

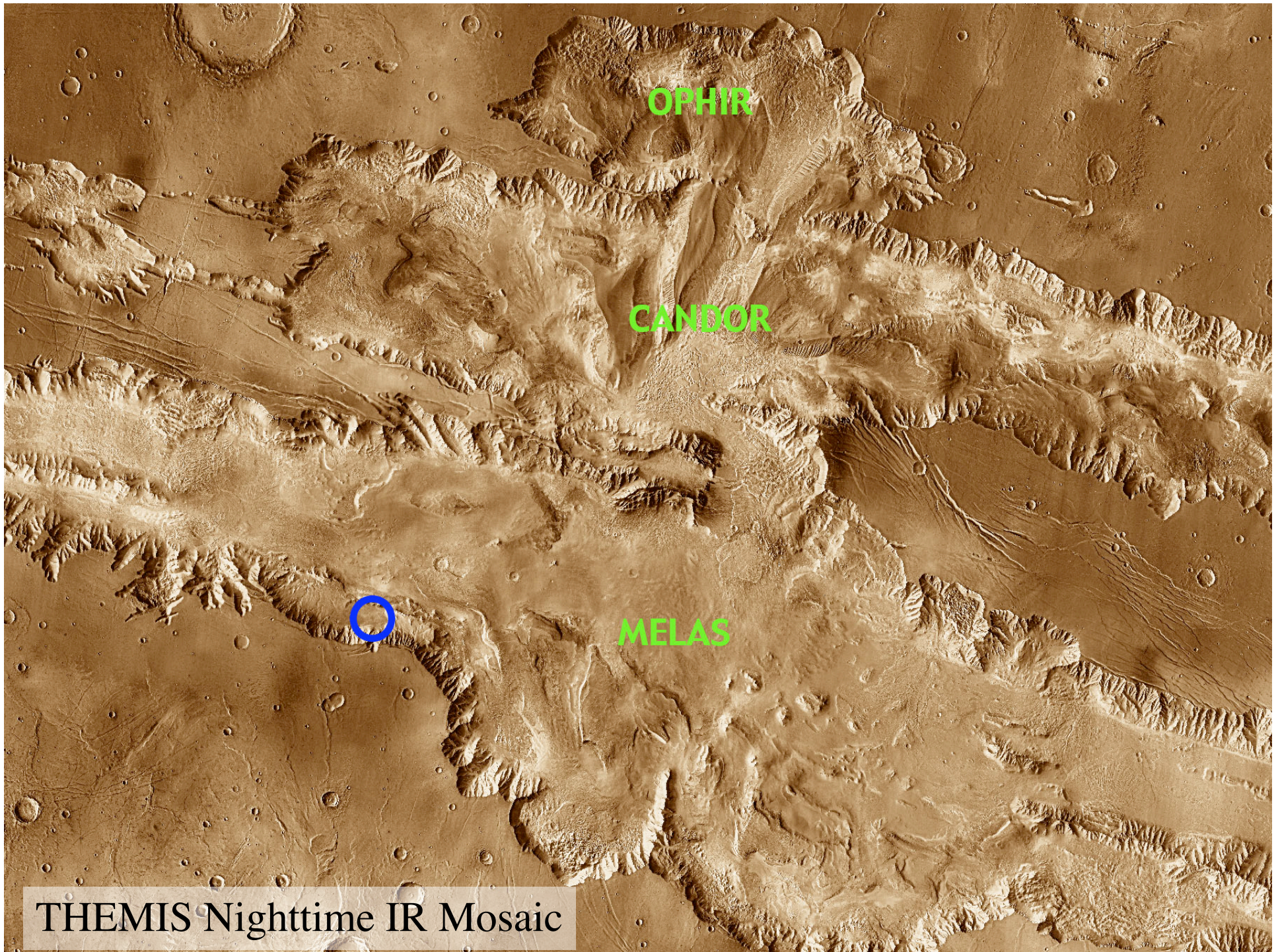
PALEO-LAKE IN MELAS CHASMA AS A POTENTIAL LANDING SITE FOR MSL

(Something for Everyone)

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CTX Mosaic Showing Location of Proposed Landing Site in Melas Chasma

