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A Topographic Study of Gullies and Recurring Slope Lineae in Hale Crater, Mars

Susan J. Conway (1), Richard J. Soare (2), David Stillman (3), Sylvain Douté (4), Joel Davis (5), and Axel Noblet (1)

(1) CNRS UMR6112 Laboratoire de Planétologie et Géodynamique, Nantes, France (susan.conway@univ-nantes.fr), (2) Geography Department, Dawson College, Montreal, QC, Canada, (3) Planetary Science Directorate, SWRI, Boulder CO, USA , (4) IPAG, Université Grenoble Alpes, Bât OSUG A CS 40700 38058 Grenoble Cedex 9 France, (5) Dept. of Earth Sciences, Natural History Museum, London, UK

Hale Crater is a ∼140 km diameter impact crater located at 36° latitude in the southern hemisphere of Mars. The impact creating Hale is estimated to have happened 1 Ga [1]. The crater ejecta and floor deposits show morphological evidence consistent with water being present in the regolith at the time of the crater's formation [4]. In addition, Hale Crater contains a range of much younger landforms consistent with the episodic or the intermittently meta-stable presence of surface/near-surface water ice and/or liquid water [6-9], including km-scale gullies [6,9] and RSL [10].

Gullies on Mars are kilometre-scale erosion-deposition systems located on steep slopes, comprising a source area (alcove), transport channel and terminal fan(s) or lobe(s) (debris apron) [11]. Their morphological similarity to water-carved gullies on Earth meant they were hailed as signs of groundwater seepage on their initial discovery. Since that time the role of water in their formation has been debated. Recent imaging has revealed that gullies are active at the present day [18] and this activity occurs during winter when temperatures are too cold for liquid water or brine to form or flow, suggesting a role for CO_2 ice in their formation [18].

Recurring Slope Lineae (RSL) are dark streaks located on steep slopes that grow during warm seasons to hundreds of metres in length [19] for several metres of width. They originate at rocky outcrops on the steepest slopes in the equatorial- and mid-latitudes [21]. Once they stop growing, they fade and reoccur in the following year. Their incremental growth and link to hydrated perchlorates [10] has led numerous researchers to propose liquid water/brine as responsible for the origin and growth of RSL, despite the low availability of humidity in the soil or atmosphere at the time of their formation. Alternate hypotheses struggle to explain the morphology or seasonal growth of RSL [23,24].
Here we use topographical information derived from stereo photogrammetry and refined using photoclinometry [25] at 20 m/pix from CTX and 1 m/pix from HiRISE to characterise the slopes, orientations and topographic position of both gullies and RSL in Hale Crater in order to assess the role of liquid water in their formation.

References: [1] A.P. Jones et al. (2011) Icarus, 211, 259–272. [4] L.L. Tornabene et al. (2012) Icarus, 220, 348–368. [6] D. Reiss et al. (2009) PSS., 57, 958–974. [7] R.J. Soare et al. (2018) GSL, 467 [9] K.J. Kolb et al. (2010) Icarus, 205, 113–137. [10] L. Ojha et al. (2015) Nat. Geosci, 8, 829–832. [11] M.C. Malin and K.S. Edgett (2000) Science, 288, 2330–2335. [18] C.M. Dundas et al. (2012) Icarus, 220, 124–143. [19] A.S. McEwen et al. (2011) Science, 333, 740–743.. [21] D.E. Stillman et al. (2017) Icarus, 285, 195–210. [23] F. Schmidt et al. (2017) Nat. Geosci, 10, 270–273. [24] C.M. Dundas et al. (2017) Nat. Geosci., 10, 903–907. [25] Jiang, C.; Douté, S. et al. (2017) ISPRS, 130, 418-430.