Geology & Planetary Mapping
Winter School

"Geological map of the Cerberus fossae's lava flows (Elysium) and their interpretation and implications “

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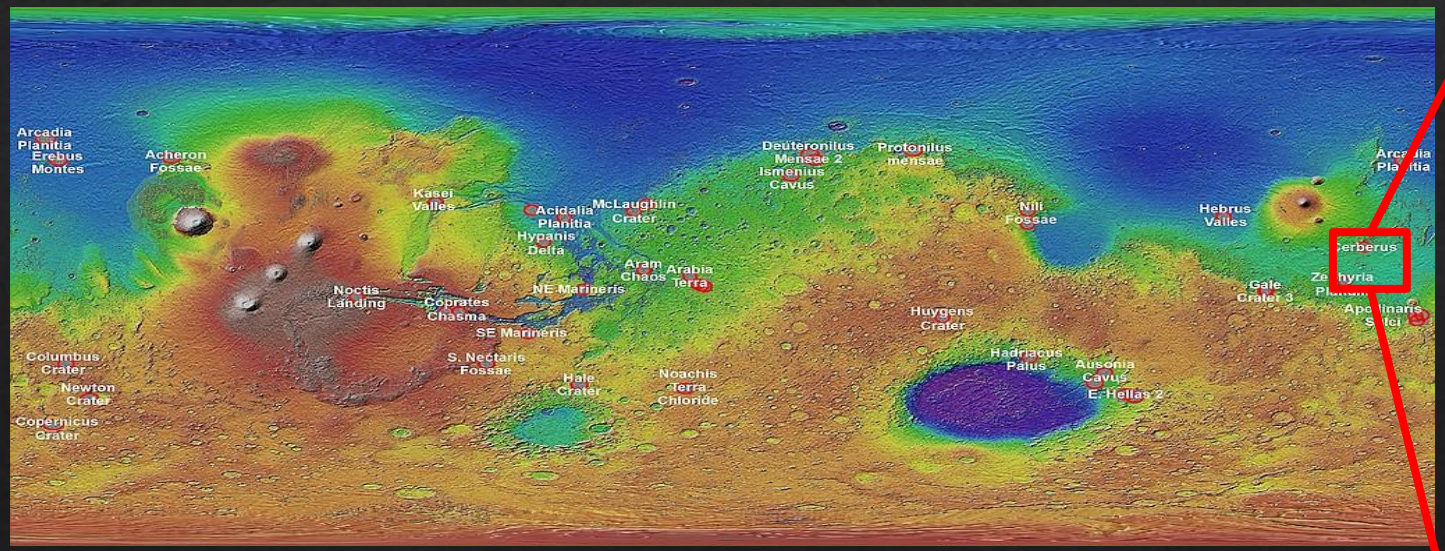
INTRODUCTION

- Mars ***is an enigmatic planet;***
- ***A lot of*** **opened** ***questions have been not actually solved about a lot of areas ;***
- ***Cerberus fossae area → complex geological history;***
- ***Geological map useful for to update the point of view about interpretation of this area → map with high detail from the cartography point of view;***



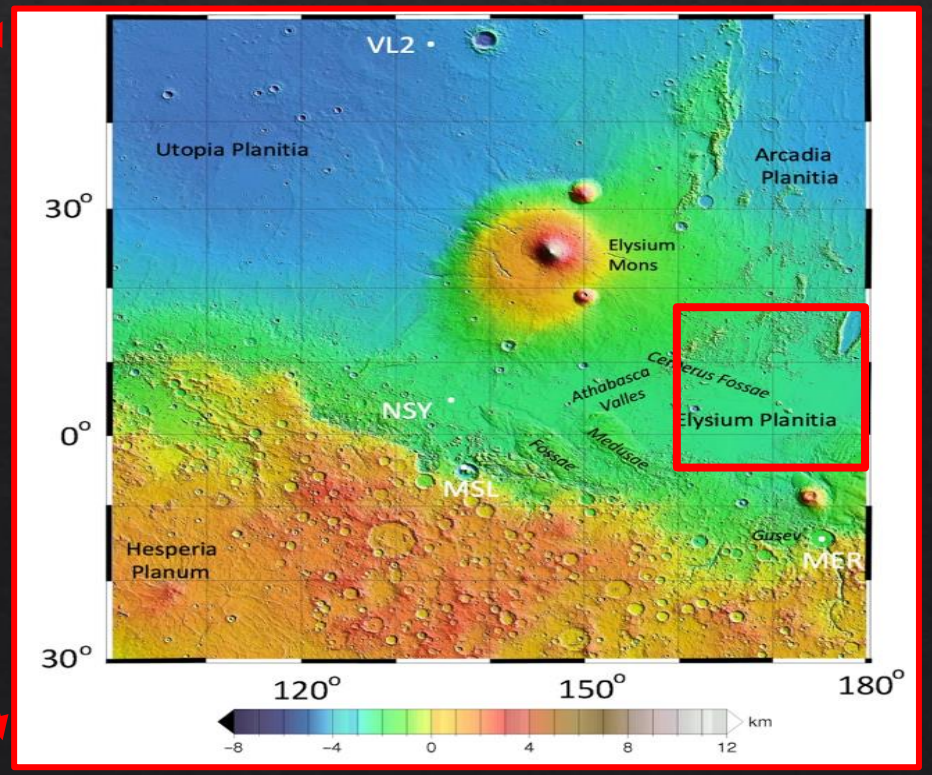


Fig.1 (left)Location on a global map of Cerberus Fossae https://astropedia.astrogeology.usgs.gov/download/Mars/MarsReconnaissanceOrbiter/CTX/HumanExplorationZones/thumbs/AA_CTX_Human_EZ_sites_1024.jpg

Fig.2 (right) Area in detail from Golombek, M., Warner, N.H., Grant, J.A. *et al.* Geology of the InSight landing site on Mars. *Nat Commun* 11, 1014 (2020). https://doi.org/10.1038/s41467-020-14679-1

