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, [3]1700 East Fort Lowell, Tucson, AZ, 85719 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., 1-3]. One way to better understand what Gale used to be like is to look at its geologic history. Hydrated sulfates, minerals that have been altered due to the presence of water through circulation of acidic surface waters (precipitation or snow/frost) have been found within Gale crater [4]. Understanding where the sulfates are located and what type are present, monohydrated (MHS) or polyhyrdated (PHS), can help us understand the geologic history of Mars as well as the environment of deposition. The transition between MHS and PHS also can provide information into Mars' past environmental changes. Looking at the distribution and type of sulfate minerals not only can help us understand the past environmental conditions of Mars but also allows us to understand the water, bound within hydrated minerals, that is present today. Processed spectral images from CRISM, or the Compact Reconnaissance Imaging Spectrometer, allows the distribution of PHS and MHS to be determined. Here we show where some PHS and MHS are located and their relation to the morphology within Gale Crater using the CRISM ID FRT00017D33.

Methods: The base map used was the 5 m Gale CTX image mosaic. The CRISM observation this study used was FRT00017D33, and is located at the southeast section of Aeolis Mons in Gale crater given with the pink rectangular outline in the location map (**Fig. 1a**). This CRISM observation was georeferenced to align with the CTX basemap. The spectral summary parameters used include SINDEX, BD19002, and HCPINDEX [5]. Using these summary parameters, the PHS appear magenta in color and the MHS appear yellowish green [6]. The CRISM image was overlain on top of the CTX basemap, and then geologic contacts were outlined to illustrate morphologies in order to relate the morphology with mineralogy shown in with the CRISM data. The CRISM spectral data was used to delineate regions that exhibit consistent mineralogic signatures into discrete units, shown in **Figure 3.** Geologic contacts were mapped using the CTX data, then checked with the CRISM data, shown in **Figure 2a**.

An elevation profile also was created to illustrate how the elevation changes in respect to the mineralogy given in **Figure 2b**. The resolution of the DEM was 90 meters, and the total length of the profile was 641.5 meters [7]. The location of the profile is given **in Figure 2b.** This section was chosen because it appeared geologically interesting, as there appears to be a distinct change from PHS to MHS with an increase in elevation. This pattern from PHS to MHS does not appear to continue north or south of the region of interest. Geologic contacts were illustrated with a solid black line. An overall geologic map for this CRISM ID also was created to show a very rough interpretation of where the MHS, PHS, and HCP are located, as given in **Figure 3**.

Results: The area focused on within FRT17D33 is approximately 1,500 meters by 900 meters, which is only a small fraction of the entire image. This area was chosen due to an isolated lobe of Aeolis Mons present that exhibits a distinct change from PHS to MHS with increasing elevation. Morphologic boundaries are outlined using a solid black line in **Fig. 2a**.This was accomplished by using the CTX image to identify the specific morphologic boundaries, and then it was checked with the CRISM data. East of the lobe, the mineralogy is more dominated by MHS, while west of the lobe PHS appears to be more prevalent. 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. But what appears to be shown is a higher presence of PHS in the upper western half of the ID and a higher presence of MHS in the upper half of the eastern section. The bottom section of the ID appears to consist mostly of other hydrated minerals that are not sulfates, including high calcium pyroxene.

Using the elevation profile, the shows a distinct presence of MHS from approximately 276 meters to 470 meters, illustrated by the green portion of the elevation profile. The MHS looks like it is overlaying a layer of PHS that is present on both sides of the isolated lobe, illustrated by the red portions of the profile. While this pattern does not seem to continue in other areas nearby, further work is needed to determine if this is accurate. This is inverted compared to Buczkowski's mineralogic topographic profile from 2020 abstract, further work is needed to determine if this is an isolated incident or if the stratigraphy is different on the this portion of Aeolis Mons.

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References: [1] Thomson, B. J. et. al (2011) *Icarus*, *214* (2), 413-432 [2] Grotzinger et. al (2014) *Science, 343, 6169* [3] Cabrol, N. A. et. al (1998) *Icarus*, 139. [4] Sheppard R. Y. et al. (2020) *JGR,* doi: 10.1029/2020JE006372. [5] Buczkowski D.L. et al. (2020) *LPSC 51,* Abstract #2664. [6] Viviano-Beck C. E. et al. (2014) *JGR, 119,* 1403–1431, doi:10.1002/2014JE004627. [7] Calef F. J. III and Parter T. (2016) MSL Gale merged DEM, PDS Annex.