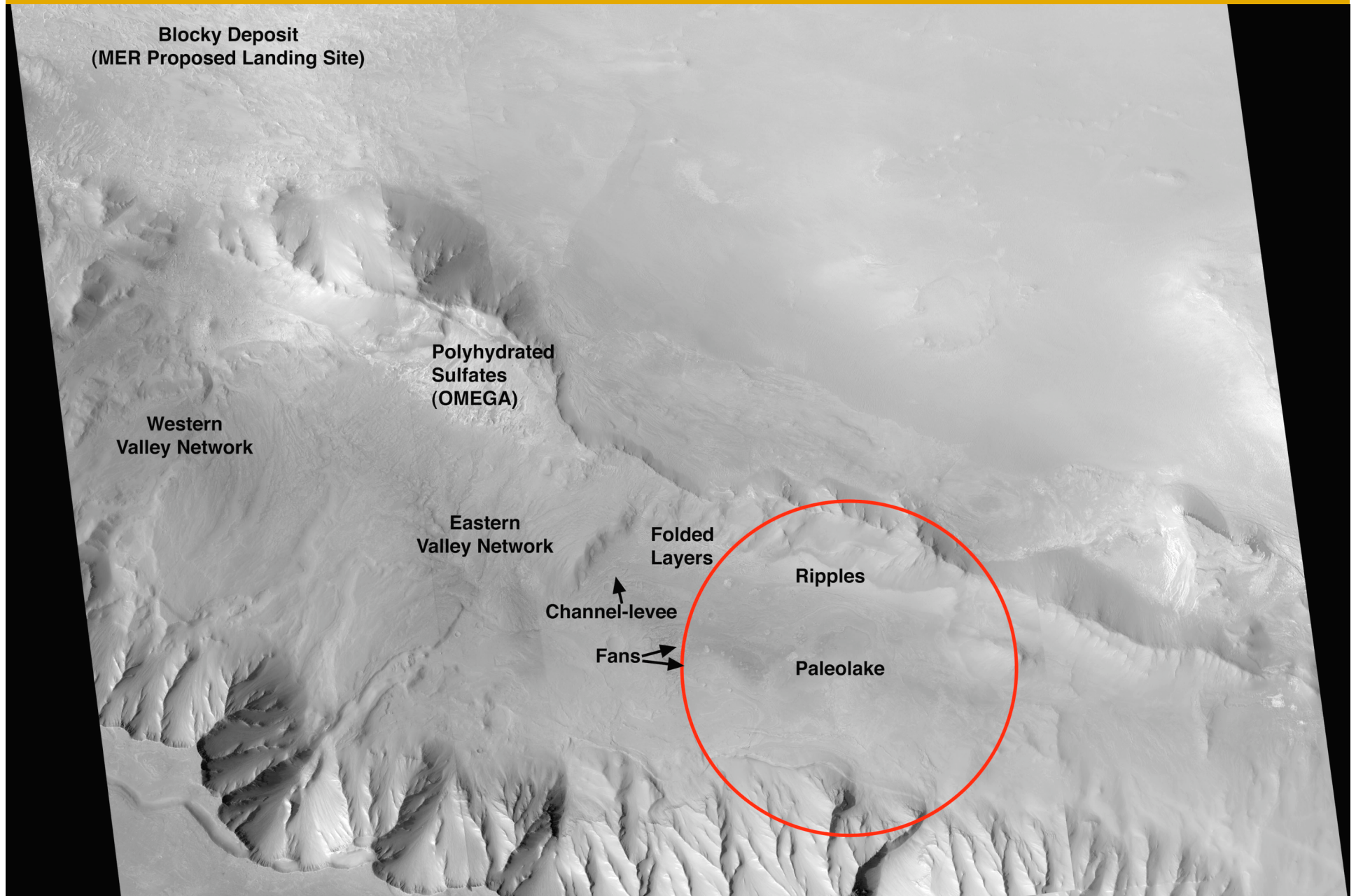


THEMIS Nighttime IR Mosaic

Why land MSL at Melas Chasma site?

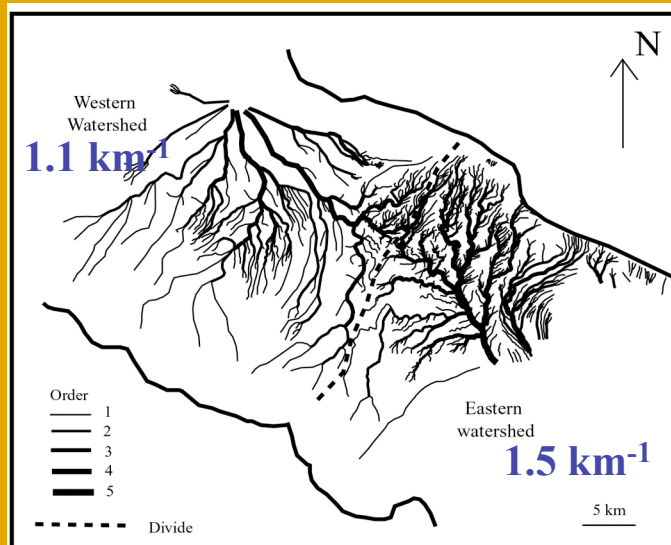
- The proposed MSL landing site ellipse is located on layered beds in a postulated paleolake [*Quantin et al.*, 2005] in a basin along the wallrock in southwestern Melas Chasma.
- To the west of the landing ellipse are extensive Hesperian-aged valley networks that likely formed by precipitation over thousands of years.
- Folded beds, sulfate deposits, and depositional fans are also features of interest adjacent to the landing ellipse.
- The fluvial landforms in particular are unique aspects of this location that would provide us with an opportunity to better understand climatic conditions and water activity in this region.
- The evidence for a paleolake and depositional fans indicates that this region could have been a habitable location in the geologic past.

Lots of interesting geologic features in and adjacent to ellipse



- Preliminary analysis by *Quantin et al.* [2005] noted the valley networks in southwestern Melas terminate in a closed depression that follows a contour line at –1540 m and is filled with layered strata, attributes consistent with a potential paleolacustrine environment.
- Mapping of the Melas valley networks by *Quantin et al.* [2005] suggests these valleys were incised by runoff from a lengthy period of precipitation that may have extended well into the Hesperian.
- Hundreds of meters of layered, sedimentary rock are preserved and extend across the proposed MSL site and adjacent study region.
- Volume calculations of the sediments comprising the layers by *Quantin et al.* [2005] suggest they could be lacustrine strata composed of reworked material from incision of the valleys.
- Different amounts of erosion have stripped layers to expose stratigraphic sections throughout the site, providing an extraordinary view of the sequence of depositional events.

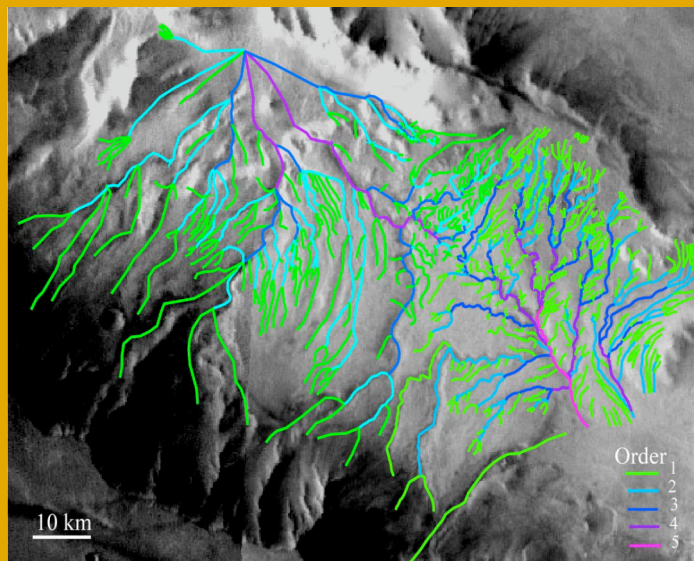
Study of the features of the valley networks by Quantin et al [2005]