DATA

Product Id- CTXs
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B17_016466_1859_XN_05N187W
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B20_017534_1851_XN_05N185W
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G05_020158_1855_XN_05N183W
G05_020369_1837_XN_03N184W
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G23_027160_1831_XN_03N186W
P15_006880_1859_XN_05N187W
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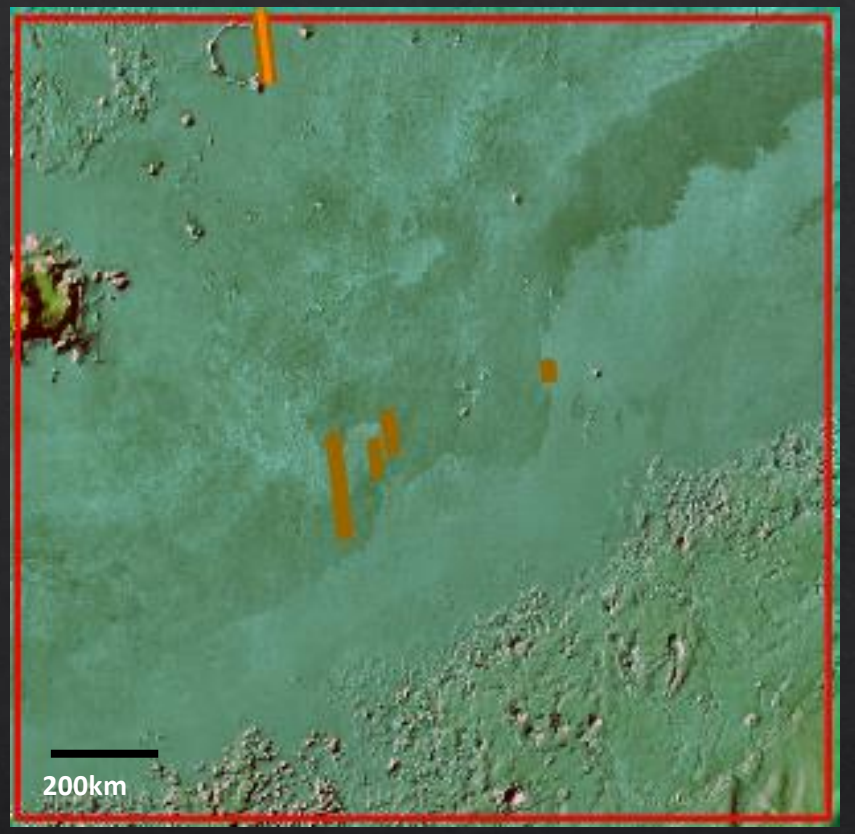


Product ID- Hirise
ESP_028004_1825_RED
ESP_029771_1825_RED
ESP_033463_1820_RED
ESP_030483_1830_RED
ESP_016255_1850_RED

- CTXs images → 6 m/p
- Hirise images → 0.3 m/p

Supporting data:

- Themis IR (Day and Night) → 100 m/p

PILOT

USGS science for a changing world

https://pilot.wr.usgs.gov/

- Murray Lab's CTX global map

http://murray-lab.caltech.edu/CTX/

CERBERUS PLAINS' LAVA FLOW

(N -0.07/5.03, E171.8/177,2)

