NEW RSL CANDIDATES ON THE MEDUSAE FOSSAE FORMATION. S. Mihira[1,2], T. Ruj[2], and T. Usui[1,2]
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Introduction: Recurring slope lineae (RSL) are dark and narrow (0.5-5 m) features of Mars that gradually lengthen in the summer and fade in the winter [1, 2, 3]. These features suggest that liquid water is flowing on the shallow subsurface of Mars today [1, 4]. Previously Stillman et al. (2016) have reported RSL distributions from 4 geographically distinct regions, namely a) Chryse and Acidalia Planitia region, b) equatorial region, c) Valles Marineris, and d) southern mid-latitude [5].

We report new potential RSL candidates in the Medusae Fossae Formation (MFF), located in the equatorial region (135°E - 257°E, 15°N - 15°S) (Fig. 1). According to epithermal neutron data from the Gamma-Ray Spectrometer [6] onboard on Mars Odyssey, the MFF region shows a higher concentration of near subsurface water equivalent hydrogen compared to the surroundings (Fig. 1) [7, 8]. This hydrogen anomaly has the possibility to indicate the presence of hydrated minerals or the presence of near-surface water ice [9]. Observation from the Radar sounder data has found nadir echoes offset in time-delay from the surface return in orbits over MFF material [10]. These echoes are interpreted as either due to subsurface water ice or low-density dust [10]. Therefore, even MFF is located near the equatorial region, MFF has the possibility to preserve subsurface ice. As a candidate landing site for human exploration on Mars, a low latitude area where the energy from the sun can be effective and is desirable (± 30° on both sides of the equator) [11]. Therefore, the evidence of water ice in the MFF could be ideal for future exploration targeted on near-surface ice deposits.

Methodology: RSL-like features were mapped through high-resolution context (CTX) camera images [12] in an ArcGIS environment. Those CTX images were used to determine whether RSL-like features were visible or not. If an RSL-like feature was found, we have then investigated multiple through CTX images (2-5) captured at different times of the year. The RSL-like features were confirmed if it has the appearance feature or not and were classified on that basis. Apart from that, we have confirmed the distribution of hydrogen by the Subsurface Water Ice Mapping data [7, 8] and compared the existence of the RSL-like feature in the areas with high-hydrogen content and those with low-hydrogen content spanned through similar latitude. Since RSL is common on the crater walls and hill slopes [1], we selected two craters of similar size and one place that has many hills from each area and compared them (Fig. 2).

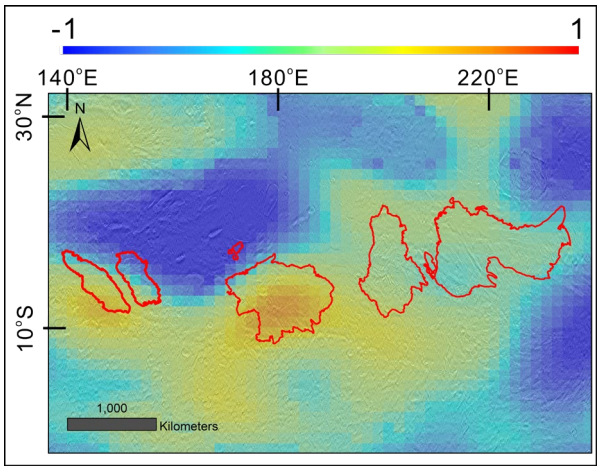

Fig. 1 Mars Odyssey Neutron Spectrometer maps of near-surface water equivalent hydrogen data produced by Pathare et al. (2018) [8]. The regions surrounded by the red lines are the MFF. The reddish area has a high-hydrogen content, and the blueish area has a low-hydrogen content.

Results: We have identified more than 1000 RSL-like features in the MFF. They are located on the slopes of crater rims or hills. RSL-like features are 100 - 500 m in length however, few of them are over 900 m in length. They indicate dark and narrow line features, and some of them appear at one time (Fig. 2). Recent RSL-like features appear to be darker than older features. Once they appear, they fade with time. However, our preliminary observation has not found them to disappear at the time span of 10 years, unlike confirmed RSL by previous studies [13]. Additionally, RSL like-features are more frequently observed in the areas with high-hydrogen contents than the areas with low-hydrogen contents (Fig. 2).

Discussion: The origin of RSL has not been clear yet, however it has been suggested that RSL may form due to water flow near the surface [1]. In this study, a large number of RSL-like features were found in the area of MFF with high hydrogen content, whereas a significantly low number of RSL-like features were found in the area with low hydrogen content. This indicates that the high hydrogen signature is triggered by RSL-like features in the MFF.