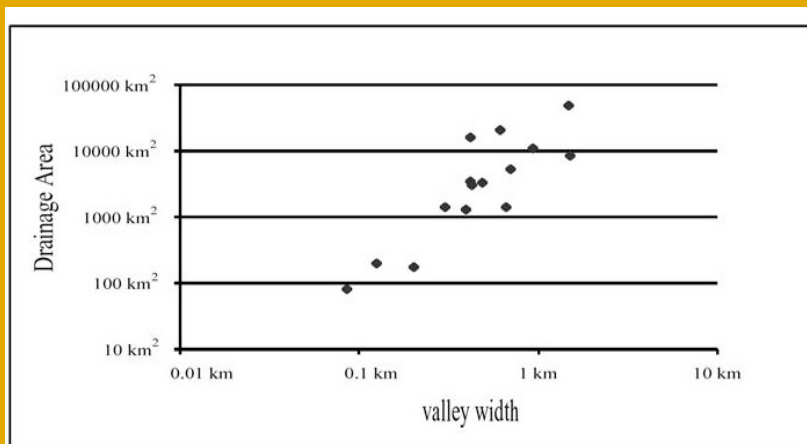
High drainage density



Valleys head at varying elevations, near divides

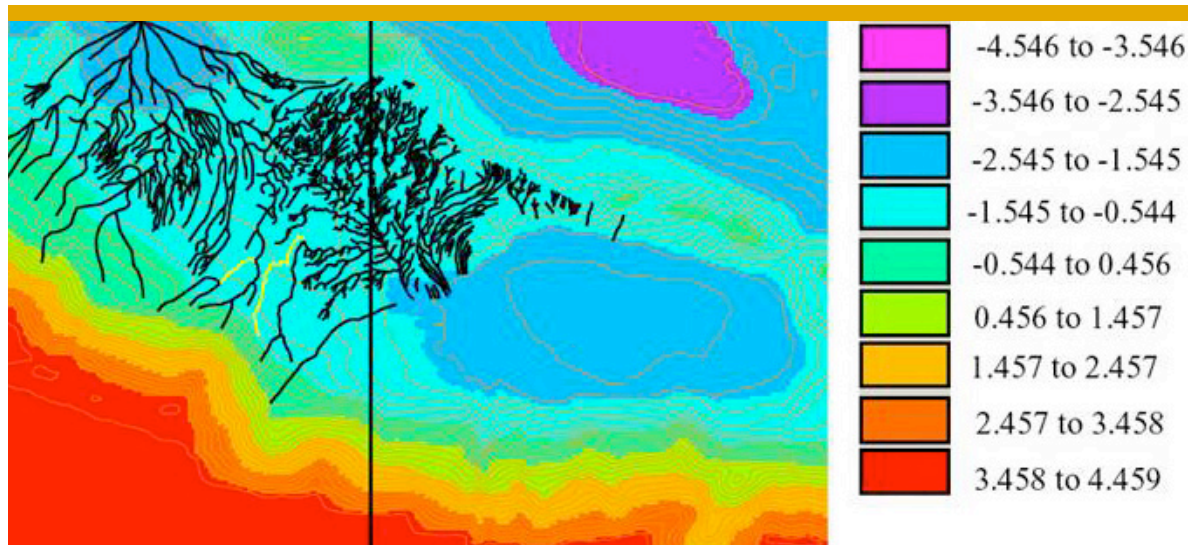


Mature networks



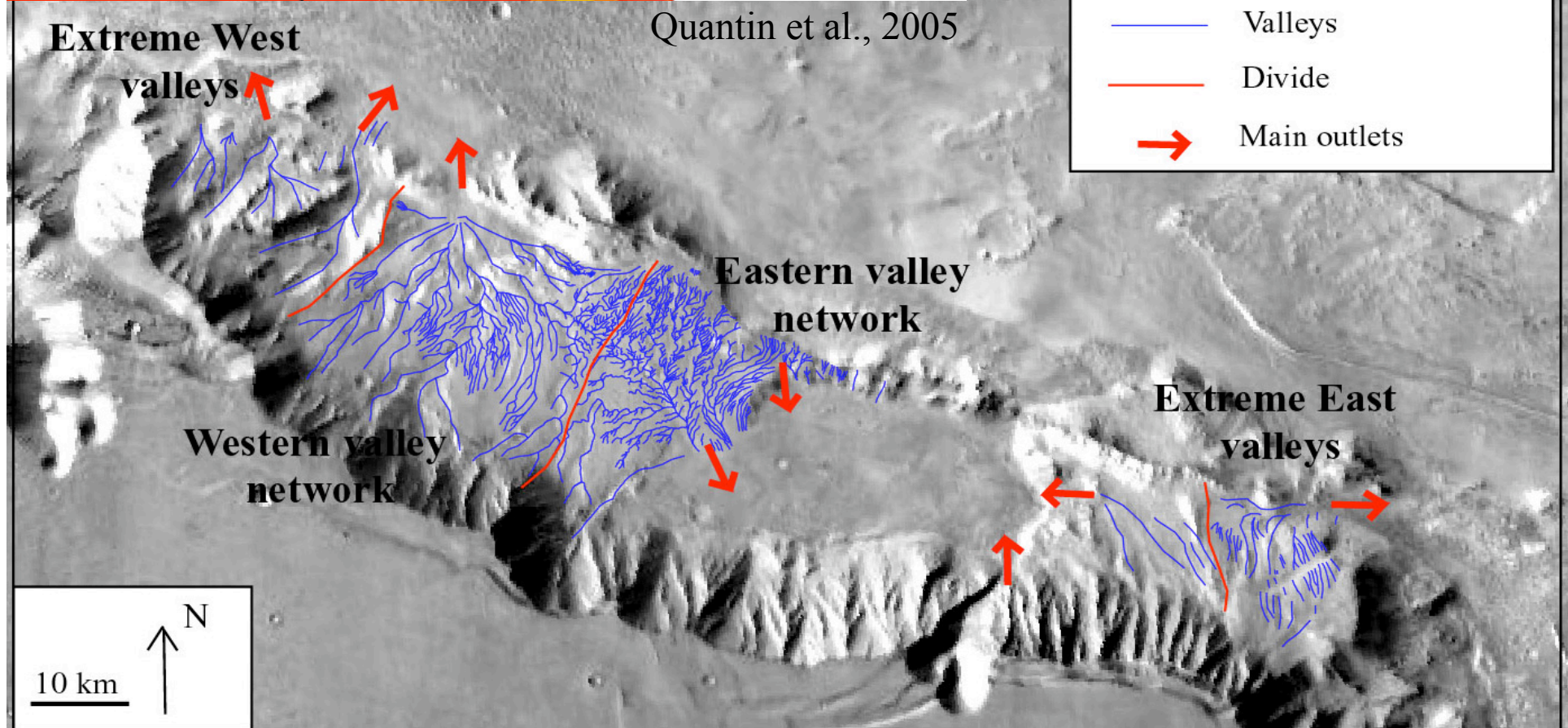
Relation between the paleodischarge and the upstream drainage area