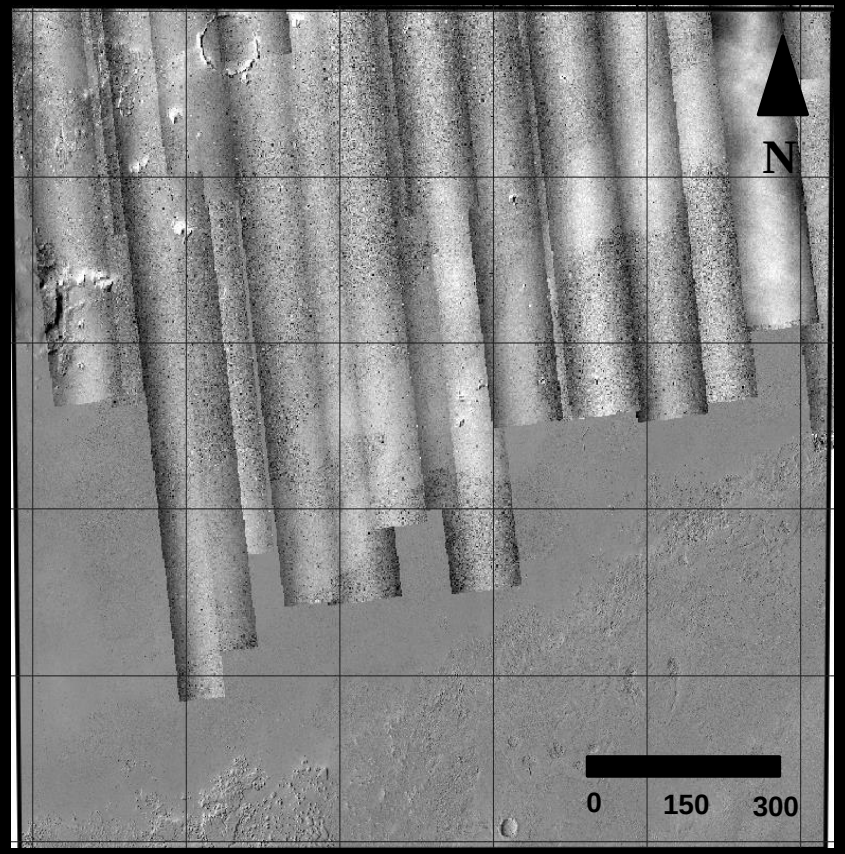


Fig.3 → CTXs + Murray lab's CTX global map

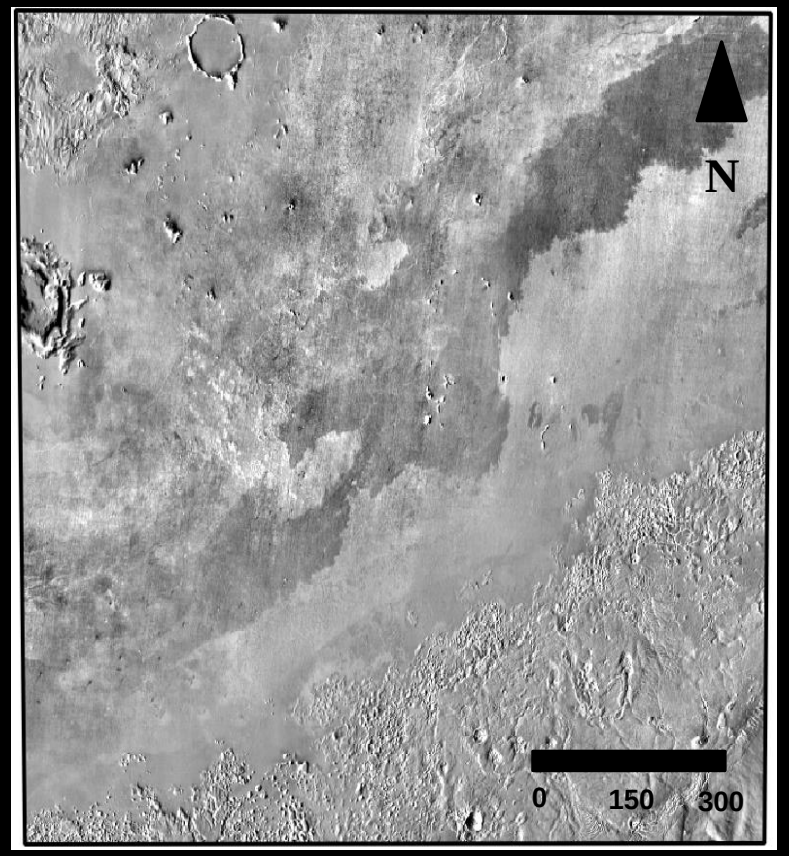


Fig.4 →THEMIS IR-DAY

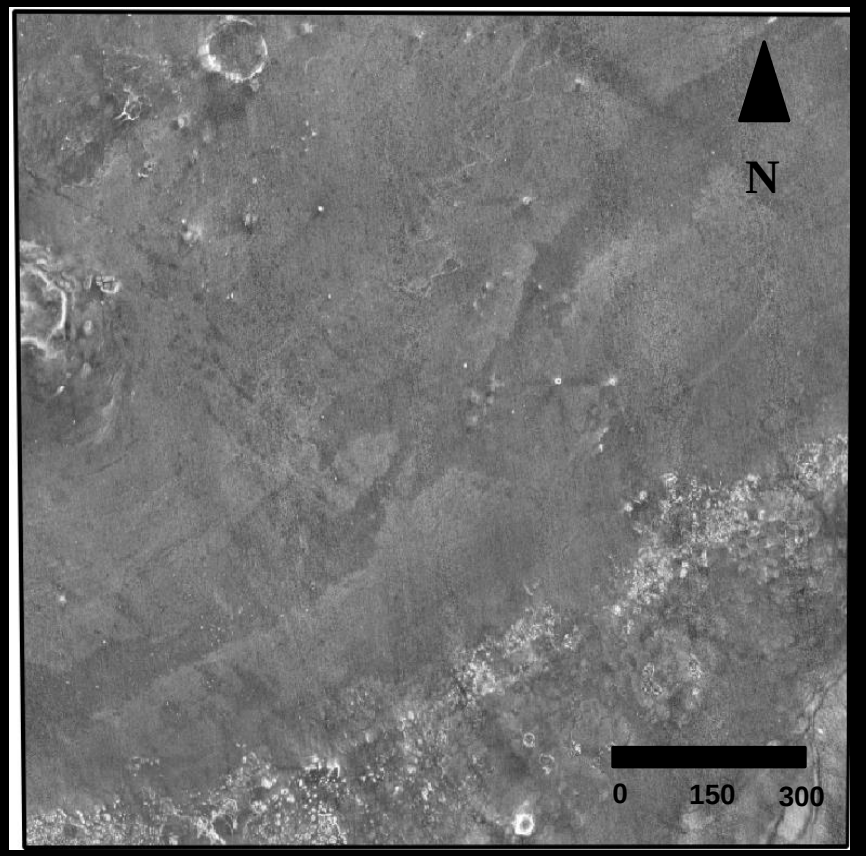
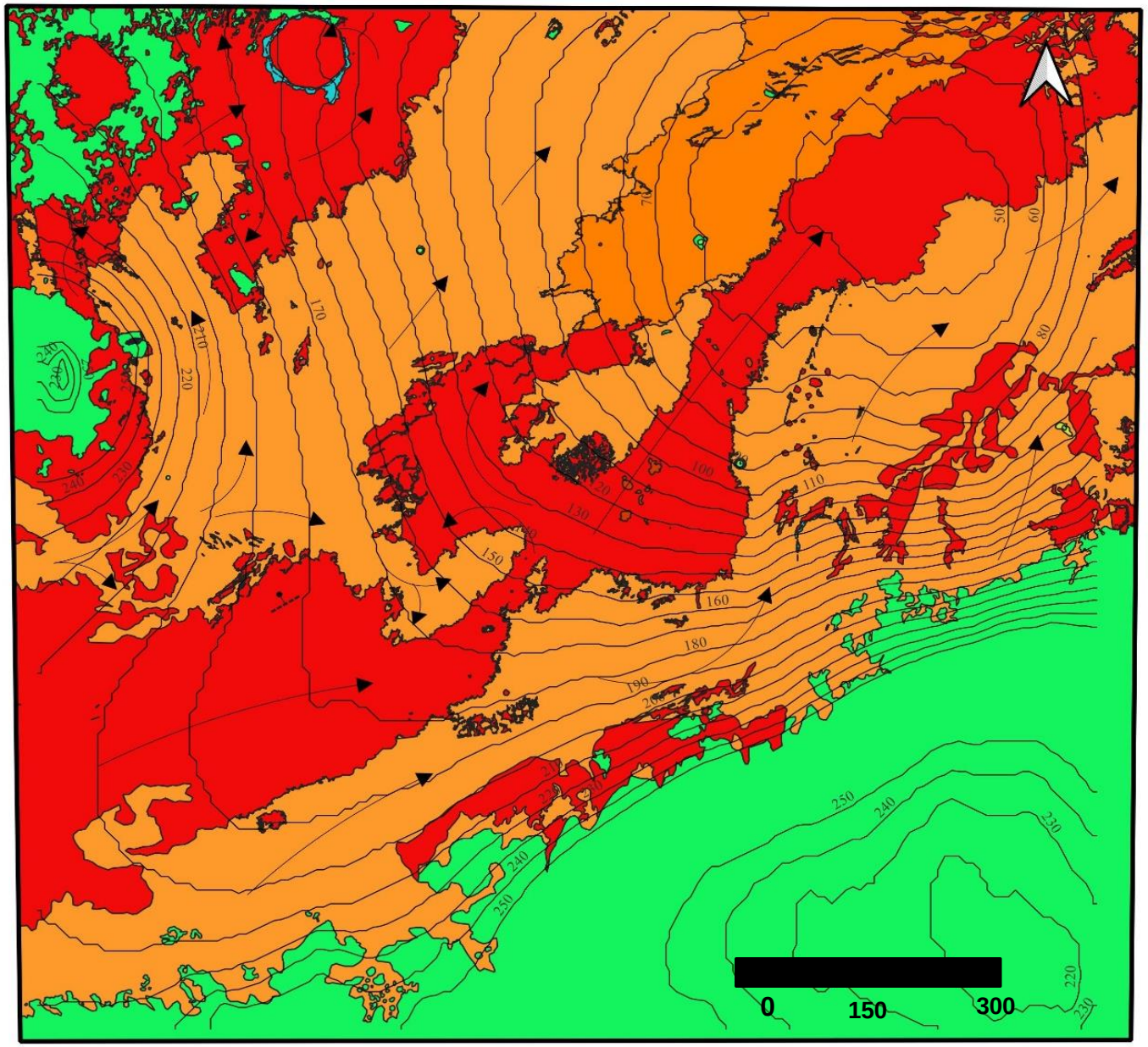


