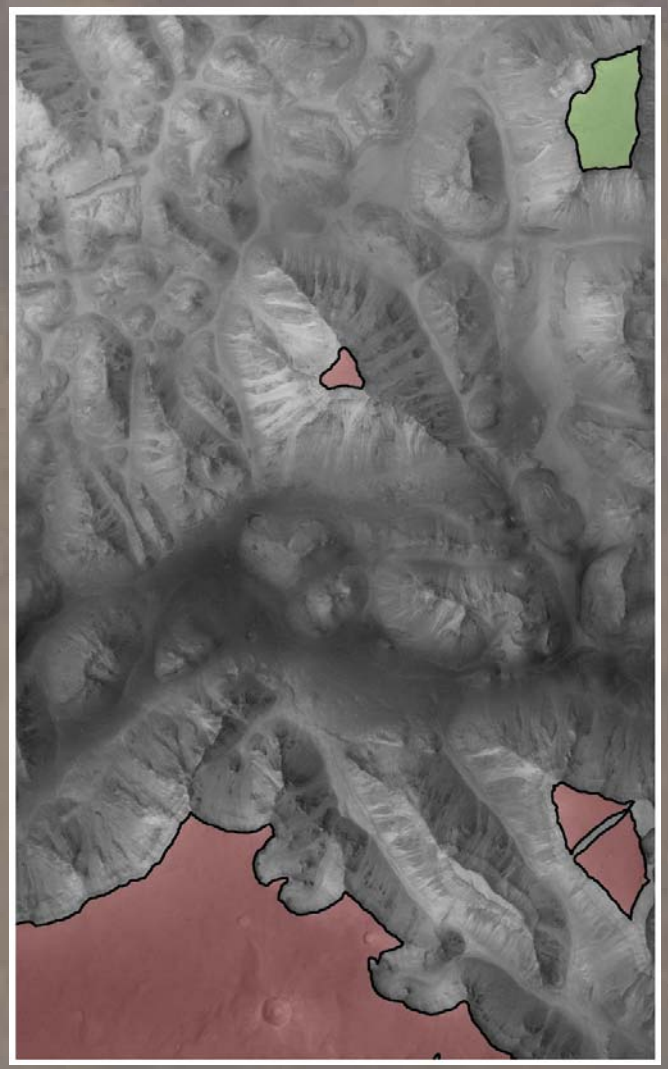
Height range:
-5100 m (floor)
to 2500 m (red color)

