Analysis of Pluto's Al-Idrisi Montes and the Adjacent Deep Trench Feature. Gabriel Byers, Ronnie Evans, Samuel Byers. Jonathan Nguyen. Klein High School, Spring, TX.

Introduction: The Klein Astronomy Research Team (KART) in previous years has studied moons of Jupiter and Saturn looking for evidence of subsurface water through features such as linea and large ringed structures. In search of new horizons this year, the team began looking at the heart of Pluto, Sputnik Planitia, and a string of mountains on its westernmost edge, the Al-Idrisi Montes. By using the information from the Southwest Research Institute and geographical information found on JMARS, the team collected elevation points from a 93,742.5 square/kilometer region of western Sputnik Planitia. Through our examination on the elevations of the trench and mountains, we are looking for a correlation between the height of the Al-Idrisi Mountains and the movement of Sputnik Planitia, be it by solid state convection, viscous relaxation, or another possible mechanism.

Experimental Setup: We decided to collect data points from the Al-Idrisi Mountains and the trench, then we specified the longitude and latitude of each point. Our team of four split the points into sections and we collected the elevations at each point. After initially finishing our data collection we realized that the amount of points collected would not be adequate enough to make a definite conclusion. Because of this, we nearly quadrupled the amount of collected points, ending up with around 1250 points of elevation.

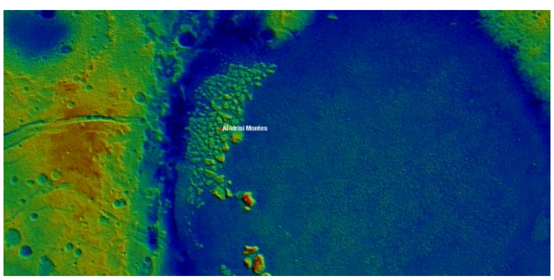

Fig. 1 *The colorized elevation map of the western half of Sputnik Planitia which includes the Al-Idrisi Montes and the adjacent trench.*

Discussion: We have observed that there is a very deep trench along the western edge of Pluto's ice-covered basin well known as the Sputnik Planitia. This intrigued the Klein Astronomy Research team because the observation began to raise questions and ideas, such as, "Why is the trench there?", "Is Sputnik Planitia moving?", "If it is moving, is it moving west or east?", "Do you think solid state convection is a possible reason?". What added to this is that the Al-Idrisi Montes are directly east of the trench and seem to follow the curve of the trench as it travels along the west edge of Sputnik Planitia. The easternmost mountain peaks of not only Al-Idrisi but of the Baret Range just southern and to the east of Al-Idrisi, are much more elevated than the mountains closer in proximity to the trench. For example, the mountains closer to the trench range from around 200-1000 meters in elevation, and the ones farthest from the trench range from 1500-2800 meters in elevation.

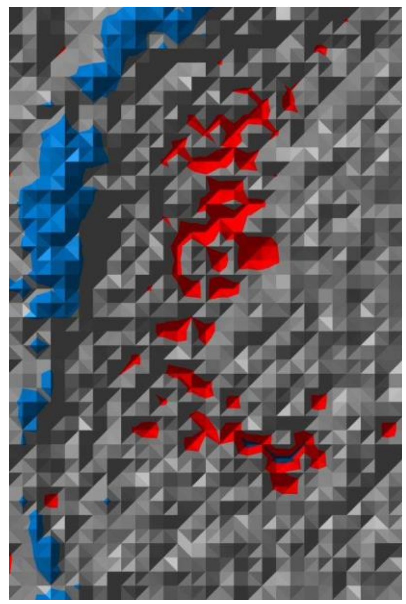

Fig. 2 *The topographic map above is the result of the data points collected. The red areas are the extreme highest points, the Al-Idrisi Montes peaks. The blue being the extreme lowest points, the trench between the mountains and the mainland.*

