

Evidence of Learning #6

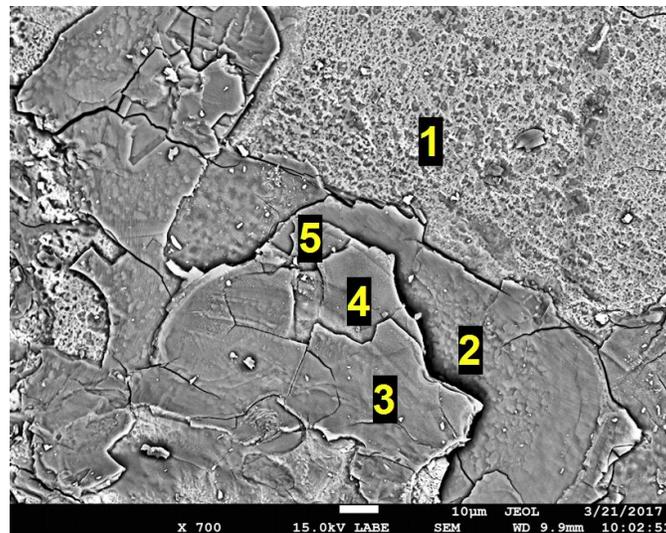
Date: April 13, 2017

Subject: Astrobiology

Analysis:

After an amazing first day at NASA, I learned a lot. On the second day of work, my mentor gave me full liberty and independence on the SEM. She really wanted me to get a good feel of how to use the instrument.

I began the day by again, looking for unique textures in the sample and I did find one place.

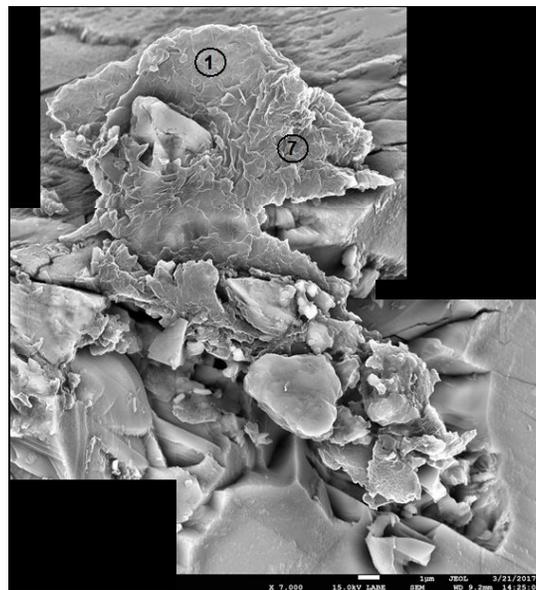


This image that I took consists of multiple plates that are laying on top of each other. That tells us that weathering took place. It can't be because of wind because it is inside the rock. The only other explanation for this is water. Additionally, because there are multiple layers, I

concluded that there were multiple episodes of water flowing on the planet. Furthermore, I magnified into each layer and found that each plate had a different textures and salt. This again proved that Mars sustained water at one point. Nakhla is one of the best meteorite samples that provides evidence of aqueous martian conditions.