Most confirmed RSL has recurred seasonally [1]. They appear in the summer, and they disappear in the winter. However, RSL-like features in the MFF do not indicate those recurring features. Instead of that, they appear and slowly fade away. In a time span of 10 years, we have not seen any evidence to disappear totally. For example, in the Valles Marineris region, there are reports of RSL candidates that lengthen, regardless of the season [9]. We suggest that in the area that has not been affected by seasonal temperature change so much, instead, the RSL shows a long-term recurring feature.

Conclusion: The potential RSL candidates were found in the MFF. MFF, the area that indicates high-hydrogen content, has a possibility of the presence of available water in the accessible subsurface despite there being in low latitude. The potential RSL candidates and the high-hydrogen content in the MFF have the possibility to have a mutual relationship.

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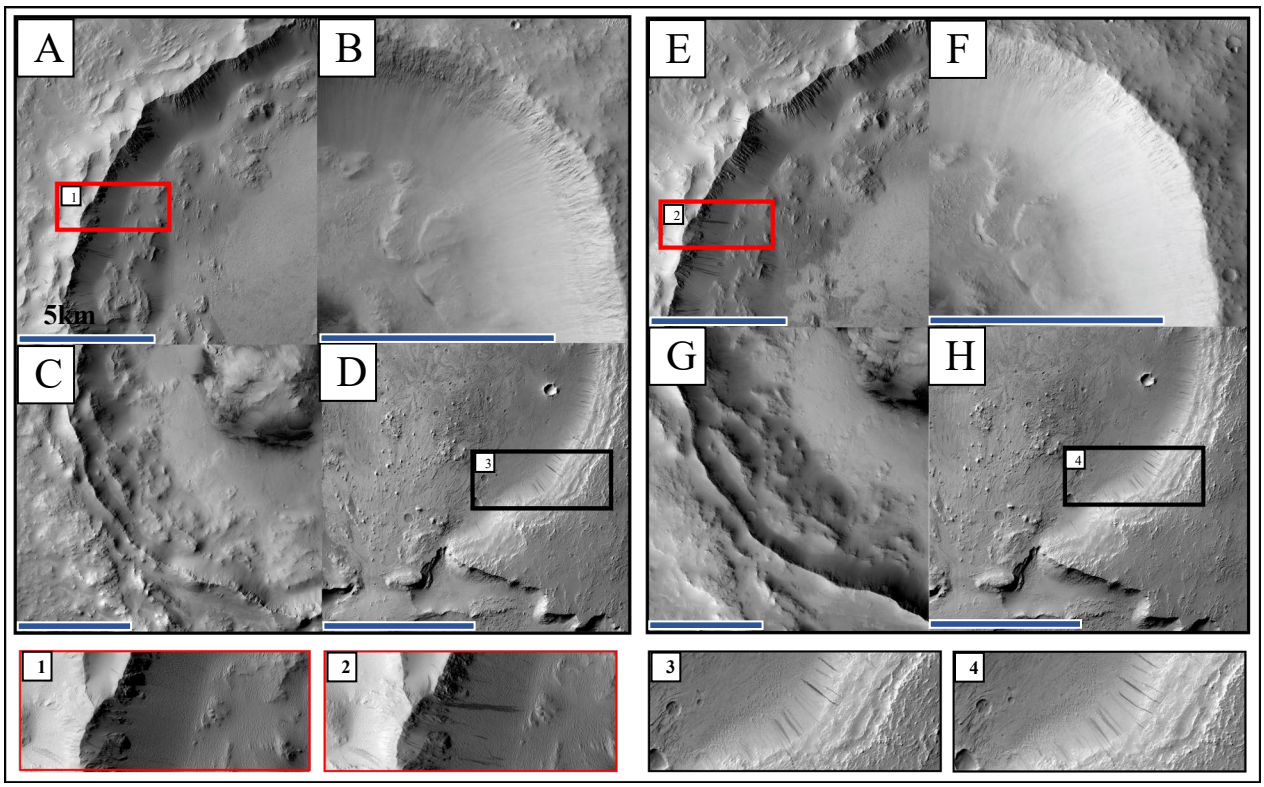

Fig. 2 Comparison of RSL-like features on the slope of the crater rims of the area with high-hydrogen contents and low-hydrogen contents at a different time. This image shows the change over time within four craters. The figure on the left is older and the figure on the right is a recent image. On the right image, few RSL-like features appear over time. The red boxes (1, 2) and black boxes (3, 4) bottom of the figure are focused on RSL-like features that appear. The RSL-like features that appear are darker than other RSL-like features. These four craters are selected from two areas with high-hydrogen content (A, D, E, H) and two areas with low-hydrogen content (B, C, F, G), respectively. RSL-like features tend to be found in the area with high-hydrogen content. The scale bars at the bottom left of each image indicate 5 km. These images are taken at A: 2007-09-16. B: 2008-05-22. C: 2008-04-07. D: 2008-04-25. E: 2018-03-17. F: 2020-05-03. G: 2018-03-17. H: 2014-01-16.