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Discontinuous valley networks on Mars: A comparative survey

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1. Introduction

Discontinuous channel and valley systems on Mars formed by fluvial processes [1, 2], snow pack melting [3], volcanic processes [4] are found in several places on Mars, but are not typical for channel or valley systems. We have previously investigated Navua Valles, a relatively pristine system where we identified several discontinuities. Discontinuities may form in regions where water infiltrates and is transported in the subsuface in permeable layers until they outcrop at the surface further downslope where the channel continues. Discontinuous-born systems may form in several settings including arid climates and in lava flows. Two examples are the Mojave River [5, 6] and the Lost Rivers of Idaho [7].

However, other workers who also identified discontinuities along long channel and valley systems inferred that those systems were once continuous [8]. Post-formation discontinuities may form by the infilling or removal of channel segments. Such processes include impact cratering where the impact crater removes the channel or nearby ejecta covers it; lava flows that are thick enough to mask the underlying topography; and debris flows that fill or overfill some parts of a channel or valley. Discontinuous channel systems may also form when the channel is formed in variably erodible layers, where the this material is partially removed, or on ice where the channel is partially carved into the sediments but in some segments its channel is entirely cut into the ice or similar ephemeral materials. Lakes with in and outlets also cause discontinuous channel pattern [9].

2. Global survey

We have surveyed the most up-to-date valley network polyline database of Mars [10, 11] and identified 11 valley networks where the map shows discontinuous line segments. We survey these systems to identify the causes of discontinuities (Figs 1-5). These valley network are typically significantly more degraded than the Navua Valles channels. We plan to exclude impact-related discontinuities and focus on discontinuities that are potential sites of infiltration. We also plan to create a database of river discontinuity sites on Earth that would include sites that are listed as potential causes for discontinuities on Mars.

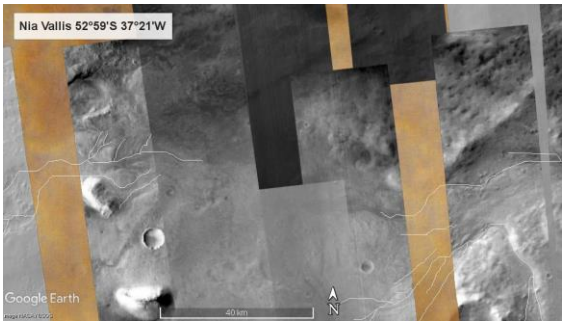

Fig. 1. Nia Vallis. Figures are from Google Mars CTX mosaic with HRSC fill.

