

Recurring Slope Lineae and Chlorides in the Southern Hemisphere of Mars

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Introduction

- Recurring Slope Lineae (RSL): candidates for liquid water on the martian surface [1]
- RSL peak activity during southern summer [1, 2]
- RSL active below H₂O freezing point → **brine flow?**
- CaCl₂, MgCl₂: most likely compounds in brine [3]

The purpose of this study is to investigate the likelihood that RSL are formed by chloride brines.

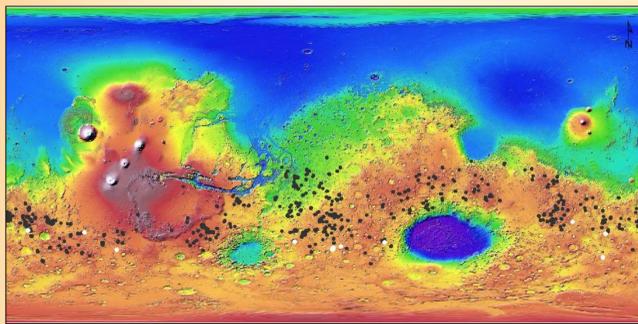


Fig. 1: MOLA colorized elevation map of Mars with chloride deposits (black dots) and RSL included in this study (white dots). Map coverage: +90 to -90 latitude, +180 to -180 longitude.

Materials and Methods

- HiRISE imagery: confirmed RSL mapped in JMARS [4]
- THEMIS decorrelation stretch (DCS): chlorides appear blue in bands 875, teal in 964, and yellow/orange in 642
- Searched for overlap between chloride signatures and mapped RSL [5, 6]
- Focused on local/regional chloride deposits near RSL because individual RSL not resolvable with THEMIS

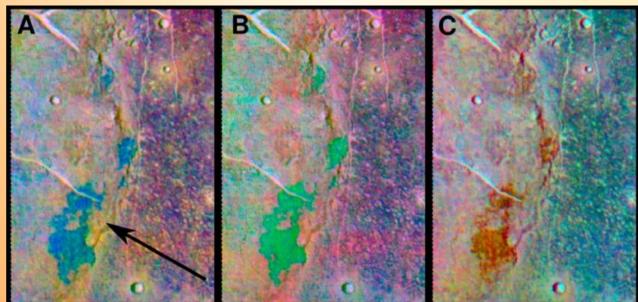


Figure 2: Characteristic chloride deposit (black arrow) in THEMIS DCS at 18.9° S, 332.2° E. Chlorides are A) Blue in bands 8, 7, 5 (875), B) teal or green in bands 9, 6, 4 (964), and C) yellow or orange in bands 6, 4, 2 (642). [7]

Results

Confirmed RSL were mapped at each location listed in **Table 1** and as shown in **Figure 3**. Palikir Crater was the most distinct locale, showing local evidence of chlorides in areas where RSL were most densely located (**Figure 4**). This locale has also shown periodic evidence of ferric iron in the near-infrared [8]. For all RSL, **DCS chloride signatures did not correlate to the presence of RSL on the regional scale**. In some cases, such as Triolet Crater, neither local- nor regional-scale evidence of chlorides was observed (**Figure 5**).

Nearest Named Crater	HIRISE ID	THEMIS ID
Palikir	ESP_022267_1380	I34263004
Tivat	ESP_013624_1335	I17599005
Pickering (SW)	ESP_022820_1415	I17966002
Raga	ESP_023004_1315	I17541004
Corozal	ESP_022440_1410	I07847004
Asimov	ESP_016156_1320	I17699007
Lohse	ESP_022908_1365	I43131002
Horowitz	ESP_022678_1475	I17919002
Rabe	ESP_022682_1360	I34456002
Huggins (SE)	ESP_022783_1275	I23609005
Triolet	ESP_022808_1425	I34201002

Table 1: Confirmed RSL and associated imagery for which THEMIS coverage and DCS products were used. [9]