We can confidently say that the Al-Idrisi mountain range has moved east in the past, as it could possibly have been connected to the mainland. It is shown in **Figure 1** that the mountains are almost the same elevation. The range appears to be of the same material as the mainland but we cannot confirm this. Another possibility is that the trench was formed by the freezing and cracking of nitrogen ice in that area. However, there is not enough information to draw this conclusion. The lowest points in the trench we measured may tell us some things about how the range was formed. There does not seem to be significant evidence that supports the theory that this was created through glaciation, solely through our observations. We have not observed any of the signs of viscous relaxation in the area of the trench or the mountains, but we have no way of disproving this theory. Sublimation is a possible factor that can affect the surface however, due to the fact that there is a difference of around 5800 m between the highest and lowest collected elevation points this is most likely not the main factor of the gaps. According to Oliver White, at NASA Ames Research Center, this leaves solid state convection as a primary resurfacing force in Sputnik Planitia. The lowest point measures at -2959.9 meters, and the highest point in the range measures at 2862.8 meters, a huge difference of 5821.9 meters **Figure 2**. The height of the peaks gradually rises from west to east in a direction away from the trench. This gives us an indication that the mountains were formed by being uplifted by the formation of the trench.

Results: Evidence suggests that the Al-Idrisi mountains may have been uplifted by the formation of the western trench feature. Solid state convection appears to be our best supposition as to how the Al-Idrisi Montes reached their heights. In certain ways, we received a partial answer for our hypothesis. According the data collected from JMARS and SwRI, the height of the Al-Idrisi Montes and the depth of the trench correlate along latitude and longitude lines. However, our hypothesis still remains in need of study and this trench-mountain system warrants serious further research. Further study could help lead to a better understanding of Pluto's interior and potential ocean.

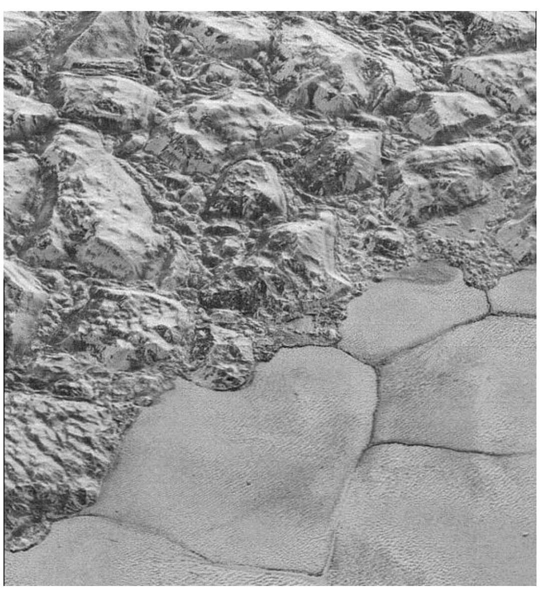

Fig 3 *High definition picture taken by New Horizons of the area that the Al-Idrisi Montes and Sputnik Planitia meet. It makes the movement of the Al-Idrisi Montes clear, just not the direction of that movement.*

References: [1] Qiang Wei et al. (2018) Young Surface of Pluto's Sputnik Planitia Caused by Viscous Relaxation. [2] Kelsi Singer et al. (2017) Chaotic Mountain Blocks in Pluto's Sputnik Planitia. [3] Oliver White et al. (2017) Geological Mapping of Sputnik Planitia on Pluto. [4] J.R. Spencer et al. (2016) The Geology of Pluto and Charon Revealed by New Horizons. [5] A.J. Trowbridge, H. J. Melosh, A. M. Freed (2016) Pluto's Geologic Activity and a Universal Criterion for Plantary Vigor. [6] Alejandro Soto et al. (2016) Atmospheric Circulation and Distribution of Nitrogen Ice on Pluto Due to Surface Ice and Topography. [7] https://charlesastro.wordpress.com/home/ (2018) Active Convection in Sputnik Planum.

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