Fig.5 → THEMIS IR - NIGHT

Geological map of Cerberus plains 'lava flows



LEGEND

Study Area

- Study area

Topography

- Countours

Geology

Linear structures

- Crater's rim
- Lava flow direction
- Impact crater
- Gravitational spreading

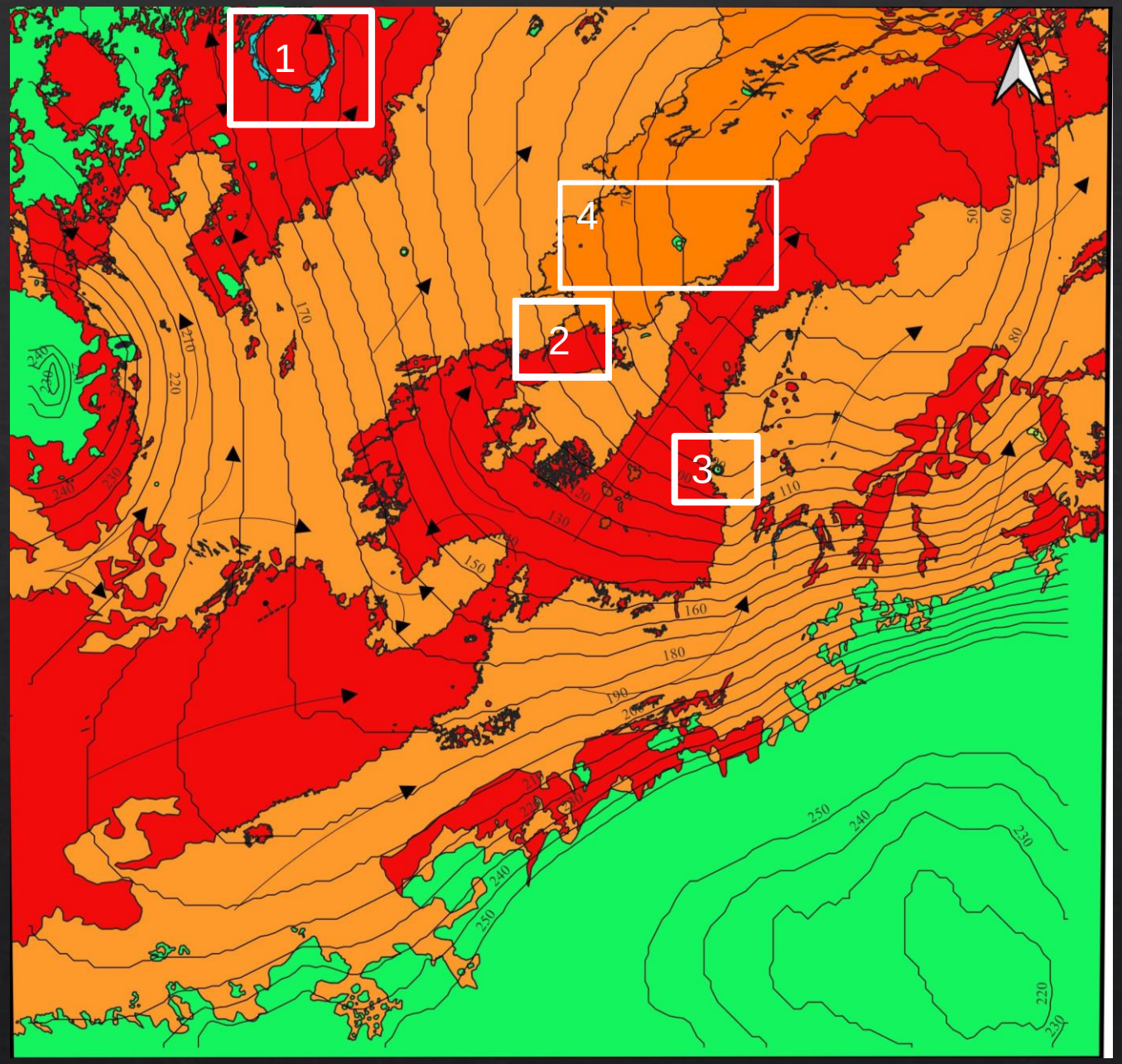
Main units

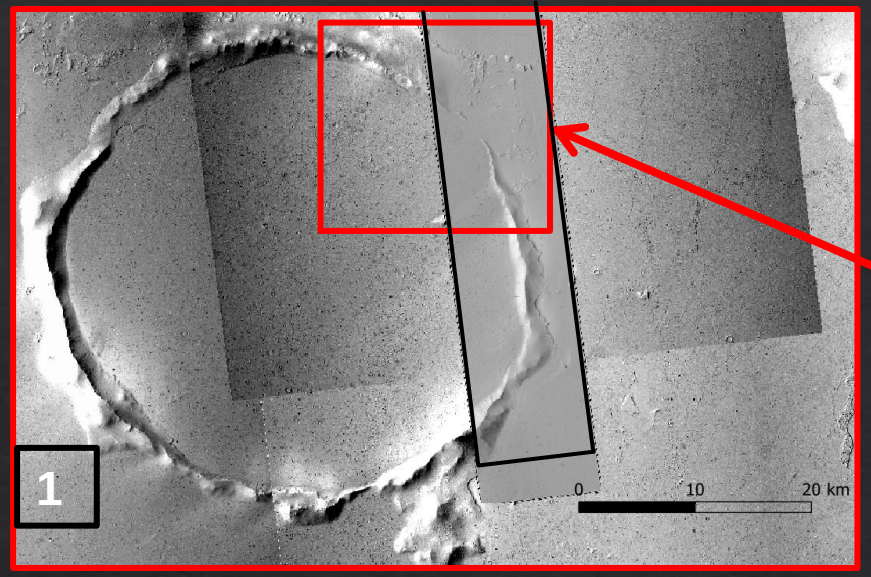
- Unit 2
- Unit 1
- Highlands
- Unit 3

