IDENTIFICATION AND MAPPING OF GLACIER-LIKE FORMS (GLFs) NEAR MARTIAN SUBPOLAR LATITUDES. Anshuman Bhardwaj[1] and Javier Martín-Torres[1,2]; [1]Division of Space Technology, Department of Computer Science, Electrical and Space Engineering, Luleå University of Technology, Kiruna, Sweden, email: anshuman.bhardwaj@ltu.se; [2]Instituto Andaluz de Ciencias de la Tierra (CSIC-UGR), Armilla, Granada, Spain, email: javier.martin-torres@ltu.se

Introduction: Based on geomorphological analysis, several studies have confirmed the ancient continental glaciation in the Martian northern plains [1, 2, 3]. Ice-debris components, also called glacier-like forms (GLFs), constitute a widespread region of distinctive landforms in Mars' subpolar latitudes. These landforms are in many cases sufficiently analogous to their terrestrial counterparts, thus allowing comparative inferences. However, our understanding of glacial processes in Martian subpolar latitudes is still majorly incomplete [4], mainly due to partial coverage of these latitudes at high resolutions.

In the past decade, there has been a significant improvement in the quality and quantity of high-resolution remotely sensed images of Mars [4]. Another encouraging fact is that most of this imagery is freely available to researchers and the public. For example, Mars Reconnaissance Orbiter (MRO) is equipped with the High Resolution Imaging Science Experiment (HiRISE) camera capturing at as high as 30 cm spatial resolution, and with Context (CTX) imager capable of taking wider-angle images at a resolution of 6 m/pixel. This has resulted into a widespread rise in scientific interest and research into Martian terrain properties and the processes that have shaped it, both in the past and at present. However, the complete coverage of Martian terrain at such high spatial resolutions still will take few years.

A globally complete inventory and high-resolution mapping of GLFs on Mars is essential for several reasons: (i) to gather information about the formation of Martian landscape; (ii) to understand the presence and phase state of H_2O on the Martain surface; and most importantly (iii) to understand the past climatic shifts on Mars [5]. A better understanding of qualitative and quantitative existence of water is particularly expected to impact both future manned exploration and search of Martian life. Visual analysis of GLFs and present climatic conditions on Mars does not support a precipitation-accumulation type regime (similar to terrestrial glaciers) for these Martian GLFs. However recent SHAllow subsurface RADar (SHARAD)-based studies [6, 7] indicate that at least some glacial landforms in Martian subpolar latitudes are predominantly composed of ice. Thus, research on Martian GLFs can also enhance our understanding of how climate can change on planetary scales, both extraterrestrially and, by analogy, on Earth.

In the present research, we have taken a classic geomorphologic approach [8, 9] for identifying such GLFs in the subpolar Martian latitudes using recent HiRISE scenes. We have focused on the regions that were never covered before in high-resolution, so that our inventory can aid to already existing inventories [e.g., 5]. We have already identified nearly 200 new GLFs in the Martian subpolar latitudes and the number is growing with new HiRISE acquisitions. We have observed the striking geomorphologic analogy between terrestrial and Martian GLFs (Fig. 1, 2). However, we plan to include following additional approaches to our future analysis of these landforms on Mars: (i) Digital Terrain Model (DTM) derivatives and morphometry, (ii) Thermal inertia maps, (iii) Gravity maps, and (iv) Feature tracking.

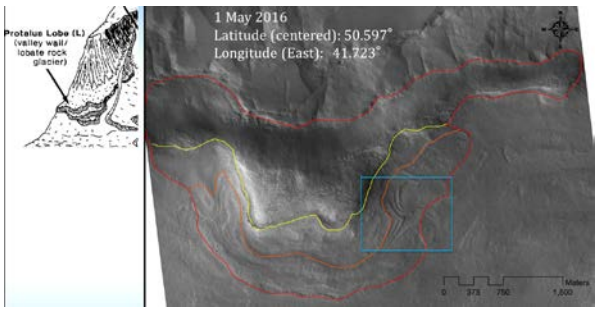

Fig.1: A lobate Martian GLF analogous to protalus lobes on Earth. Different colored contours represent various levels of this feature. The blue rectangle marks the area with huge crevasses; a suggestive of past (or even present) flow in these features.

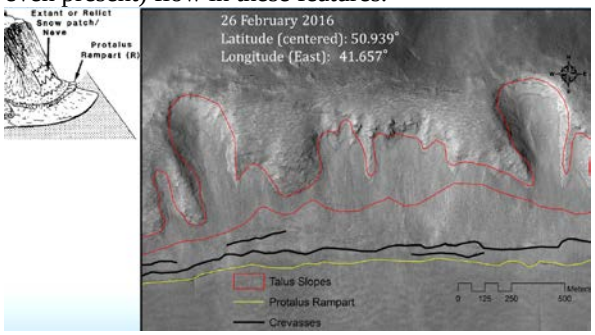

Fig.2: A Martian GLF analogous to protalus ramparts on Earth.

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