Phyllosilicates in Nili Fossae, B.J. Salzman[1], B. Regnerus[1], S. Gafinowitz[1], [1]Durham Academy Upper School, Durham, NC 27705, 13salzmanb@da.org

Introduction: On Mars there is an abundance of phyllosilicates; minerals that indicate that liquid water may have once been present on Mars. The ongoing search for phyllosilicates on Mars is contributing to our understanding of the history of Mars and to the role of liquid water during Martian history. Martian scientists believe that clay deposits represent where it is most probable that life may have once existed on Mars. With this in mind, we set out to test our hypothesis that we could locate phyllosilicates in Nili Fossae using visible THEMIS imagery after establishing the geologic setting of known clay deposits using CRISM and other data sets. Nili Fossae is an elevated region of Mars with a rough terrain in the northern hemisphere centered at approximately 75E 22N. We compared CRISM spectrometers of phyllosilicates to visible THEMIS, HIRISE and CTX imagery. On CRISM, spectrometers of phyllosilicates identify clays in red. To find these phyllosilicates we were able to overlap data sets and establish a geologic context of clays in the region. Then we selected a feature in Nili Fossae, Jezero Crater that demonstrates most of the clay distribution in Nili Fossae. The Jezero Crater is an area rich in phyllosilicates with an alluvial fan and geographic features that coincide with the settings in which we expect to see the clays.

Findings: After our extensive research we concluded that, in Nili Fossae, it is possible to visibly locate phyllosilicates through geologic setting of features. We discovered that phyllosilicates in Nili Fossae are located in layered complexes. Most of the layered complexes that contained clays were seen in channels and crater walls. Clays were also identified in randomly scattered hills (ejecta?) and in sedimentary features such as the Jezero deltas. We believe that phyllosilicates in Nili Fossae are located in layers because clays were formed in standing water, which led to the sedimentary formation of layers with clays positioned within them. Then clay deposits were redistributed by impacts and by the action of flowing liquid water. We believe that phyllosilicates in Nili Fossae can be visually located through THEMIS, HIRISE and CTX, but CRISM is needed to prove the presence of clays. This area of the Jezero Crater is a perfect representative of Nili Fossae because it contains layered complexes, channels, crater walls, hills and deposited sediments.

Our Site: In Nili Fossae the area of the Jezero Crater at 77.29E and 18.502N has many of the geologic features that have been shown to possibly have phyllosilicates. Our site contained a river channel breaching the wall of a crater and emptying into a delta. We have found in our prior research that all three of these geologic features have a higher chance of possessing phyllosilicates. However, despite the high quantity of visible THEMIS, HIRISE AND CTX images, the only CRISM images of the channel and crater wall that exist are half-resolution images with inconclusive results. In addition, the only image of the alluvial fan experienced atmospheric interference, and provides inconclusive data. This area should be retargeted by CRISM not only for its diverse geomorphology, but the possible presence of large quantities of phyllosilicates.

Image 1: The whole area compared with a delta on earth

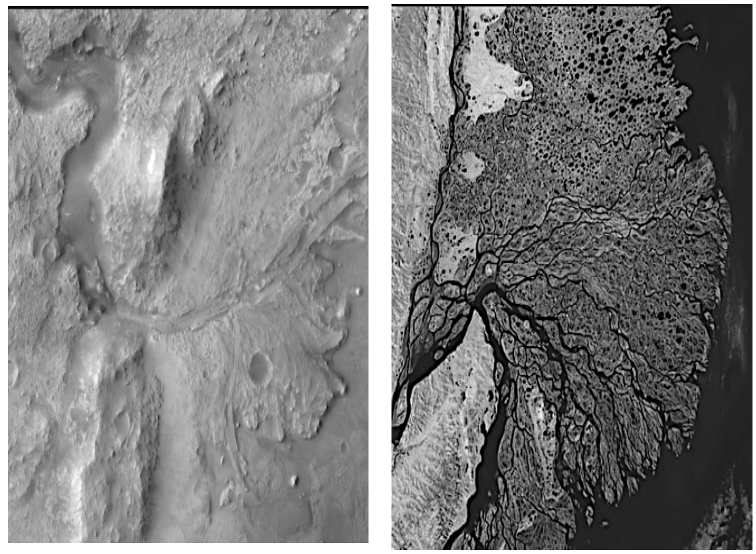
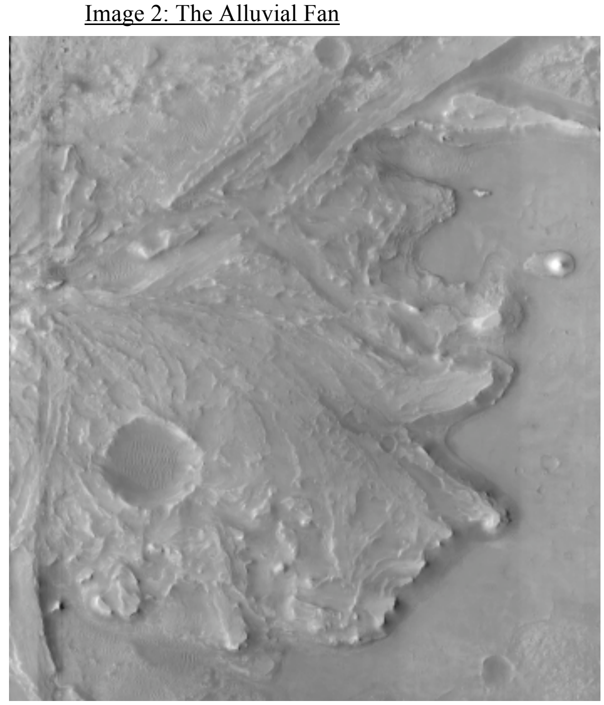