Density and Maturity Rare on Mars: Consistent with Long Period of Precipitation



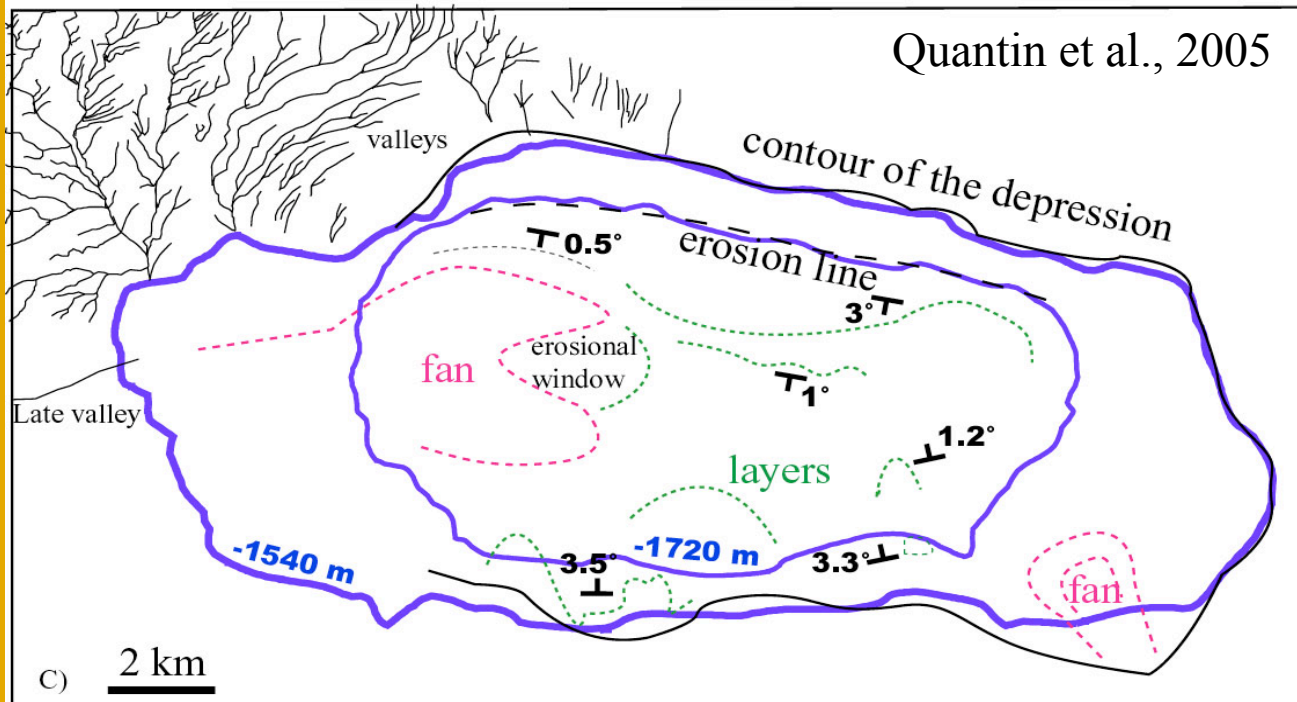
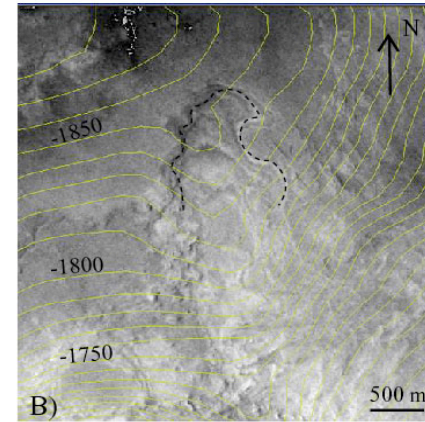
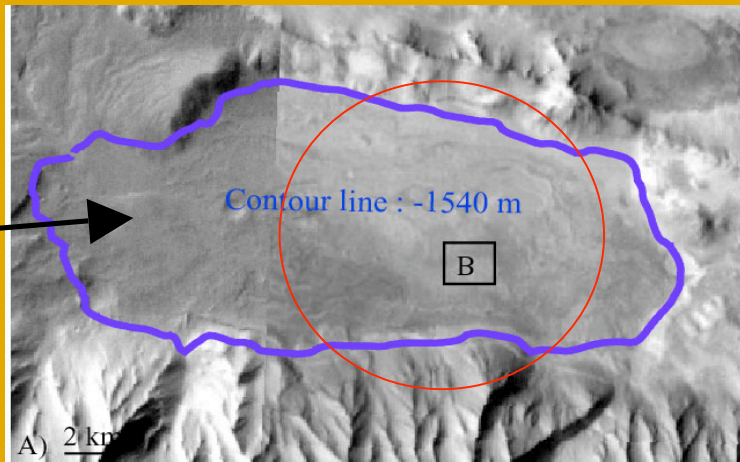
Ellipse is located
where valleys
empty into paleo-
lake