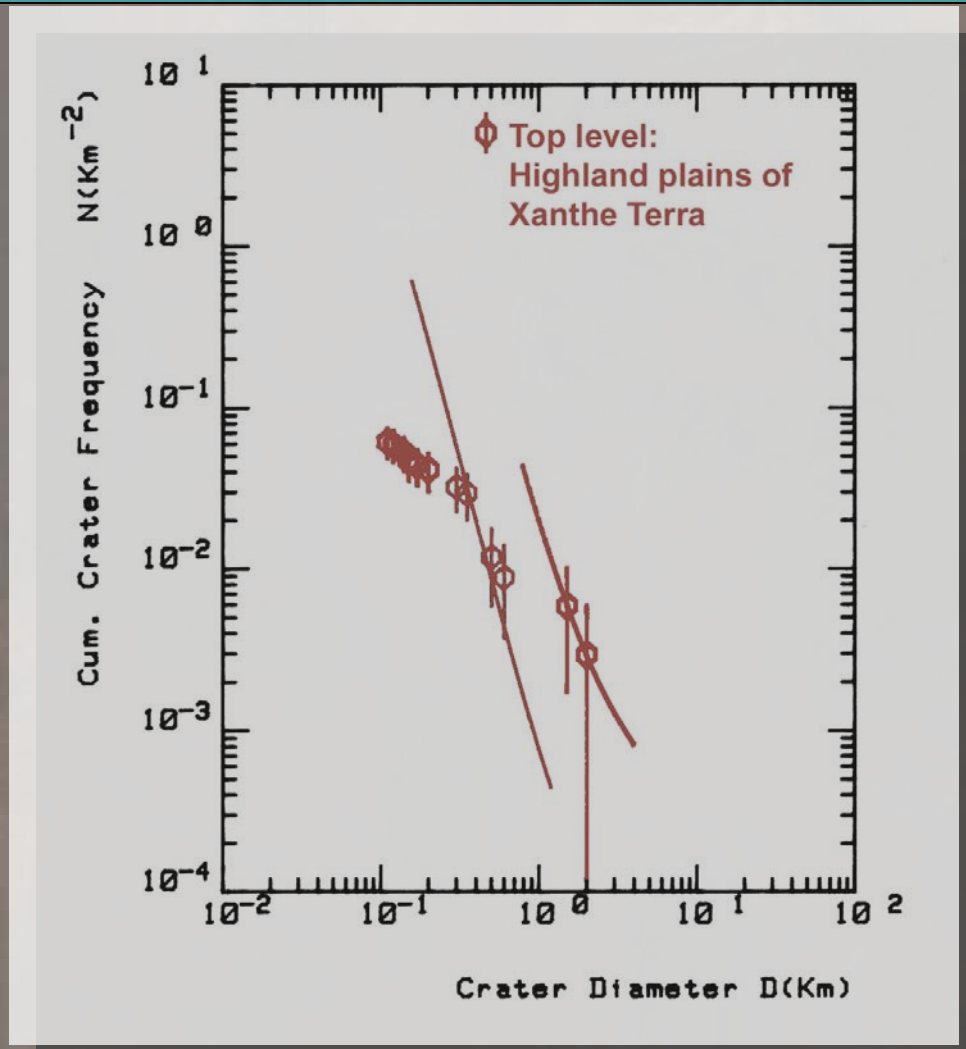
Cratering chronology



Stratigraphy and ages

Xanthe Terra / Hydraotes Chaos: Top level

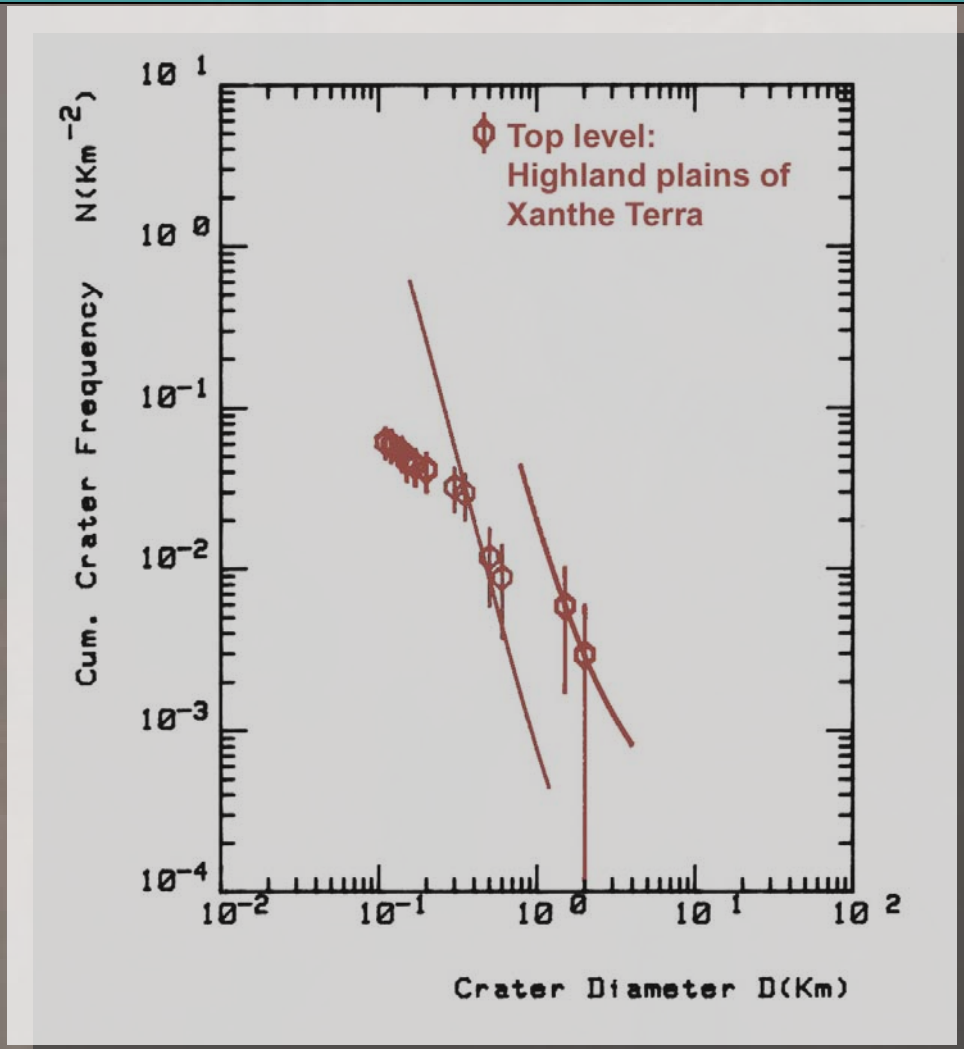




Xanthe Terra: ~3.9 Gyr