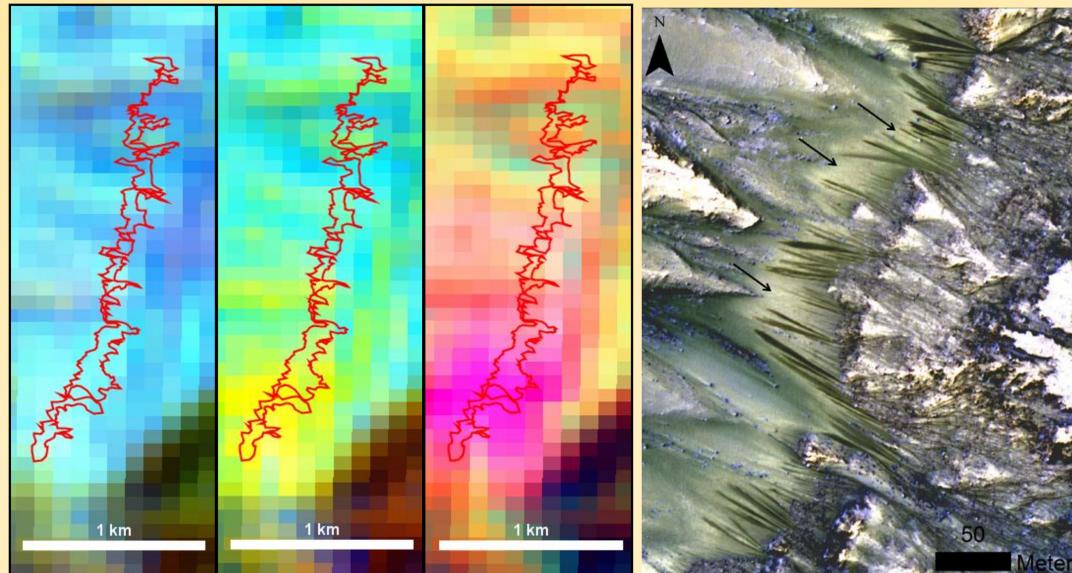


Figure 4: Confirmed RSL in Palikir Crater, mapped in red over THEMIS DCS 875 (far left), 964 (middle left), and 642 (left). Active RSL in Palikir Crater in HiRISE visible imagery, where ferric iron was detected by CRISM during periods of high RSL activity (right) [8].