Quantin et al., 2005



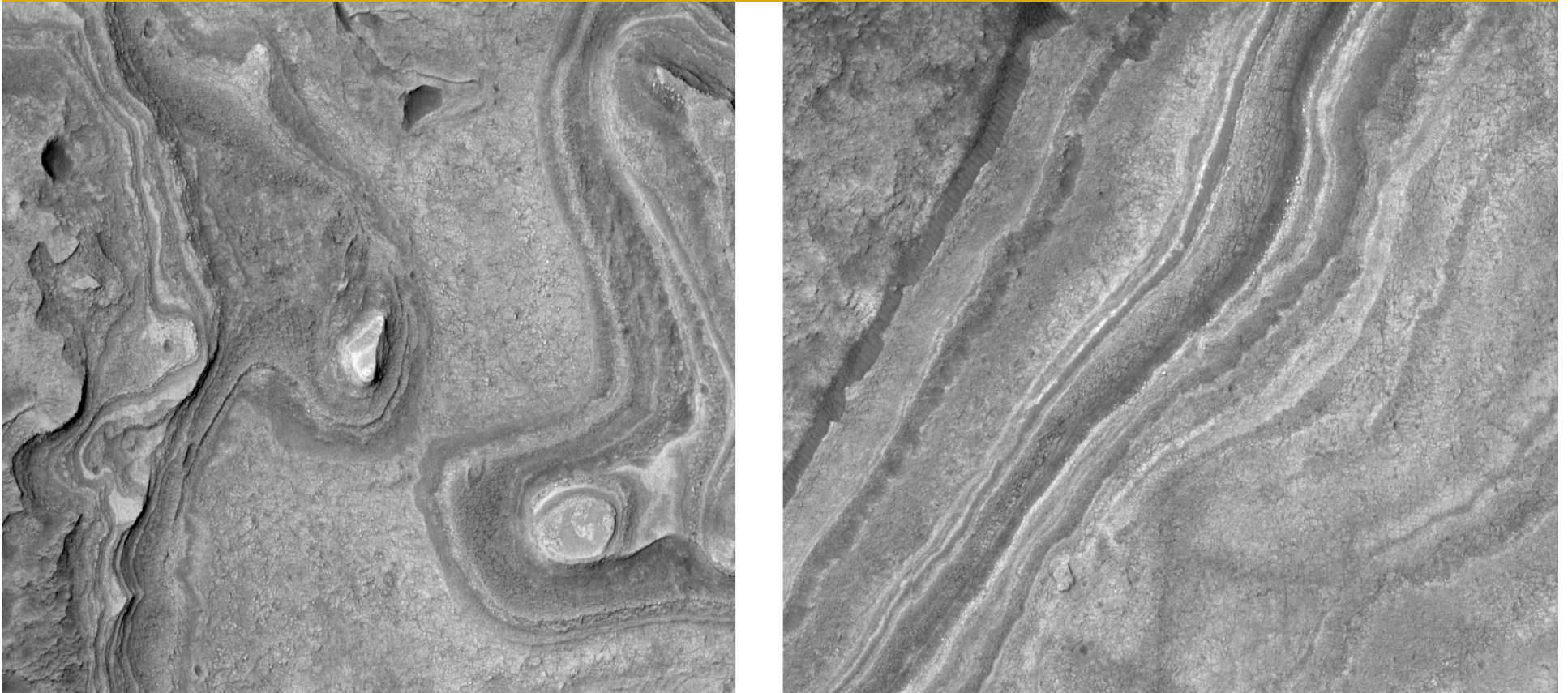
Evidence for a paleo-lake

Maximum
water Volume
 157 km^3



Landforms at -1540 and -1720 contours define elevation of two lake stages

HiRISE examples of layering inside landing ellipse



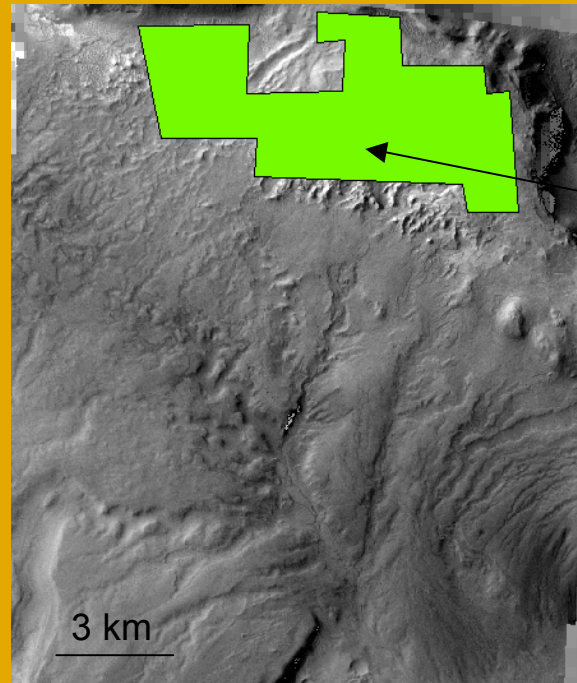
- Albedo differences between layers appear to reflect compositional variations rather than surficial contamination
- MSL could analyze multiple beds through traverses along the strata