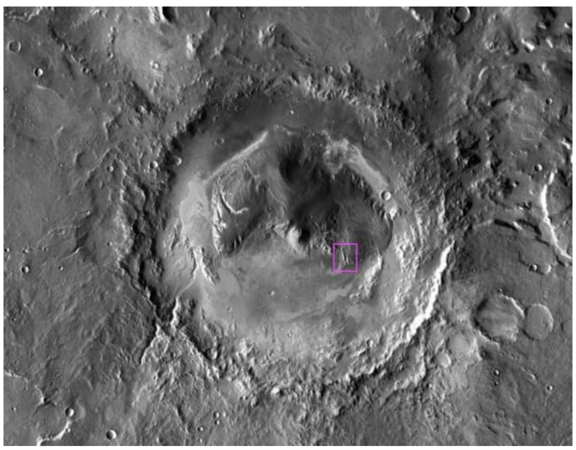

Figure 1a

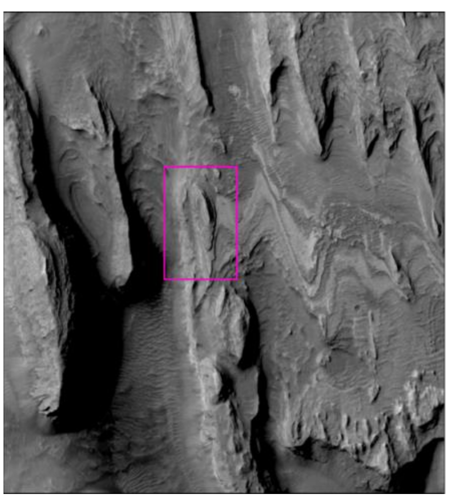

Figure 1b

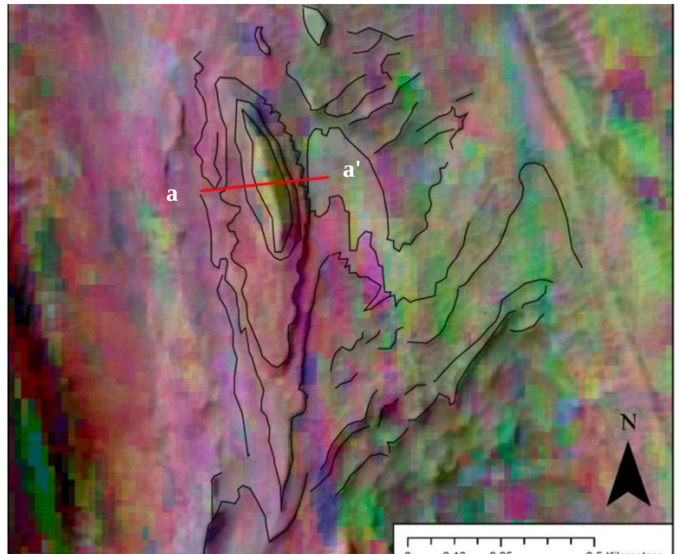

Figure 2a

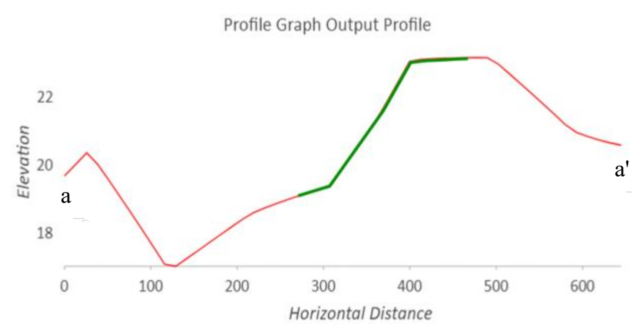

Figure 2b

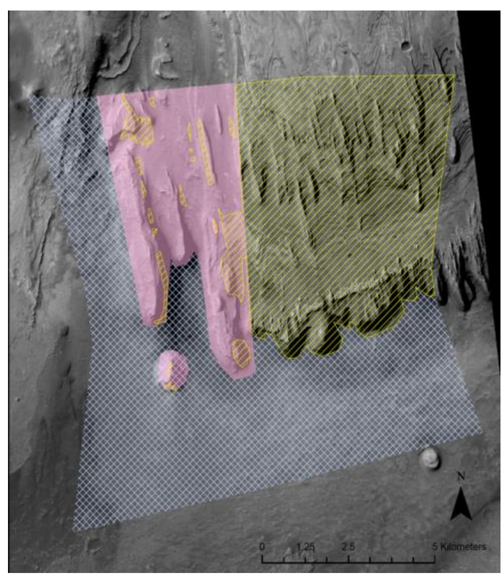

Figure 3

Figure 1a. Location map of where within Gale crater CRISM ID 17D33 is positioned.
Figure 1b. Location map of where within the CRISM ID the isolated lobe studied is found.
Figure 2a. CRISM ID overlain on the CTX 5 m Gale basemap, black lines indicate morphological boundaries. Red line gives the location of the elevation profile in Fig. 2b. Magenta colors represent PHS and yellowish green represent MHS. Point a is located 8,194,915E, 328,934S and point a' is located 8,195,253E 328,899S.
Figure 2b. Elevation profile outlining the change in elevation over the red profile line in Fig. 2a. Green line represents where the MHS are found within the isolated lobe.
Figure 3. Preliminary mineralogic boundary sketch map of CRISM ID FRT17D33. Yellow represents PHS, pink represents MHS, and blue HCP. The white box outlines location of Figure 2a.