

Geomorphological characterization and mapping on Martian rock glaciers

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Introduction

Viscous Flow Features (VFFs) are debris-covered icy landforms predominantly located at Martian mid-to-high latitudes ($>45^\circ$). They exhibit high water-ice content, distinctive downslope flow patterns and heterogeneous surficial deformation structures [1]. A specific sub-category is **Glacier-Like Forms (GLFs)**, which display surface lineations, crevasses, and moraine-like ridges [2], closely resembling terrestrial valley and rock glaciers (**see Poster F2.28**).

On Earth, **valley and rock glaciers** are composed of permafrost or frozen debris driven by cohesive downslope movement, and have a periglacial origin [3].

Overall, these features on Mars act as key indicators of paleoclimate and represent potential water reservoirs for future human missions. *In this work, we aim to understand their formation, long-term evolution and current activity state.*

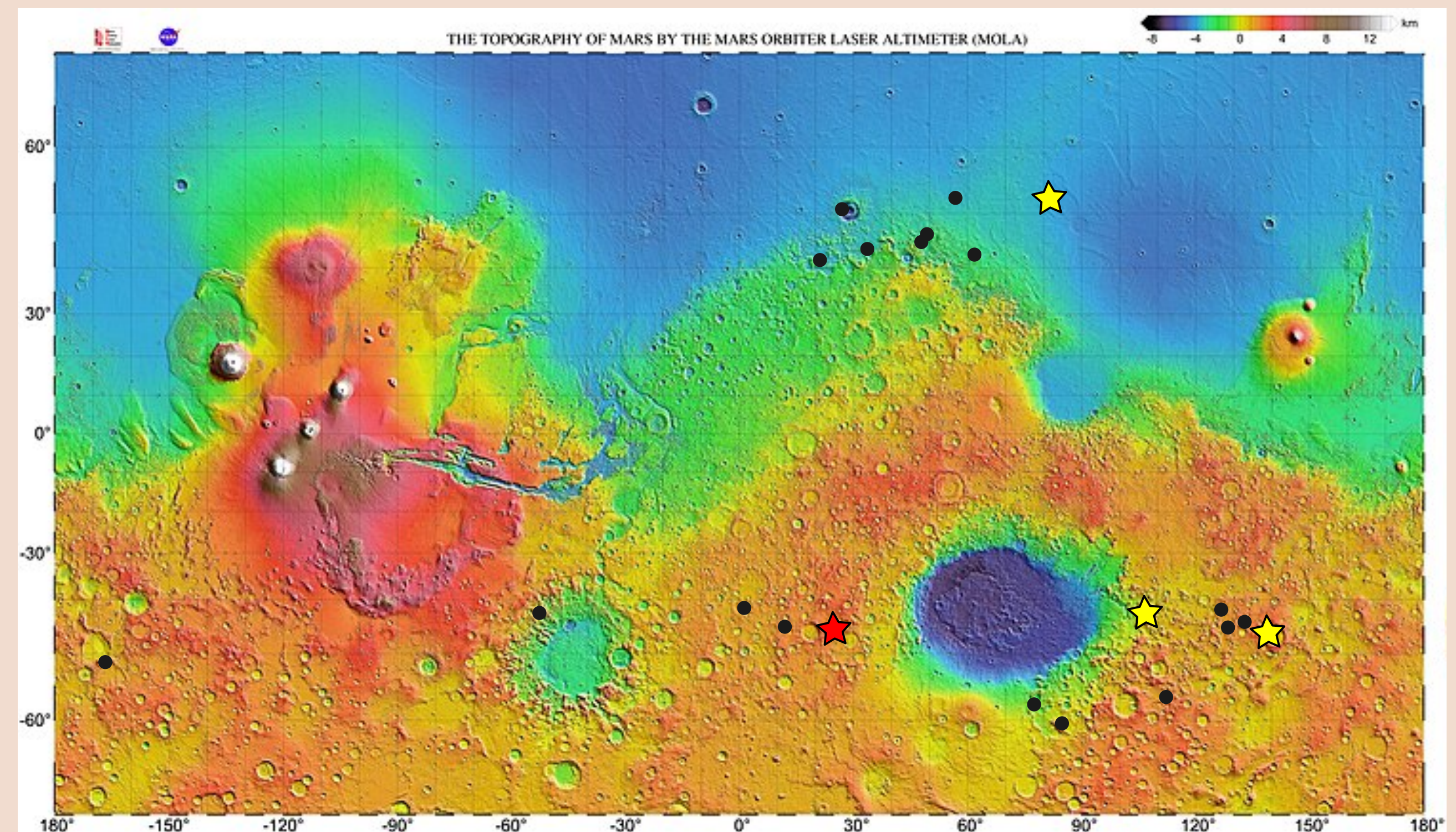


Fig. 1. Global distribution of Martian rock glaciers (black dots). Stars indicate the locations of the geological maps: red star is related to geomorphological map done by Bertoli et al. [7], yellow stars are geomorphological maps shown here.