Sulfates in and around the landing site



Polyhydrated
sulfates in
OMEGA

*Gendrin et al.,
Science, 2005*



HiRISE color

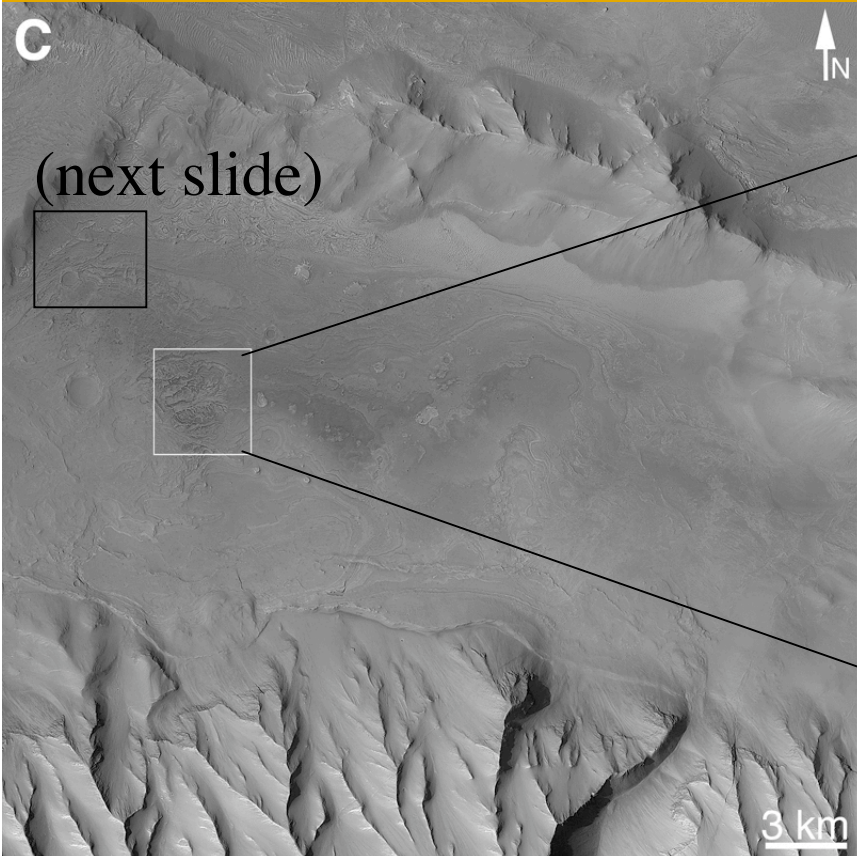


- The sulfates detected by OMEGA to the northwest of the ellipse correspond to a light-toned unit upslope along the wallrock.
- CRISM results (R. Milliken) indicate sulfates in the lightest-toned materials within the landing ellipse.

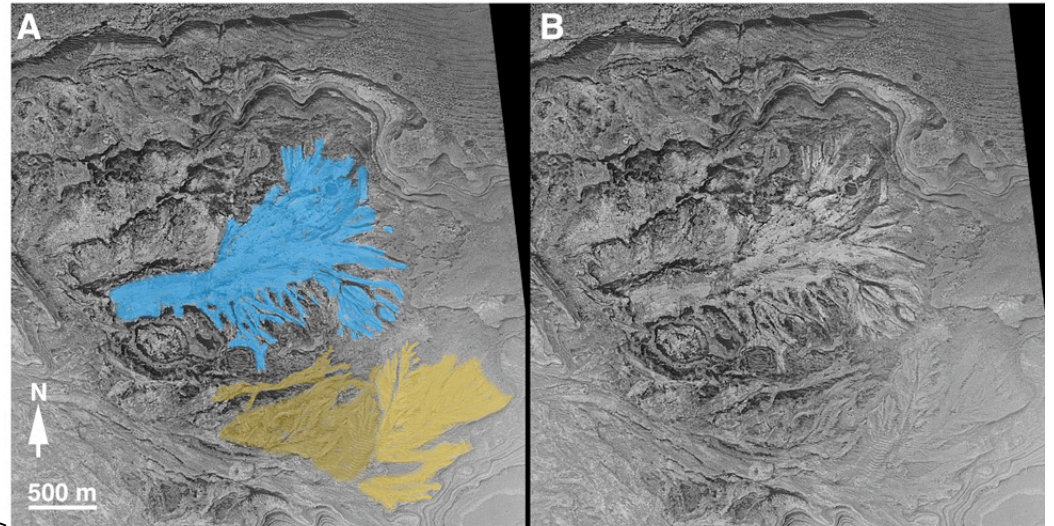
Features just outside the landing ellipse but within driving distance for analyses

- A deep depression to the west of the ellipse reveals two fan-shaped forms, apparently distributary depositional fans, at different levels within the strata [Williams et al., 2005].
- In another location to the west of the ellipse are steeply inclined beds bounded by geometric discontinuities that have been interpreted as clinoforms, fan delta deposits, and a channel-levee system similar to terrestrial deposits [*Dromart et al.*, 2007].
- Folded beds are also present in the northwestern portion of the Melas paleolake.