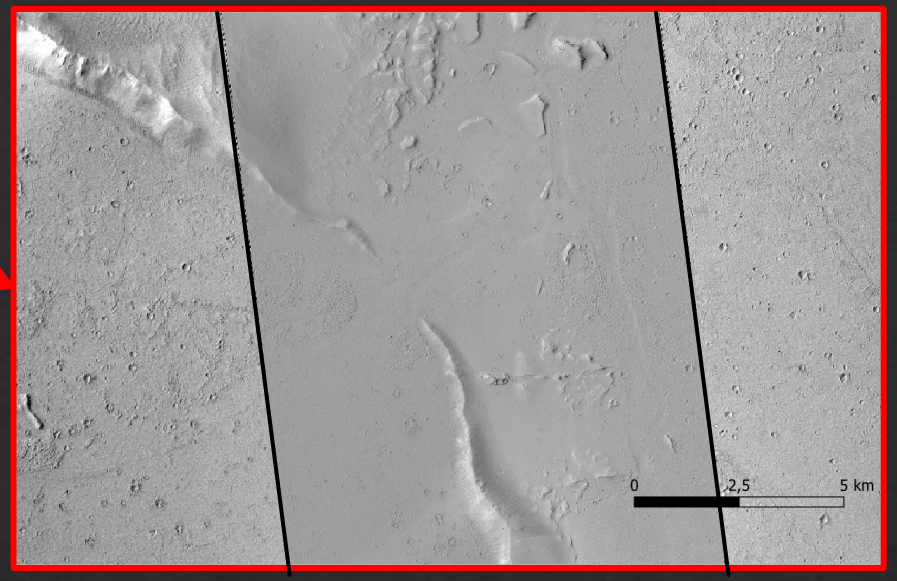
Secondary units

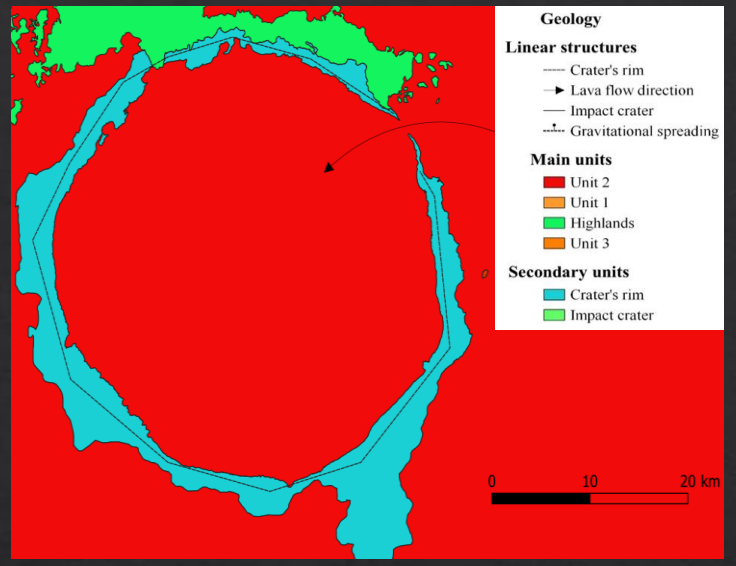
- Crater's rim
- Impact crater

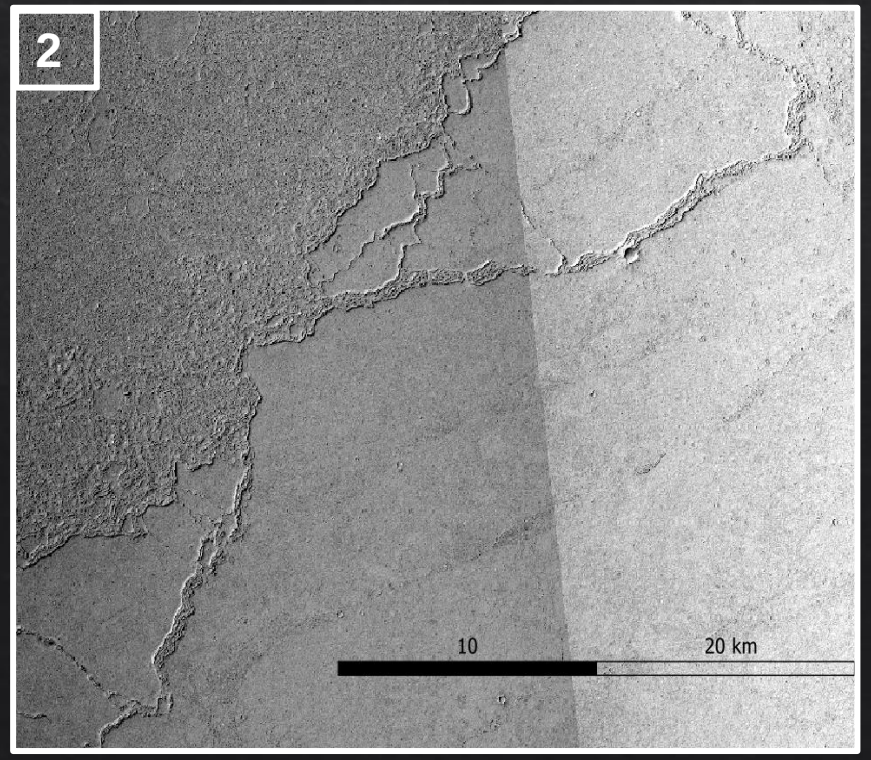
KEY AREAS

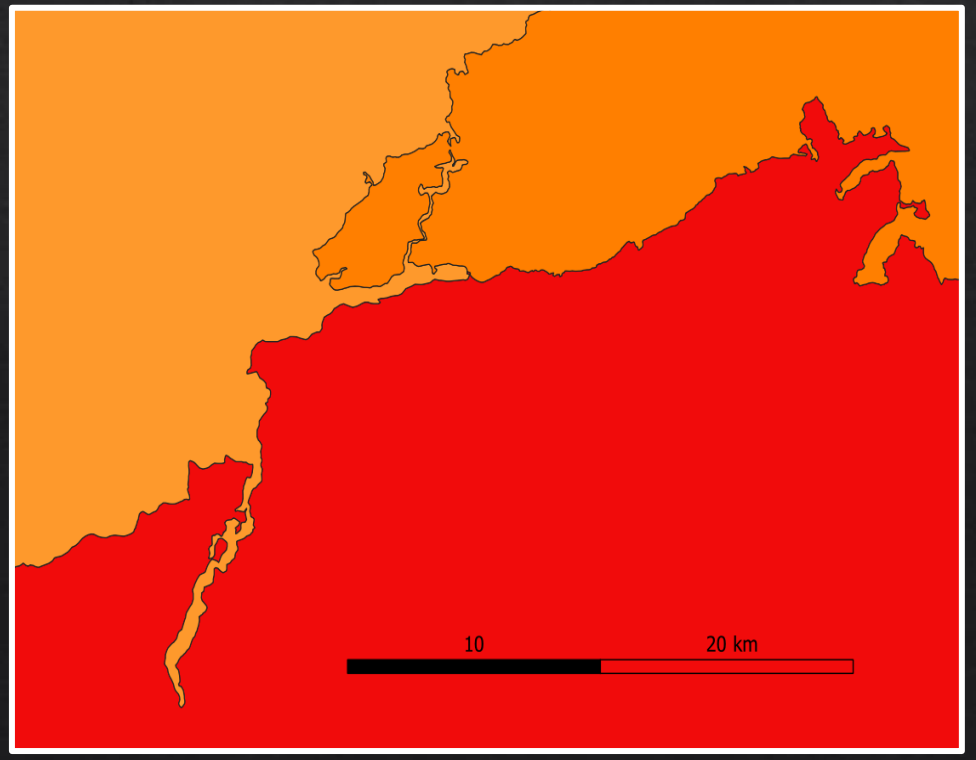






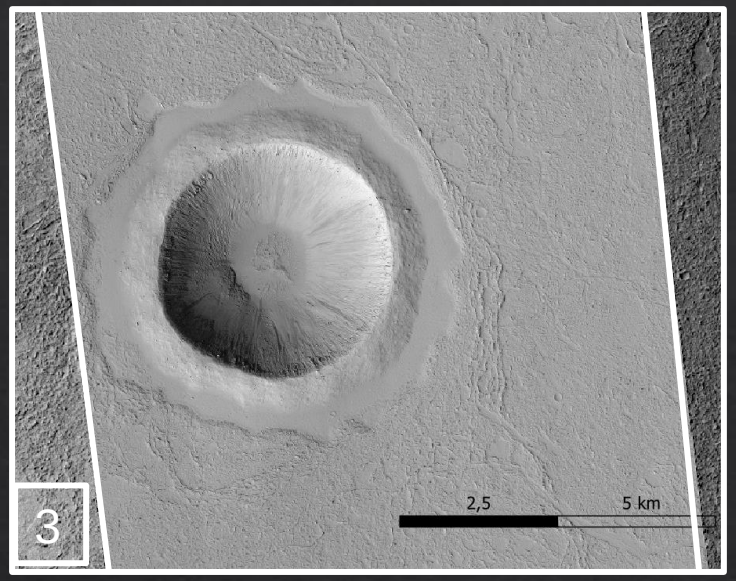






- Fig.6 A, B, C In the top → Reference Hirise ESP_016255_1850_RED → N 4.813, E 173.27952 → crater filled with lava flows; Not exclude the possibility also of water – lava interaction;