Methods

- global database → global statistical analysis
- selection of representative targets
- detailed geomorphological maps

Datasets

- HiRISE: high-resolution images and DTMs [4]
- CaSSIS: colored, stereo high-resolution images and DTMs [5]
- CTX: regional context [6]

Aims

- morphologic and geologic processes
- degradation patterns
- geological context

Fig. 2. Geomorphological map of Renaudot Crater (42°N , 62°E).

The glacial features are covered by talus deposits. Both rocky and icy materials start to flow downslope. Crater floor is characterized by rough material and polygonal terrain, locally overlapped by smooth units.

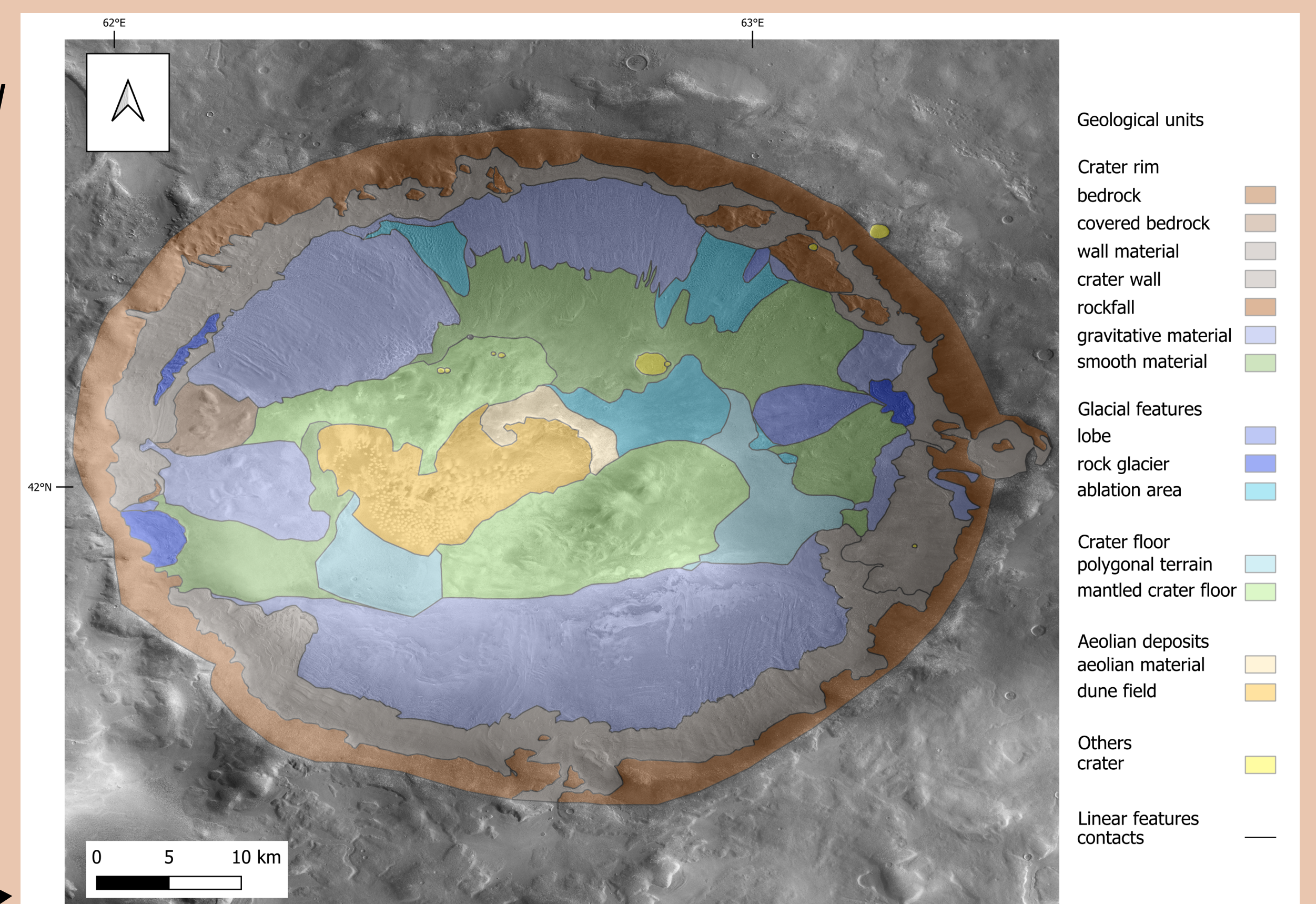


Fig. 3. Geomorphological map of an unnamed crater near Kepler Crater (45°S , 138°E).

It has more glacial landforms than Renaudot Crater, but it shows the same geomorphological sequence of glacial features.