Depositional Fans just to West of Landing Ellipse

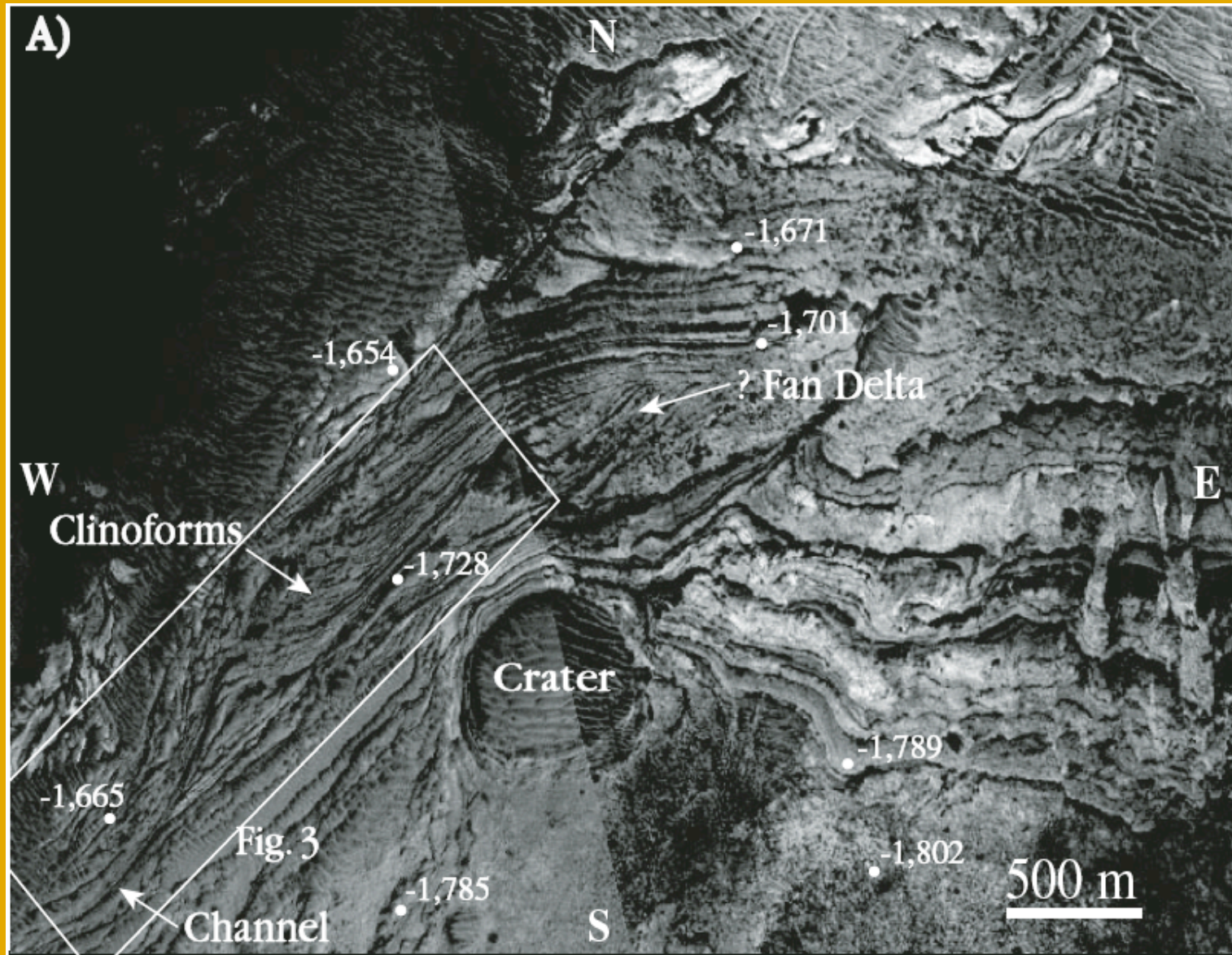


Depositional Fans were buried then exhumed



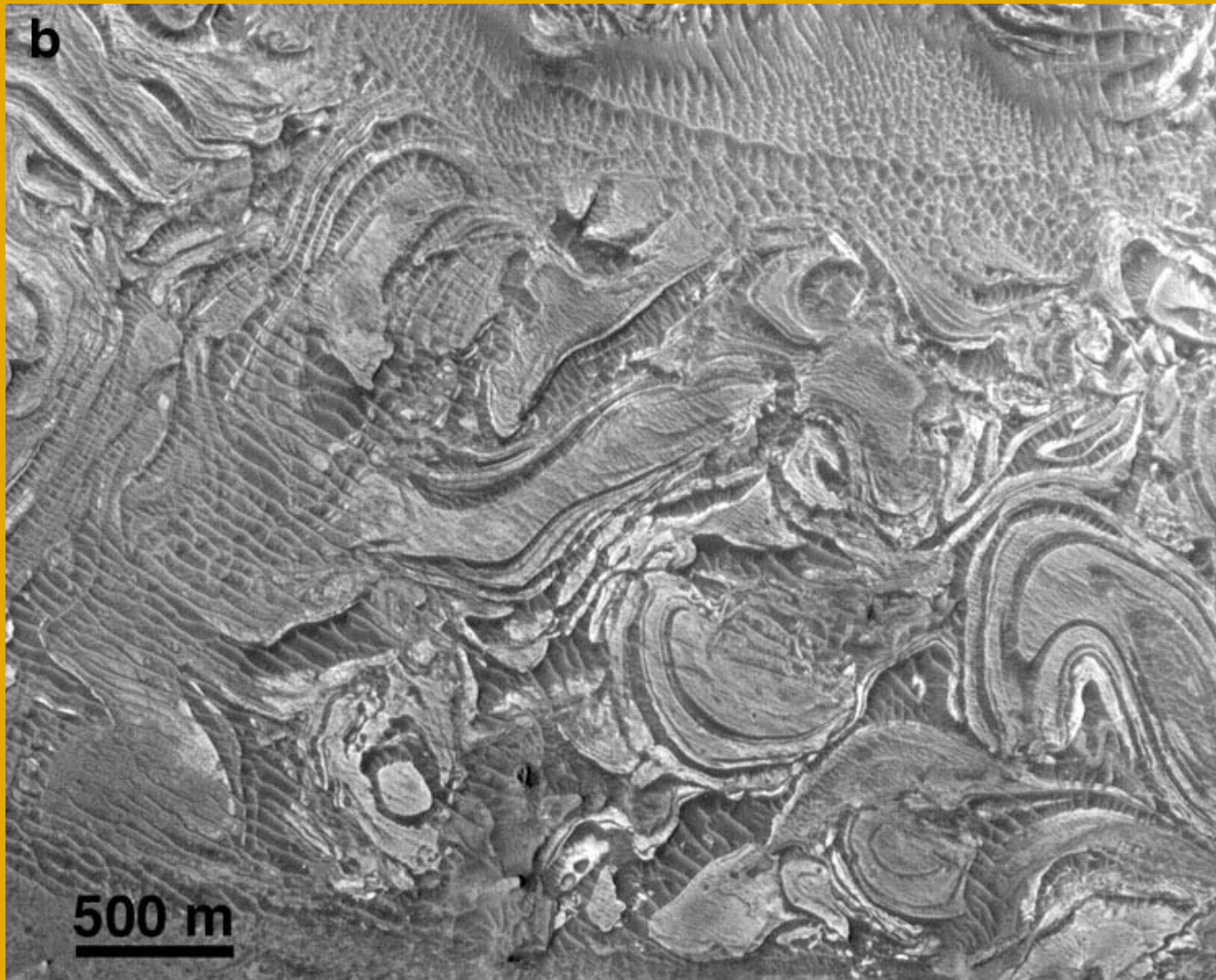
From www.msss.com

Depositional fans could be alluvial or deltaic
and
could be evaluated during MSL traverse