- Fig.7 A, B in the bottom →N3.43704,E174.56133 → volcanic ridges → due to interaction and collisions of lava flows
  Reference CTXs:
  G21_026527_1828
  B20_017534_1851
  F20_043630_1858
  D02_028004_1840



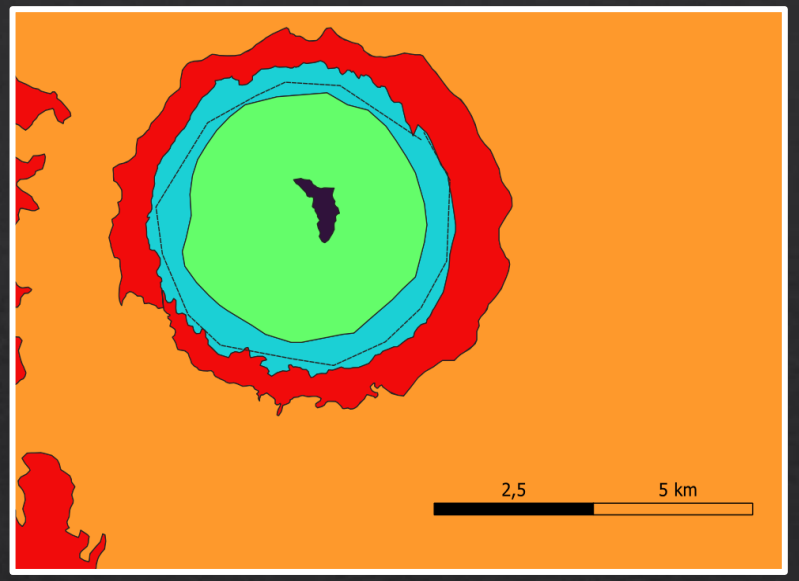
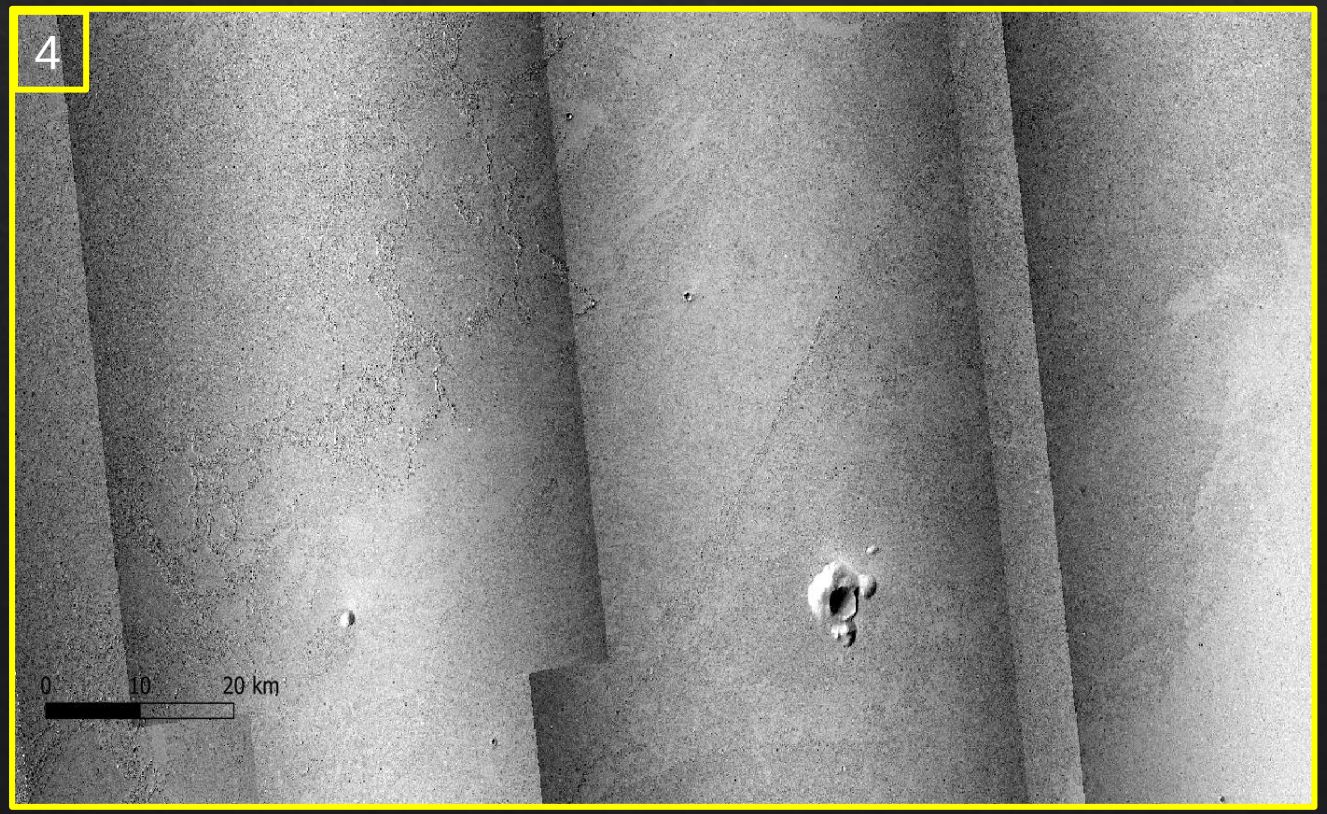
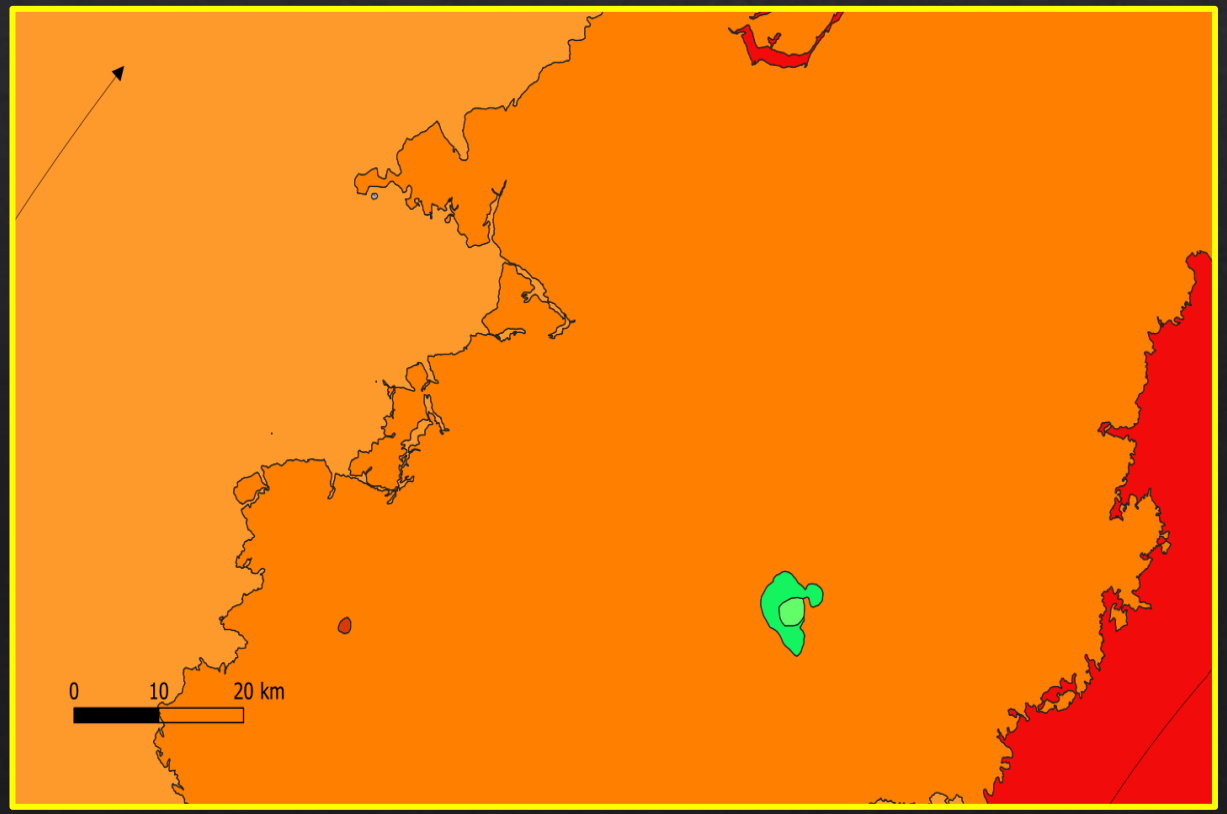