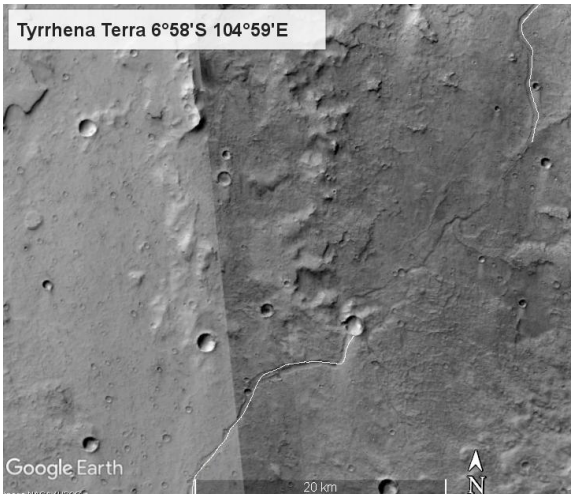

Fig. 2. Tyrrhena Terra: 6°58'S 104°59'E

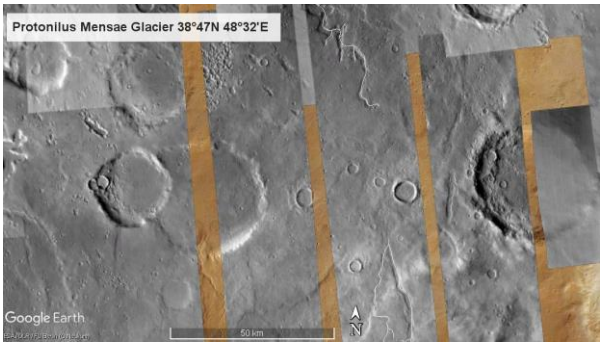

Fig. 3. Protonilus Mensae: Discontinuous channel probably related to glaciation

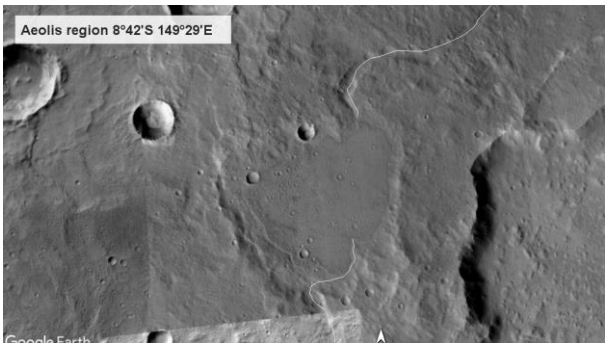

Fig. 4. Aeolis region. Discontinuous channel within a slight depression possibly related to glaciation

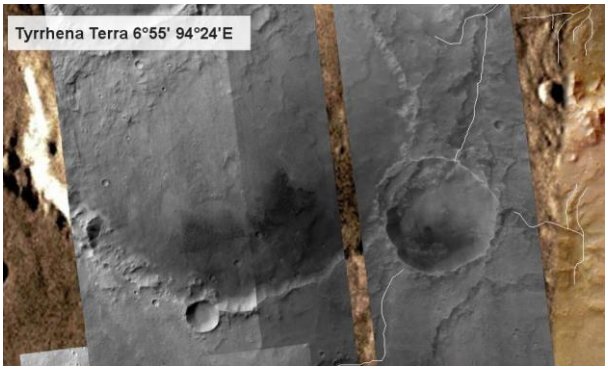

Fig. 5. Tyrrhena Terra. Discontinuous channel segment at an impact crater

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References

[1] Hargitai, H., Gulick, V., Glines, N., 2017. Discontinuous Drainage Systems Formed By Precipitation and Ground-Water Outflow in the Navua Valles and Southwest Hadriacus Mons, Mars. Icarus. doi://10.1016/j.icarus.2017.03.005

[2] Hargitai, H.I., Gulick, V.C., Glines, N. 2019 Evolution of the Navua Valles Region: Implications for Mars' Paleoclimatic History. Icarus, in press.

[3] Wilson, S. A., Howard, A. D., Moore, J. M., Grant, J. A. 2016. A Cold-Wet Mid-Latitude Environment on Mars during the Hesperian-Amazonian Transition: Evidence from Northern Arabia Valleys and Paleolakes. J. Geophys. Res. Planets, 121, doi:10.1002/2016JE005052.

[4] Hargitai, H.I., Gulick, V.C., 2018 Late Amazonian Aged Channel-and-Island Systems East of Olympus Mons, Mars. In: Dynamic Mars, Soare, R.J., Conway, S.J., Gallagher, C.J., Clifford, S.M., eds, Elsevier.

[5] Stamos, C. L., Martin, P., Nishikawa, T., Cox, B. F., 2001. Simulation of Ground-Water Flow in the Mojave River Basin, California. USGS Water-Resources Investigations Report 01-4002 Version 3 Sacramento, California

[6] Sharp, R. P., Glazner, A. F. 1997. Geology Underfoot in Death Valley and Owens Valley. Mountain Press Publishing Company Missoua, Montana, 9–19.

[7] Rathburn, S. 1993. Pleistocene cataclysmic flooding along the Big Lost River, east central Idaho. Geomorphology 8, 305-319.

[8] Mest, S.C., Crown, D.A., 2001. Geology of the Reull Vallis Region, Mars. Icarus 153, 89–110 doi:10.1006/icar. 2001.6655

[9] Hargitai, H.I. Gulick, V.C., Glines, N.H. 2018. Paleolakes of Northeast Hellas: Precipitation, Groundwater-fed, and Fluvial Lakes in the Navua–Hadriacus–Ausonia Region. Astrobiology, 18(12).

[10] Hynek, B. M., Beach, M., Hoke, M. R. T., 2010. Updated global map of Martian valley networks and implications for climate and hydrologic processes, J. Geophys. Res., 115, E09008, doi:10.1029/2009JE003548.

[11] Alemanno et al.: 2018, Global Map of Martian Fluvial Systems: Age and Total Eroded Volume Estimations, Earth and Space Science Journal, 5, 560-577, doi:https://doi.org/10.1029/2018EA000362, 10.5281/zenodo.1051038