Image 2: The Alluvial Fan

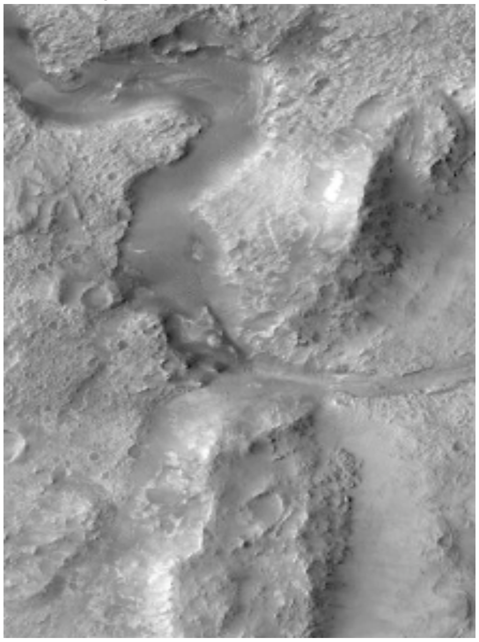


Visible Images of Area: These are visible images of our site from CTX, THEMIS and HiRISE. This first image is from CTX and cropped down to show the entire area of our image. Image 1 shows the whole area. It shows the channels, crater walls and the delta that we think contain clays. If a CRISM spectrometer image was taken targeting this area it should possess all of the features in its image. Adjacent to this image of the whole area of the Jezero crater is a picture of a real delta on earth. The image gives an accurate representation to how similar this delta on Mars is to Earth.

The delta. Image 2 is a high quality image of the delta and the alluvial fan. This was taken by HiRISE. In the picture the viewer can see how layers are located along the edges of the fan and the clear pattern of the deposited sediments. The delta is perfectly formed and probably resulted from built up sediments as water flowed into standing water in the crater.

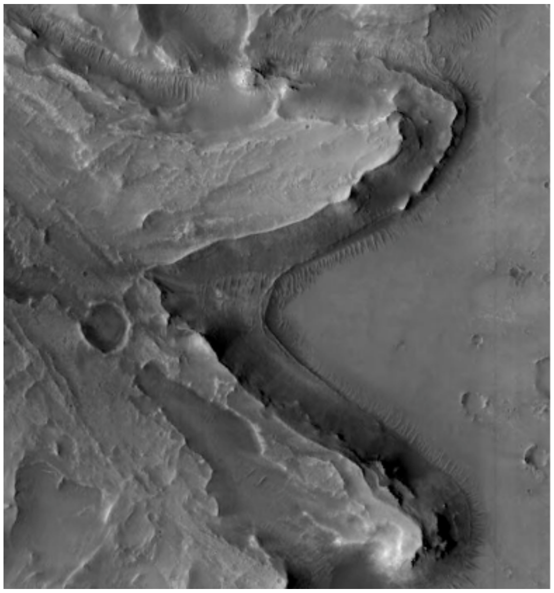
The channel and crater wall. Image 3 was taken by CTX and zoomed in. It shows the crater wall and the channel in our target image. It shows a clear layering in the crater wall and in the channel which can be seen from the varying albedo levels and geomorphology.

Image 3: The Channel and Crater Wall



Phyllosilicates in the edges of the alluvial fan. Image 4 was taken by HiRISE. Within the channel walls, layers of clays are apparent, but there is also clay in the deposits of the delta. The layers along the clays are consistent with our findings that phyllosilicates are found in layers and then deposited as sediments.

Image 4: The Edge of the Alluvial Fan



Possibility of finding clays through visible imaging: In conclusion, these findings show that with visible imaging devices like THEMIS, HiRISE and CTX in an area like Nili Fossae it is possible to conjecture where clays would be located. I have been able to use these methods of understanding the morphology of Nili Fossae and estimate where clays are on Mars. By overlaying THEMIS and CRISM imaging I can see that phyllosilicates usually exist within these features of layers, channels, crater walls, deposited sediments and at times crater ejecta within Nili Fossae. However in areas unlike Nili Fossae these assumptions may not be valid.

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