Fig. 8 A, B→ Hirise ESP_030483_1830_RED
Evidence of crater filled with volcanic materials and then subsequently, interested by eolian processes

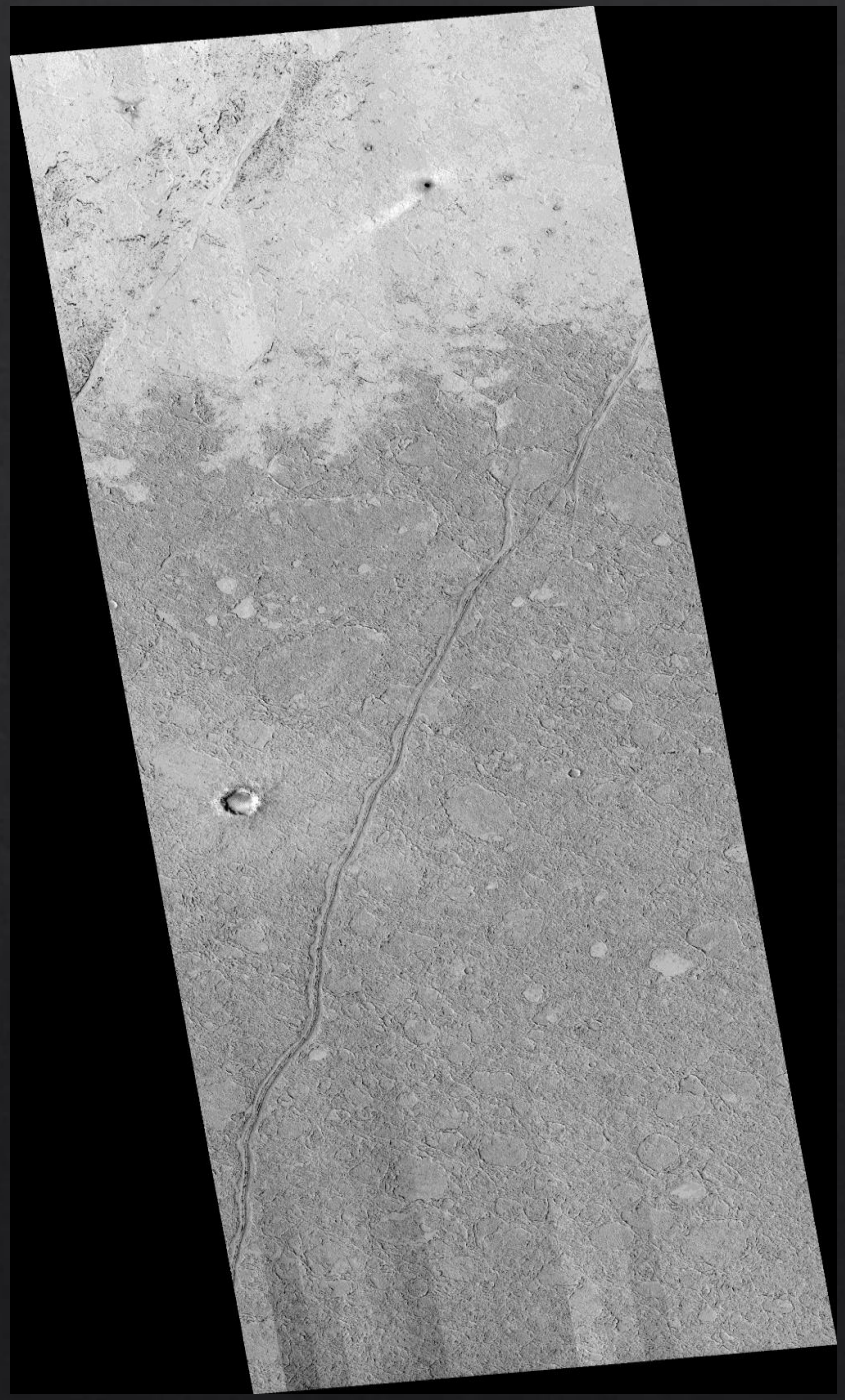
Fig. 9 A, B →Under, at N 3.9512, E174.9095, transiton area where various lava flow contact → mixed features.
CTXs :
G21_026527,
B05_011732_1852,
B20_017534_1851;





