MAPPING AND INTERPRETING THE NORTHERN FAN DEPOSIT IN JEZERO CRATER, MARS.

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Introduction: Jezero crater is a ~50 km diameter Noachian-aged ancient crater lake basin inside the western edge of the Isidis impact structure [1-2]. It is also the landing site of the NASA Mars 2020 *Perseverance* rover's mission – with the well-preserved delta along its western edge being the primary focus [1-4]. Prior to landing, it is important to gain a thorough understanding of the delta itself, along with its surrounding inlet and outlet valleys and infill deposits for context. In addition to broadening our knowledge, the information collected pre-landing can also eventually be augmented by the rover's *in situ* observations.

The northern fan deposit is of particular interest because it remains unclear whether it is related to the western delta or is its own system connected with the northern watershed – although mapping done at a lower scale than in this study supports the former [5]. Previous research has tended to group the entire deposit together [4], and recent work admits there are many unanswered questions about the northern fan [6]. For instance, mineralogical characteristics derived from the Mars Reconnaissance Orbiter (MRO) mission's Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) show that both the northern fan deposit and the western delta exhibit several of the same apparent compositional units, but that the northern fan deposit lacks the uppermost LCP/smectite-bearing unit [6]. However, the relationship between the western delta and the northern fan is not well-constrained. It is also unclear whether the fluvial origins of the northern fan were contemporary with the main western delta or significantly predated it, though a similar timeframe for both seems more likely. Thus, there is a gap in knowledge that is worth filling with a more detailed investigation.

This study aims to examine the morphology of the northern fan through orbital photogeological and multispectral mapping, and to identify geological markers that might help constrain its origin. Key objectives are to determine whether the northern fan is deltaic or alluvial, to constrain details of the flow direction, and to investigate possible remnants of the northern fan on the crater margin/wall above. This would lead to a more comprehensive understanding of the northern fan and where it fits within the broader Jezero system. This knowledge can also be used to better characterize deltaic processes within crater lake basins on the Martian surface, as a whole.

Methods: For the purposes of this study, we rely primarily on orbital imaging from MRO's High Resolution Imaging Science Experiment (HiRISE). At an approximate resolution of 25 cm/pixel, these images provide the detail necessary for thorough photogeological mapping. However, the area identified for investigation spans multiple offset HiRISE images, so we used a preexisting mosaic as the basemap [7]. The focus of our mapping was the northern fan deposit itself, though an attempt was made to section off the units directly north of it, to gain more context for the northern channel and how it interacted with this deposit. Mapping was done at a digitizing scale of 1:3000 and once linework was completed, notional unit names were assigned to the various polygons identified (Figure 1). For some of the units towards the lower half of the map, names were extrapolated from the Jezero landing site map [8]. Once our map was created, it became apparent that there were complex interactions between the many different units occurring in this region, so the next steps involve looking at these contacts more closely and searching for markers that will constrain origin and history.

Results/Discussion: This photogeologic map has identified nineteen potential units, some of which may be refined or consolidated upon further study and comparison with compositional datasets. These were mapped primarily based on morphologic characteristics, such as differences in relative brightness, tone, surface texture, and apparent roughness. Most of the units occurred within the northern fan deposit itself, although the immediate surroundings were mapped for context as well. Overall, the eastern part of the northern fan deposit had more differentiated units than the western part, perhaps indicating that more units are exposed there. The westernmost part of the northern fan deposit most directly seems to be an extension of the main Jezero delta, but further east the units grow more distinct. This preliminary observation could suggest that the northern fan deposit in fact records the interaction between the furthest reaches of the western delta and the northern channel. However, more detailed study is necessary to constrain this relationship and test this hypothesis.

To that end, future work involves looking more closely at how these units interact with each other to create a relative stratigraphic sequence, which will potentially also make it more possible to address the question of whether this is a large remnant of the western delta or dominated by the northern channel. It also involves comparing the contacts and units to CRISM data and infrared data from the Mars Odyssey mission's Thermal Emission Imaging System (THEMIS), to see how those observations supplement the photogeological map created here.

Acknowledgments: This map was produced using ESRI's *Mars HIRISE Image Mosaic* basemap.