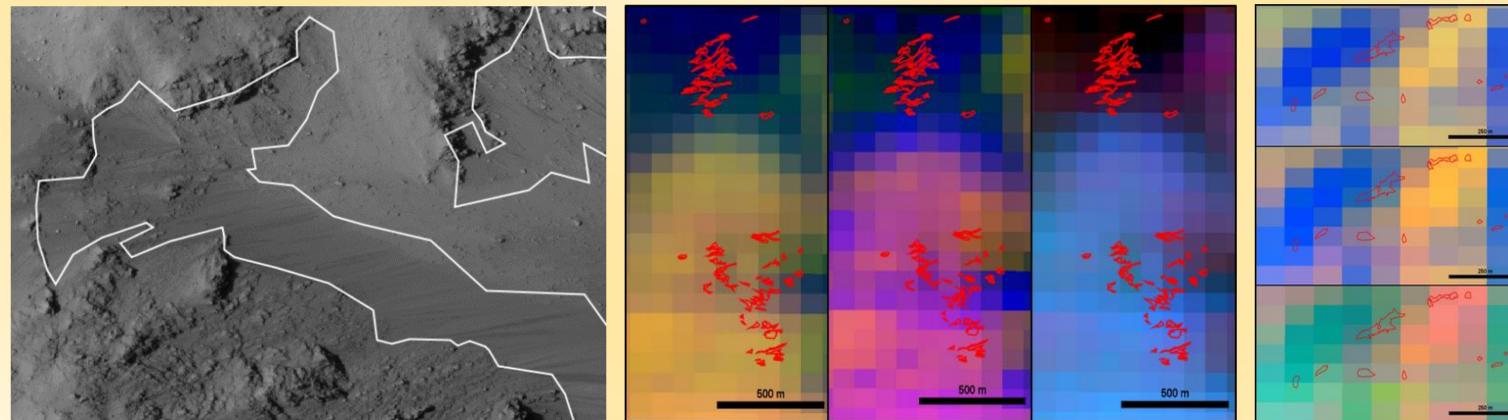


Figure 5: Confirmed RSL in Triolet Crater mapped on THEMIS DCS (from left to right) 875, 964, and 642. Confirmed RSL southeast of Huggins Crater mapped on THEMIS DCS (from top to bottom) 875, 964, and 642. All RSL regions outlined in red.

Figure 3: RSL mapped in Horowitz Crater (white outline).

Conclusions

The lack of chloride signatures collocated with RSL in the Southern hemisphere could be the result of one of three scenarios:

- RSL may not contain chlorides, either because they a) are not aqueous flow features or b) are not chloride-based brines.
- Several locales are dominated by the distinct steep-slope signature in THEMIS DCS identified by Bandfield [10]; the fact that the many RSL occur on the steep crater walls supports this scenario (**Figure 5, right**).
- The concentration of chlorides could be non-zero, but below the detection limits of THEMIS. If this is indeed the case, any chlorides present at or near the RSL are masked by the TIR properties of the surrounding terrain.

Future studies will replicate this work at equatorial RSL, which have higher chances for chloride detection by THEMIS (**Figure 6**). [9]

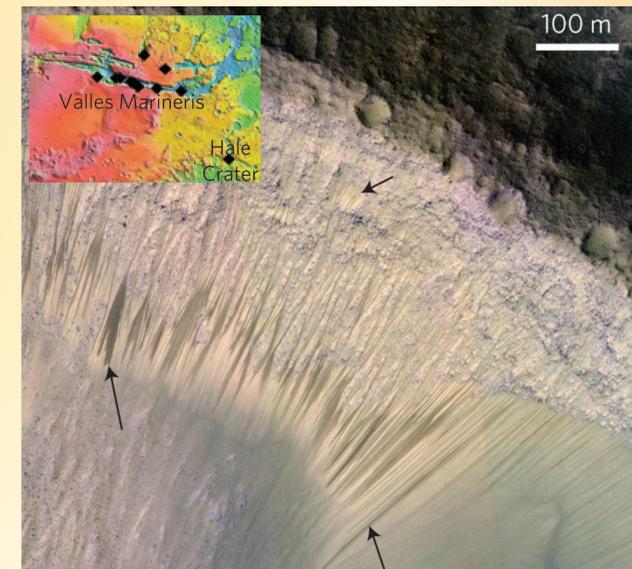


Figure 6: Equatorial RSL locations in the Valles Marineris region (left). HiRISE imagery of RSL in Melas Chasma, Valles Marineris (right). Note the length of equatorial RSL is significantly longer than those found in the southern hemisphere. [9]

References: [1] McEwen, A. et al. (2011) *Science*, 333, 740. [2] Ojha, L., et al. (2014) *Icarus*, 231, 35-376. [3] Chevrier, V. and Rivera-Valentin, E. (2012) *GRL*, 39, L21202. [4] Christensen, P., et al. (2009) *AGU*, Abstract #IN22A-06. [5] Christensen, P., et al. (2004) *Space Sci. Reviews*, 110, 85-130. [6] Osterloo, M. et al. (2008) *Science*, 319, 1651. [7] Osterloo, M., et al. (2010) *JGR*, 115, E10012. [8] Ojha, L., et al. (2013) *GRL*, 40, 5621-5626. [9] McEwen, A., et al. (2014) *Nature Geoscience*, Vol 7. [10] Bandfield, J. (2009) *Icarus*, 202, 414-428.