Erosional episode #1: ~1.6 Gyr

Stratigraphy and ages

Xanthe Terra / Hydraotes Chaos: Medium level



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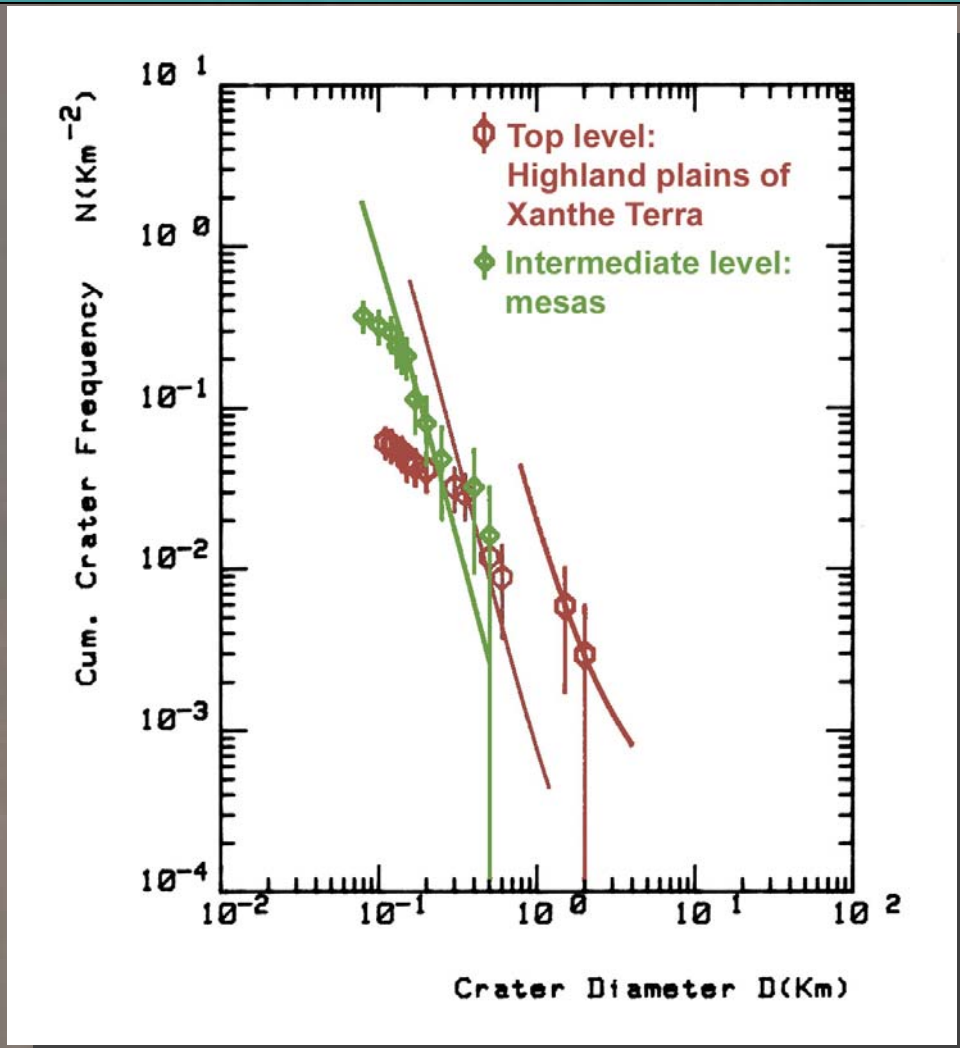
Stratigraphy and ages