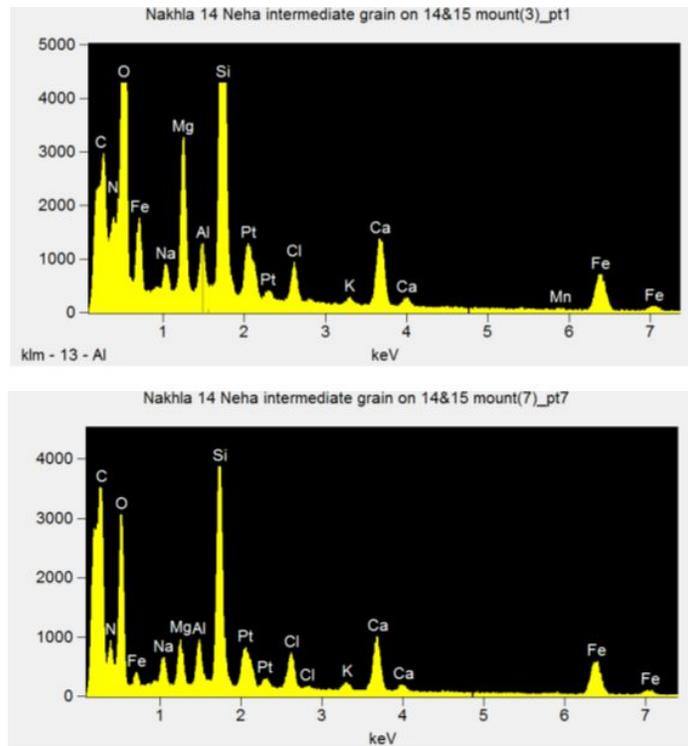
After examining this part, my mentor and I discovered a very intricate feature on Nakhla. It literally looked like a scaled done version of the Grand Canyon. We decided that it would be best to take a 3D image of that. In order to that, we first took a picture under normal circumstances and then one with a 6 degree tilt. My mentor's colleague then overlapped the two images to make it look three dimensional. This gives us a new perspective on looking at Nakhla's features.

After doing some research on that region, we moved on to look for carbonaceous matter in the sample and we did uncover a piece of organic material.

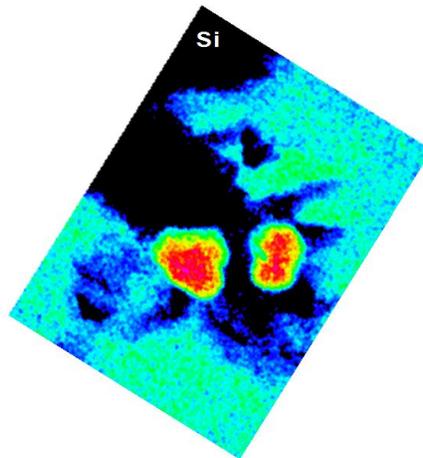
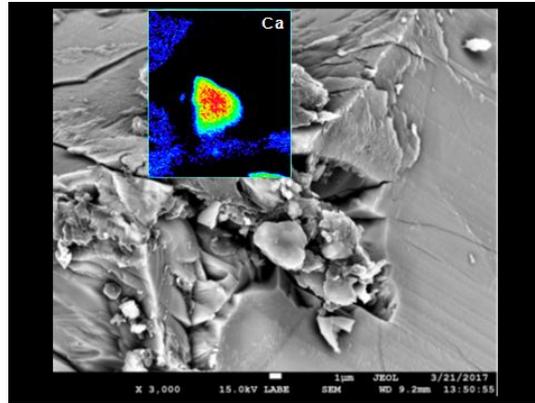


We were at first worried that the material might be a contaminant because it was residing on the edge of the sample. However, we soon discovered that it couldn't be possible because

there were multiple indigenous minerals embedded into the carbon matter. We decided it would be best to conduct a chemistry analysis and map the material to see if it was organic.



As you can see in the first graph, we can see a large peak in carbon and oxygen. This proves that the material is carbonaceous. In table 2, we also see a large peak in nitrogen. This was really exciting because it is the second time we have detected nitrogen in Nakhla, possibly showing us that Mars had nitrogen in its environment. This is definitely crucial for life to form and evolve.



These are just a few of the chemical maps we used on the Nakhla Martian Meteorite. Through this analysis technique, I was able to get an accurate spatial distribution of the key organic elements. It is definitely an useful tool to figure out how this rock developed while it was on Mars. Just like the “Grand Canyon” feature, we decided that we should do a 3D image of the organic material. So like before, we took one in a normal manner and one in a three degree tilt. With this 3D image, you can see how the organic matter has been distributed.

The research I did on Nakhla is not finished. It was the first time my mentor and I looked at it. As a result, we will continue to research the regions of interest and maybe one day formulate an abstract for something we discovered.