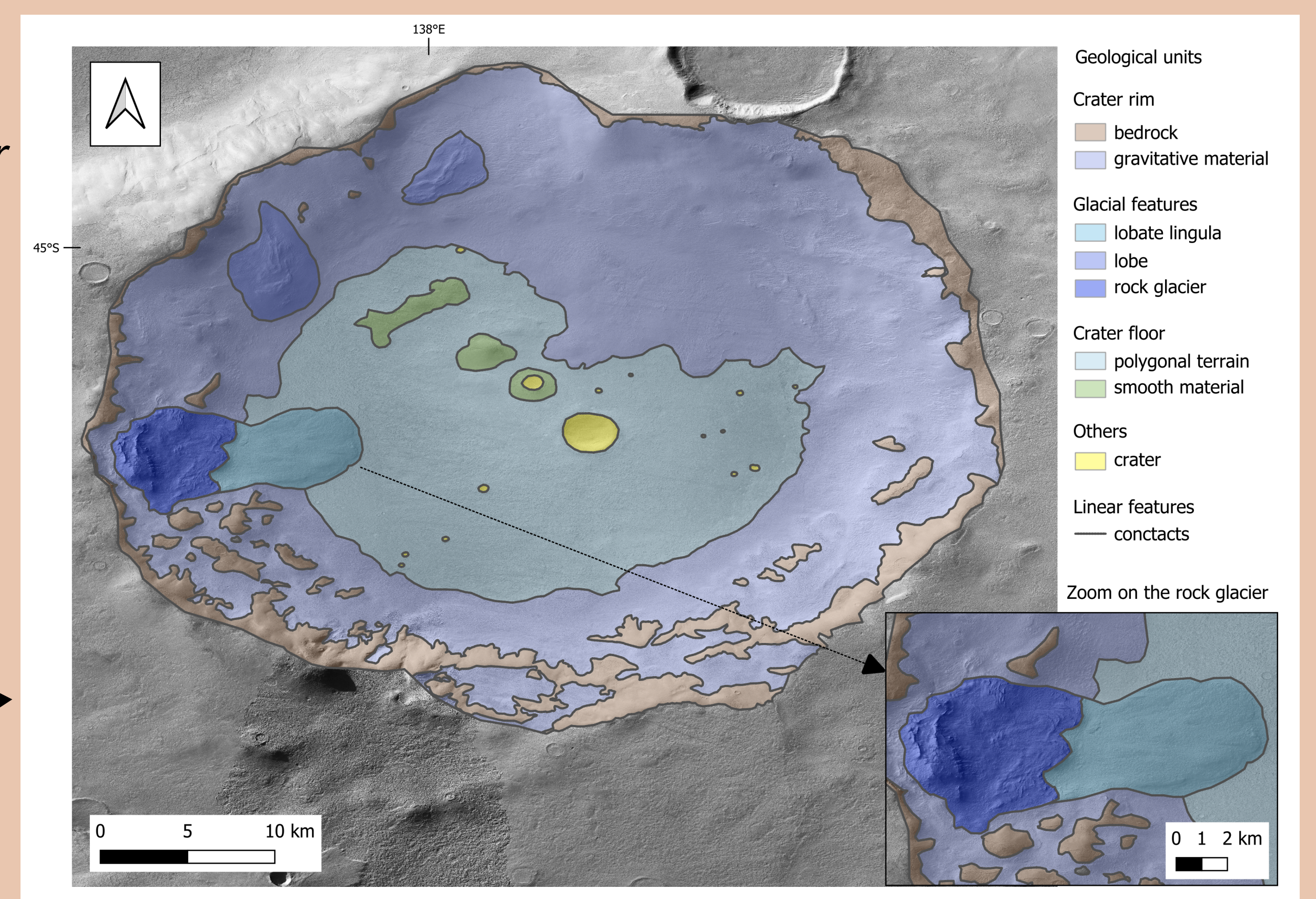


Fig. 4. Geomorphological map of two montes near Reull Vallis (41°S , 104°E).

They display the same geomorphological sequence of glacial features as the other sites, with no significant differences observed between the montes and the craters.

References

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Acknowledgements

This work has been developed under the INAF-OAPD fellowship within CaSSIS TGO e MARSIS MEX projects and the ASI-INAF agreement n. 2024-40-HH.0.

Conclusions

Martian rock glaciers show a clear concentration at middle latitudes ($\sim 45^\circ$) in both hemispheres, suggesting possible spatial clustering (see Fig. 1). Furthermore, these landforms are predominantly located within impact craters, although they are not strictly crater-exclusive.

Next steps

- CRISM surficial analysis for water-ice exposure
- SHARAD subsurface analysis for water-ice thickness estimation
- acquisition of CaSSIS data and stereo pairs of other targets
- crater counting and age determination of geological units
- study of ice preservation and climate variations