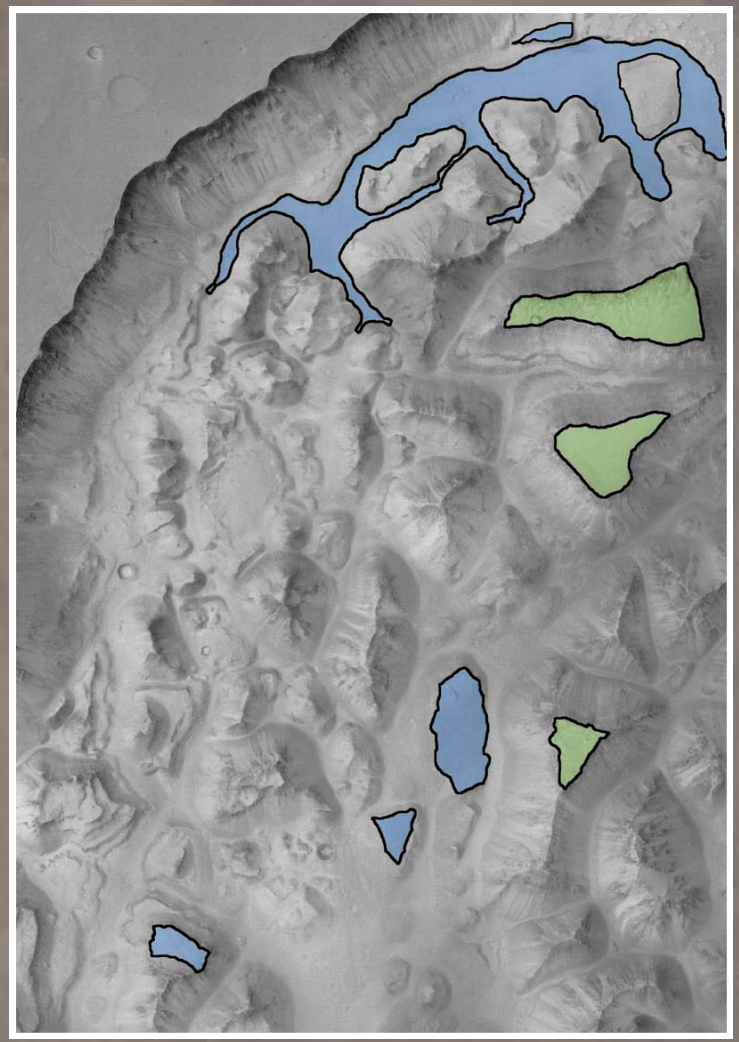
Xanthe Terra / Hydraotes Chaos: Medium level