References: [1] Tanaka *et al.* (2014) *Planet. & Space Sci. 95,* 11-24. [2] Fassett and Head (2008) *Icarus*, *195,* 61–89. [3] Schon *et al.* (2012) *Planet. & Space Sci., 67,*

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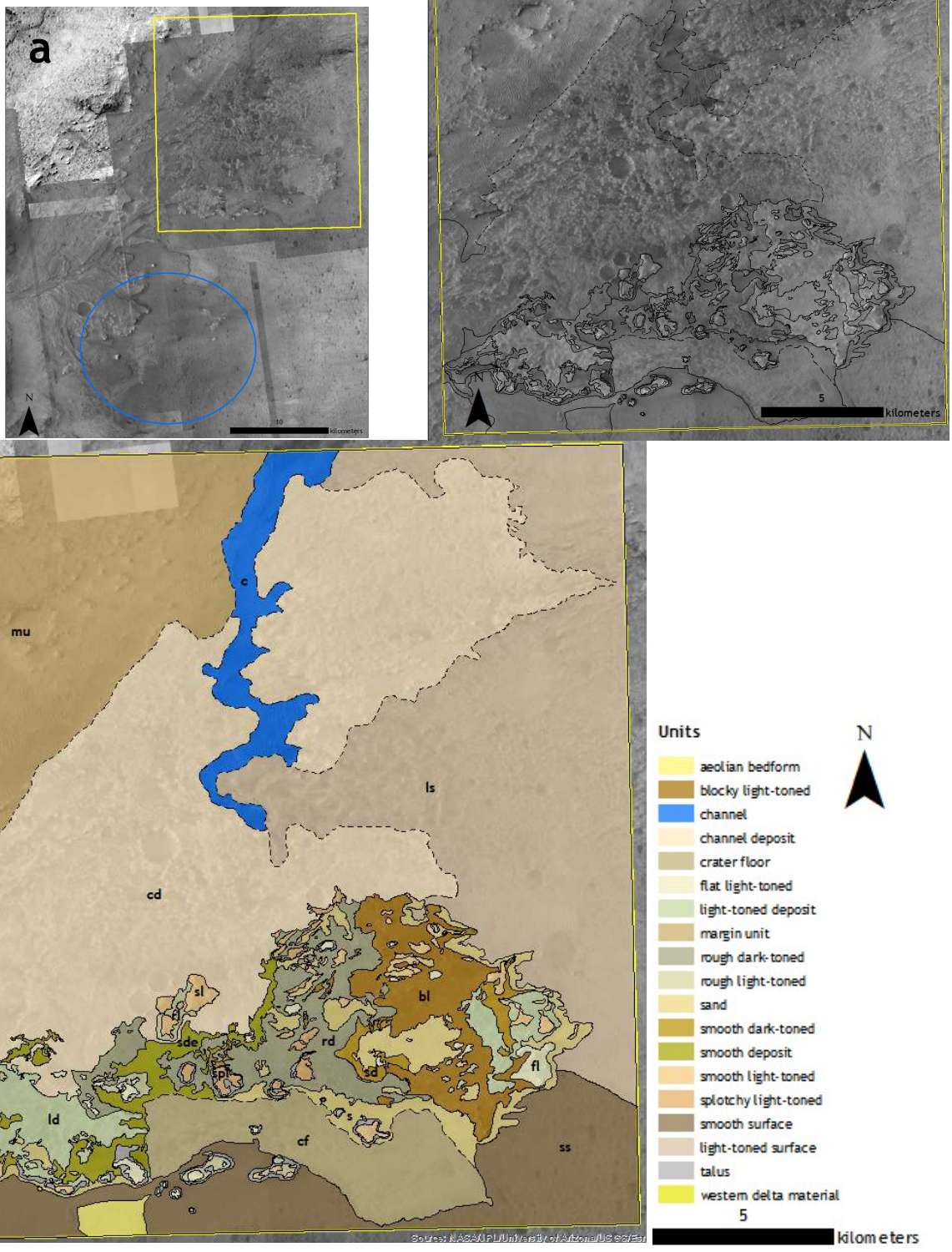

Figure 1: (a) HiRISE basemap with Mars 2020 Landing Ellipse in blue and map area for next figure in yellow; (b) HiRISE image context for map area with black lines indicating linework for initial geologic unit map; (c) photogeologic map of the northern fan deposits and its immediate surroundings, showing preliminary mapped surficial and bedrock units.