CHARACTERIZATION OF MONOHYDRATED AND POLYHYDRATED SULFATES IN SOUTHEASTERN AEOLIS MONS I.E. Ettenborough[1], B.J. Thomson[1], C.M. Weitz[2], J.L. Bishop[3], K.D. Seelos[4], [1]University of Tennessee, Knoxville, TN (iettenb1@vols.utk.edu) [2]Planetary Science Institute, 1700 East Fort Lowell, Tucson, AZ, 85719; [3]SETI Institute, Carl Sagan Center, Mountain View, CA94043; [4]JHU Applied Physics Laboratory 11100, Johns Hopkins Rd., Laurel, MD 21043

Introduction: Gale crater, the landing site for the Curiosity rover, is hypothesized to have once hosted an ancient lake on Mars [e.g., 1-4]. One way to better understand past environments within Gale is to examine its geologic history as recorded in the geomorphology and mineralogy captured in the central mound. Hydrated sulfates, minerals that have been altered due to the presence of water through the circulation of acidic surface waters (precipitation or snow/frost) have been found within Gale crater [5]. Understanding where the sulfates are located and what types are present, monohydrated sulfates (MHS) or polyhydrated sulfates (PHS), can help us understand the geologic history of Mars as well as the environment of deposition. Evaluating the distribution and type of sulfate minerals and transition from MHS to PHS can help us understand the past environmental conditions of Mars and provide insights on bound water in hydrated minerals present today. We used CRISM imagery to investigate the spectral properties of Aeolis Mons and document the distribution of PHS and MHS. Here we show where some PHS and MHS are located and their relation to the morphology within southeast Gale crater using CRISM, CTX, and HiRISE data .

Methods: The base map used was a mosaic of CTX images. The CRISM observations we analyzed include FRT00017D33, FRT0001422F, and FRT00019DD9 which are located at the southeast section of Aeolis Mons shown by the white rectangular boxes in **Fig. 1**. The CRISM observations were georeferenced to align with the CTX basemap. The spectral summary parameters used include SINDEX, BD1900, and HCPINDEX [5]. Using these summary parameters, the PHS appear magenta in color, MHS appear yellowish-green, and high calcium pyroxene found in the basaltic sand dunes appears blue [6]. Geologic contacts were mapped to illustrate morphologies that may relate to the mineralogy shown in the CRISM images. The CRISM spectral parameters were used to delineate regions that exhibit consistent mineralogic signatures into discrete units, shown in **Figure 2.** Geologic contacts were created using traditional geomorphic mapping principles via the CTX data, and were also informed via the CRISM data [7].

An topographic profile was created to illustrate how the elevation changes with respect to the mineralogy given in **Figure 3**. This was accomplished using a HiRISE stereo-derived DTM, shown in **Figure 1** by the black rectangle. Geologic contacts were mapped with a solid black line. An overall geologic map for the CRISM IDs was created to show a very rough interpretation of where the MHS, PHS, and HCP are located, as shown in **Figure 3**. Using the morphologic contacts drawn at a 1:60,000 scale, we extrapolated some of the CRISM data to areas where there was no CRISM coverage. This could only be accomplished in areas where the unit was continuous, allowing for further/improved reconciliation between spectral data and morphology in SE Aeolis Mons. Preliminary unit descriptions are still ongoing.

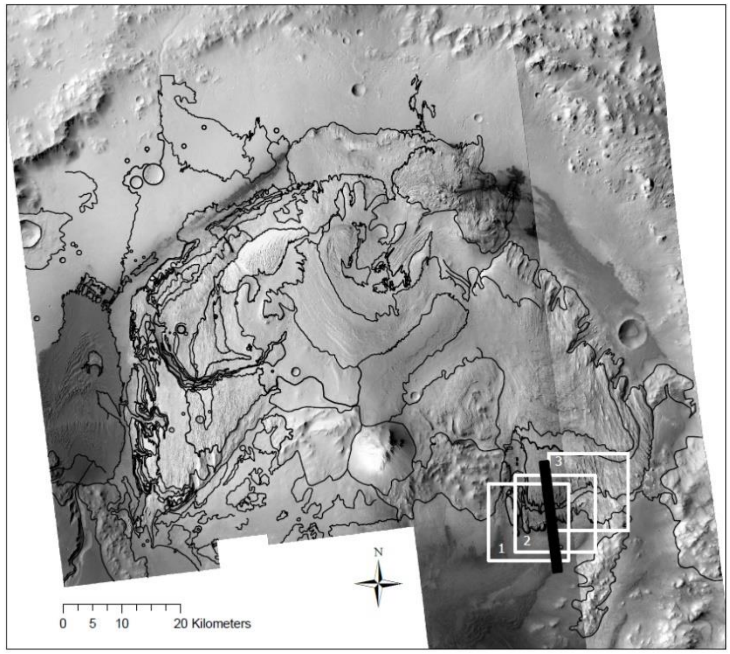

Figure 1. 5m CTX mosaic of Aeolis Mons with black lines denoting morphologic contacts. White boxes denote location of CRISM IDs used in this study, black rectangle denotes location of HiRISE DTM. Box 1: CRISM ID FRT00017D33 Box 2: CRISM ID FRT0001422F Box 3: CRISM ID FRT00019DD9

Results: Morphologic boundaries were mapped in **Fig. 1** by using the CTX images to identify the specific morphologic boundaries, and then it was compared to the CRISM data. In the east, the mineralogy is more dominated by MHS, while to the west PHS appears to be more prevalent. Below the fluted, parallel valleys in the southernmost section of the map exists extensive dark, aeolian bedforms that appear to still be active today [2]. The bottom section of the CRISM images used in this study consist mostly of other minerals that are not sulfates, including high calcium pyroxene, which is expected in martian basaltic dunes [5]. There is still some noise evident in this CRISM observation that complicates the interpretation, so more work is needed to be done to better understand the relationship of sulfates and their distribution in this area of Aeolis Mons.