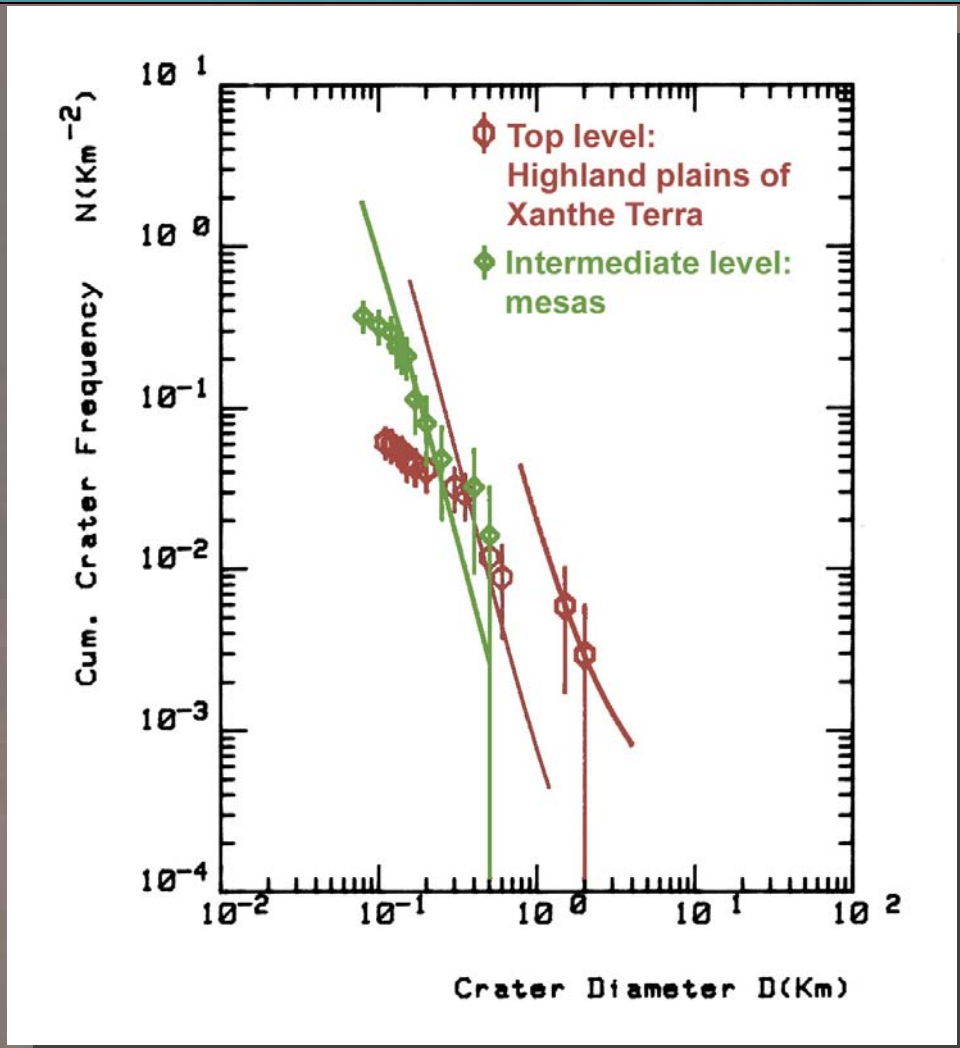


Erosional episode #2: ~0.5 Gyr

Stratigraphy and ages

Xanthe Terra / Hydraotes Chaos: Lowest level





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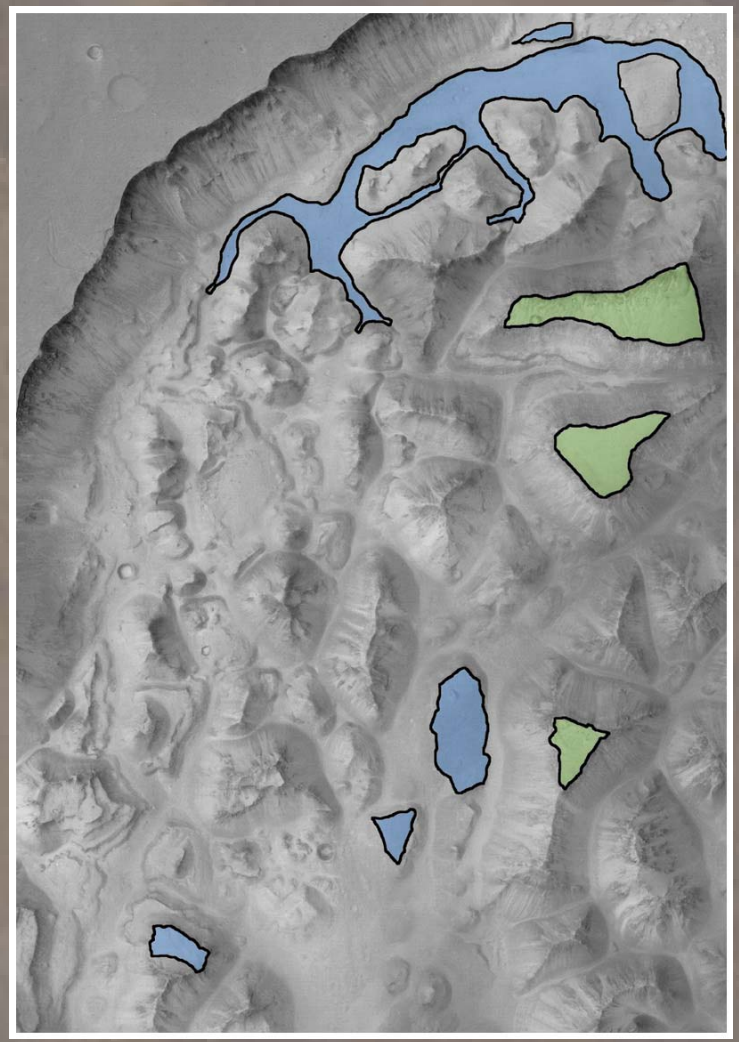
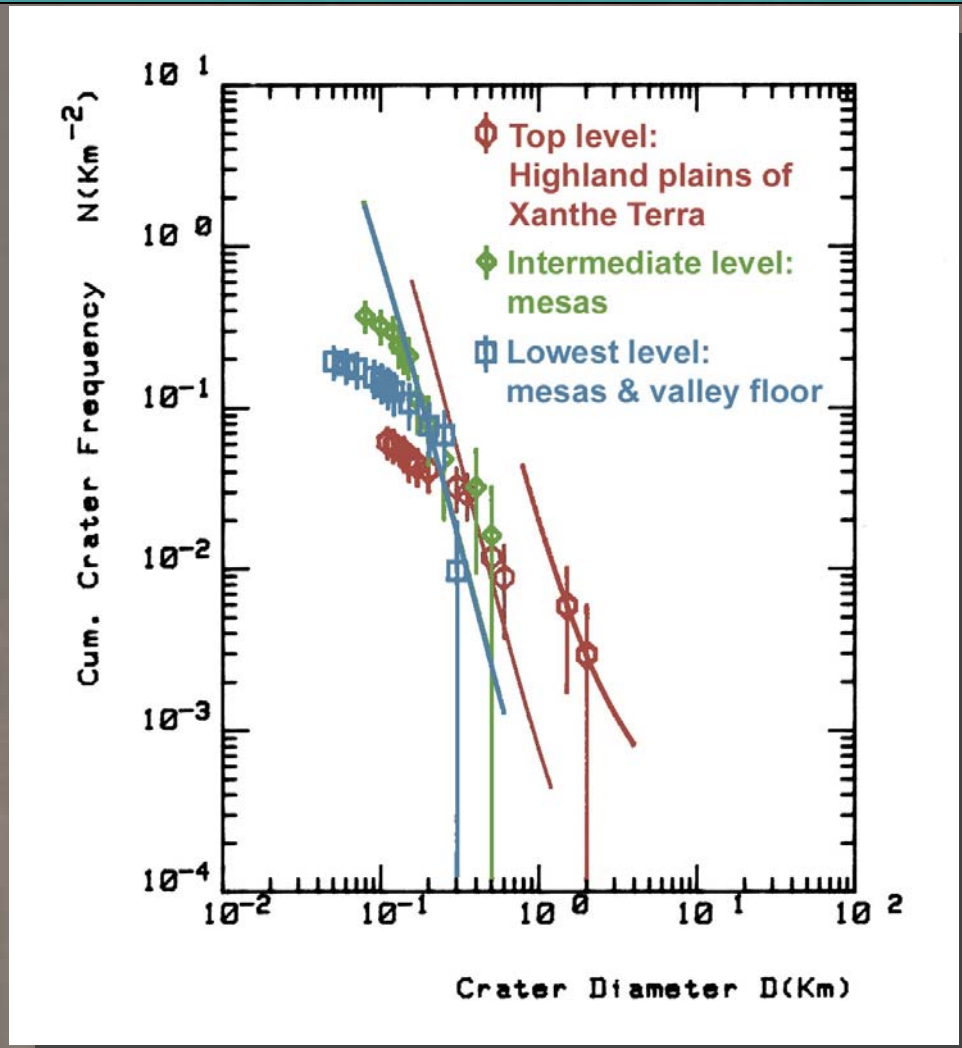
Stratigraphy and ages

Xanthe Terra / Hydraotes Chaos: Lowest level





Erosional episode #3: ~0.4 Gyr to ~0.2 Gyr

Conclusions

- Wide range of high- and lowland morphologies *(bright & dark floors, small buttes, angular mesas)*
- Morphological features resemble terrestrial landforms dissected and eroded by water
- Elevation levels from *-5100 m* (floors) to *2500 m*
- So far unclear whether different elevation levels due to:

  (1) Surface removal & subsequent abrasion

  (2) Removal of subsurface material & block tilting

Conclusions

- Xanthe Terra: plains-forming volcanism, 3.9 Gyr
- Top level mesas: long-lasting erosional process, ceased or slowed down about 1.6 Gyr ago
- Medium level mesas: erosional process, ceased (or slowed down) about 500 Myr ago
- Low level mesas, floors: erosional process, ceased 400 - 200 Myr ago

Conclusions

Xanthe Terra / Hydraotes Chaos: Geological processes through time