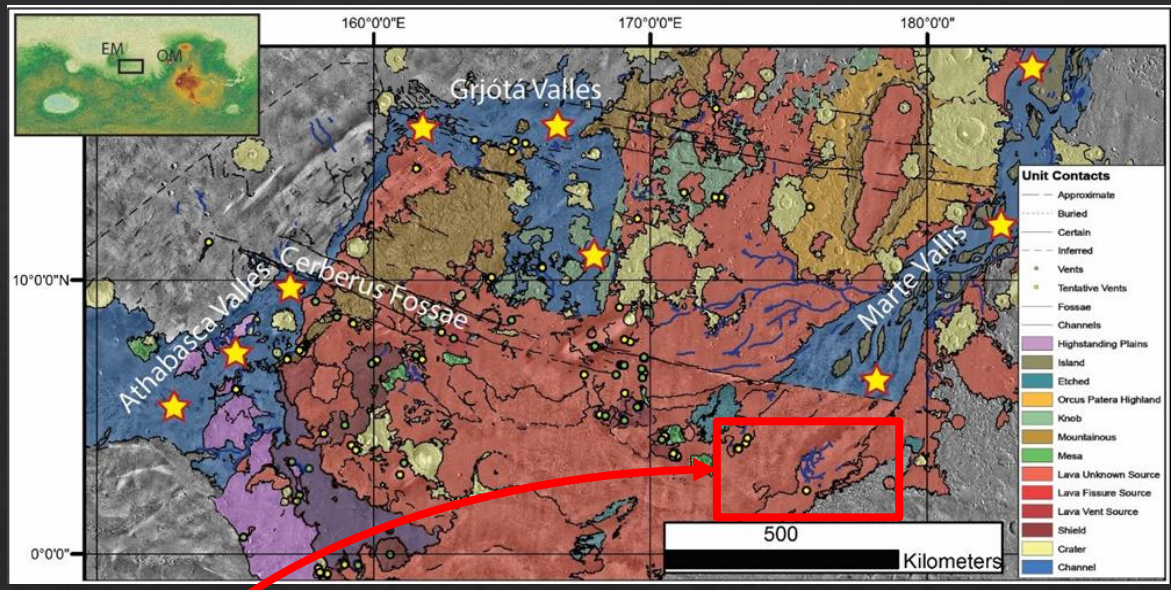
HIRISE IMAGE REQUESTED BY ME PERSONALLY

- ID: ESP_076005_1835;
- Geographical coordinates: N 3.557°, E 175.870°;
- Possible volcanic feature or tectonic feature;
- Possibility to see in detail portion of the lava flows and analyze parameters as: roughness, porosity (if possible) etc;
- Linear feature → dyke?, fault? → difficult interpretation;
- A lot of these linear features are present inside the area;



IMPLICATIONS AND OPENED QUESTIONS

- The region has been interested from lava flows and not only… probaly also water…
- Is an active region? → maybe → Insight detected most tectonic activity in the area;
- Youngest lavas → Amazonians → covered a large area until Amazonis Planitia;
- Could be a potential landing sites? If there are requirements for landing obviously;
- Updating of the geological maps of the other surrounding areas could provide new useful information to study even more in detail the whole area of Cerberus fossae;
- Possibility to apply other mineralogical methods and in the future, have also a simple of these lavas for to observe in laboratory (considering the advance of space technology about taking martian samples);



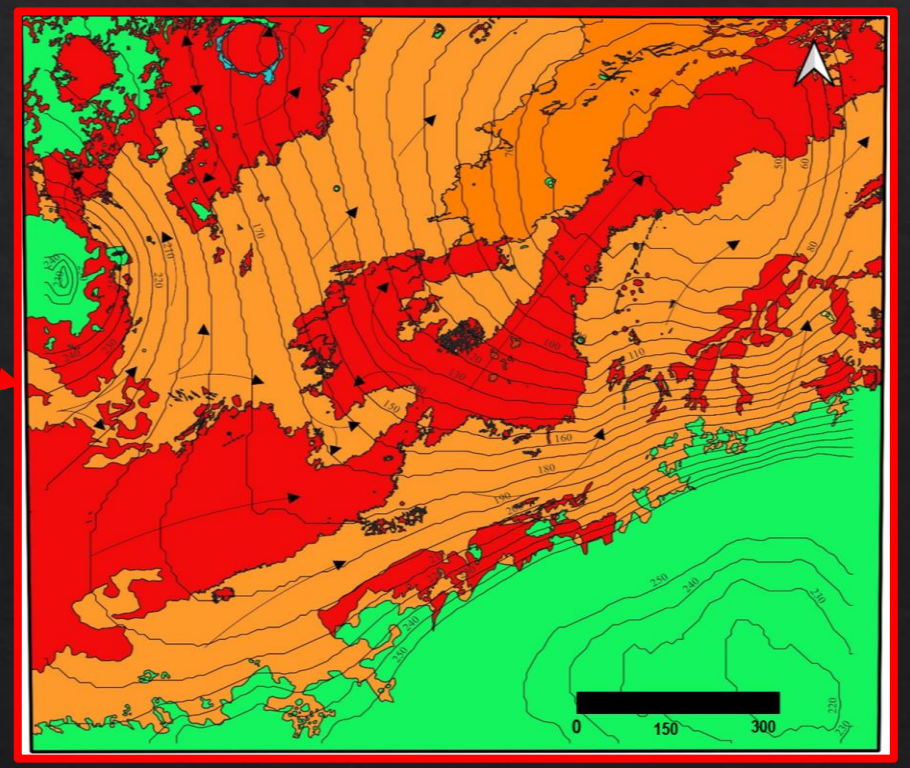


Fig.10 Golder K.B. et al.(2016) → on top-right → geological map of the total area

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