The topographic profile in Figure 3 covers the length of CRISM ID FRT0001422F. It shows an overall decrease in elevation from A to A'. The changes in elevation appear consistent with morphologic contacts and the preliminary units that have been identified. This area was initially chosen due to an isolated lobate feature where MHS appears to overlay a layer of PHS that is present on both sides of the isolated lobe, but this has not been observed elsewhere and is thought to be the result of erosion. While this pattern does not seem to continue in other areas nearby, further work is needed to determine if this is accurate. This stratigraphy is inverted compared to a topographic profile analyzed in the SW portion of the mound [7], further work is needed to determine if this is an isolated incident or if the stratigraphy is different on this portion of Aeolis Mons.

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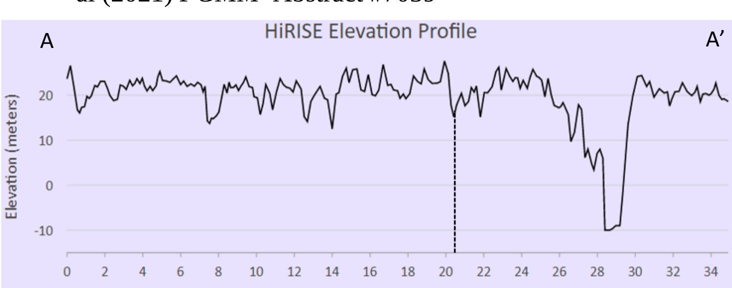

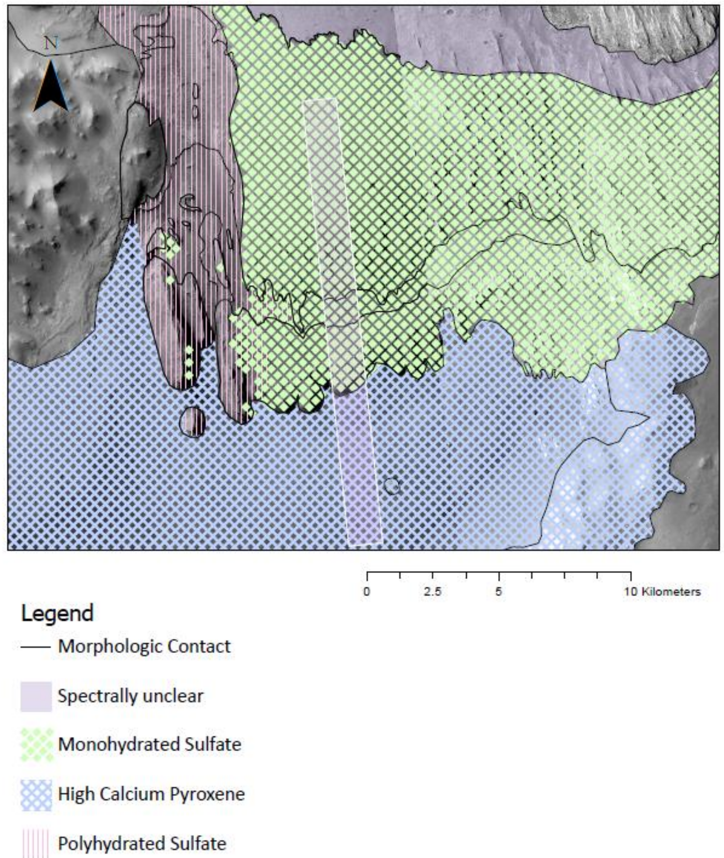

Figure 2a. (Above) CTX basemap overlain by the relative distribution of PHS, MHS, high calcium pyroxene, as well as spectrally unclear areas mapped. Black lines denote morphologic contacts.

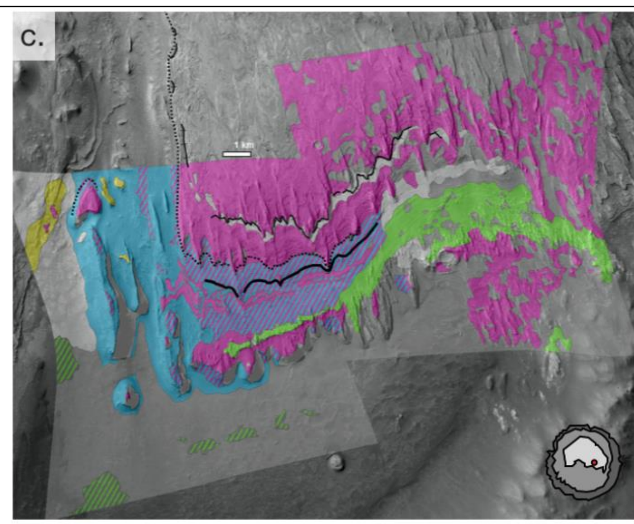

Figure 2b. (Above) Figure from Sheppard et. al. 2020 [7] mapping the distribution of PHS (pink), MHS (blue), clay (green), undifferentiated hydrous minerals (yellow), and spectrally bland (white).

Figure 3. (Left) Elevation profile from HiRISE DTM indicated in Fig. 1. Covers approximately 34 kilometers in distance with a relief of approximately 29 meters. Overall, as you move from A to A' there is a decrease in elevation. MHS found to the left of dotted line.