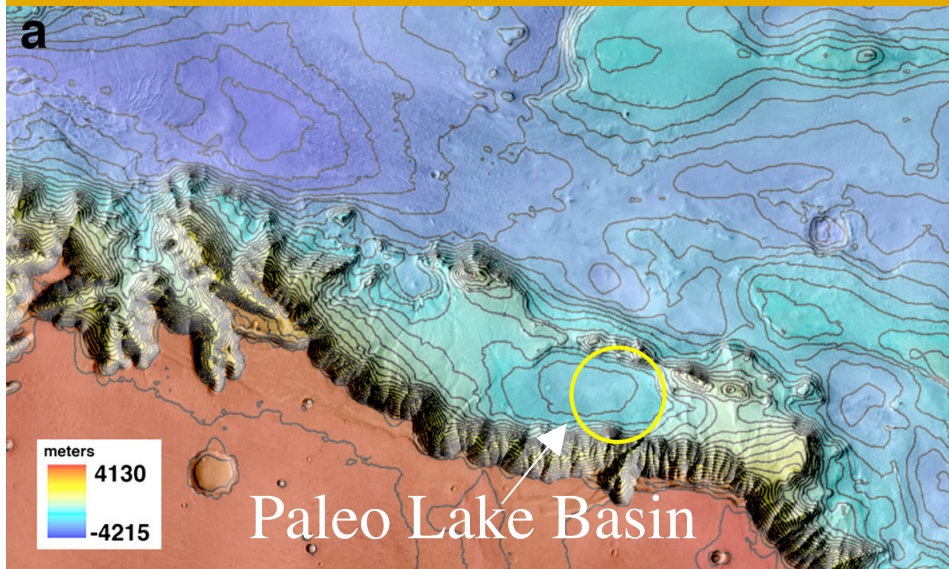
Climoforms, fan delta, and channels in Figure from Dromart et al. [2007]₁₃

Folded beds just to NW of landing ellipse

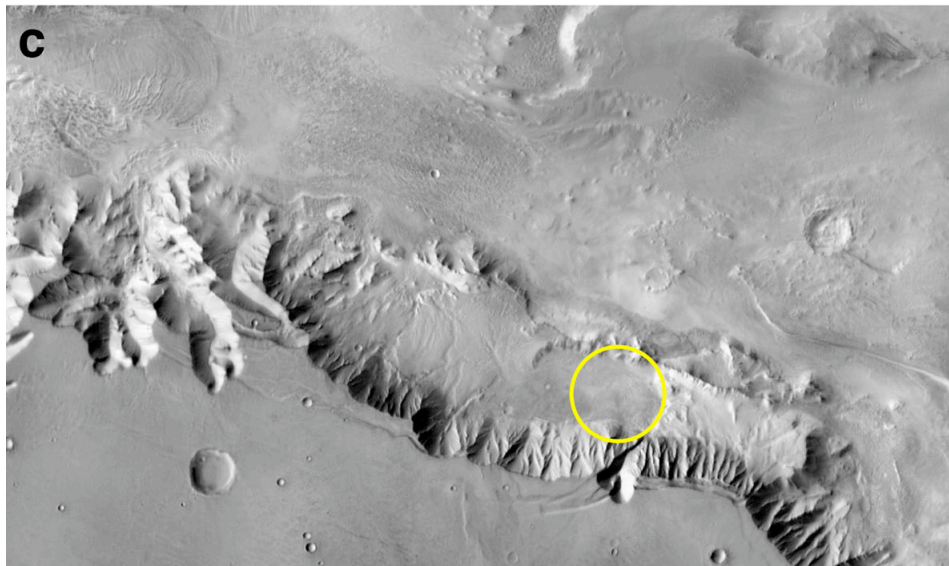
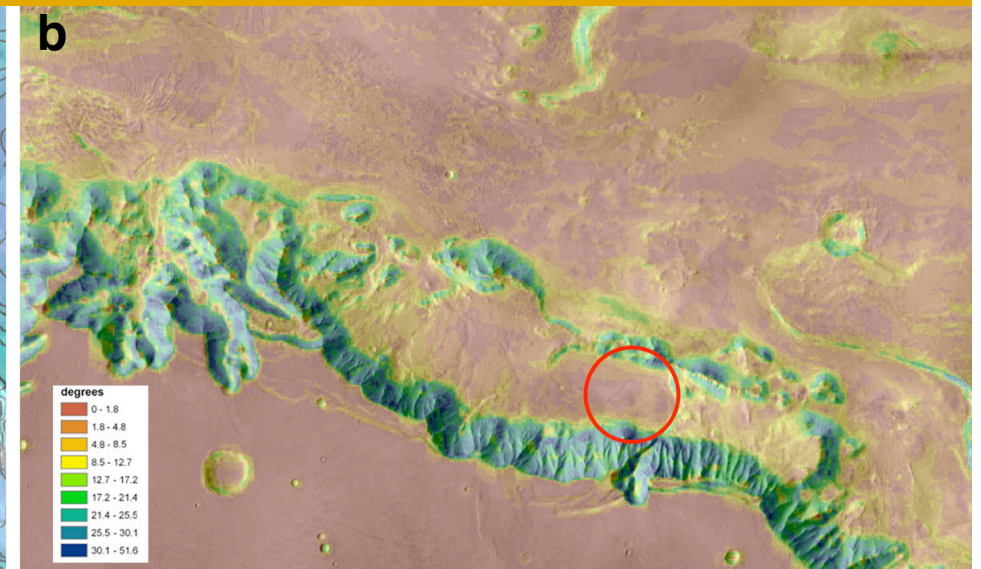


Explore nature and of folding to understand origin and apply to other locations in Valles Marineris where folded beds are exposed

(a) MOLA topography



(b) MOLA-derived slopes



(c) THEMIS daytime IR mosaic

(d) THEMIS nighttime IR mosaic

Ellipse is Relatively Dust-Free and not too Rocky

SUMMARY

- Site is located on the features of interest (lake bed sediments) so won't have to land rover nearby then drive to them like other proposed sites.
- Outside the ellipse are more science targets for analyses (folded beds, depositional fans, clinoforms, sulfates, valleys).
- Landing inside Valles Marineris would be exciting for all and offer spectacular views of the canyon.
- Could answer questions about how light-toned layered deposits within Valles Marineris formed, what caused folding, what is wallrock.
- Habitable environment in the Hesperian would meet science objectives for MSL mission.
- Recognize that ellipse is currently too large to meet safety requirements-- BUT, on MER mission the ellipse shrank over time so perhaps engineers can reduce ellipse size for MSL and make it fit here

