Possible Correlation Between Lunar Rille

Width and Depth ~ Sinuosity and Length

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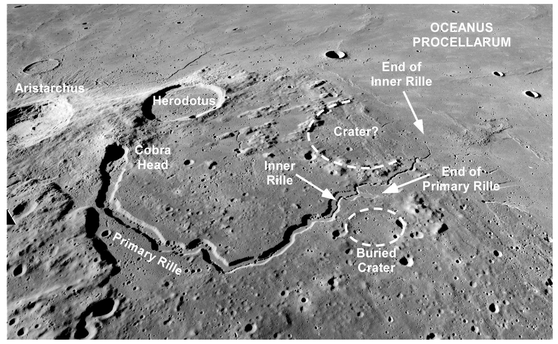
ABSTRACT

The lunar landscape has many interesting features, but we focused our attention on the lunar rilles. Learning about the formation of these structures inspired us to choose them as our research question. We focused on finding out if there was a correlation between the width of a lunar rille and its depth as well as seeing if length effected the sinuosity of a rille. Five locations on the Moon were selected and data was collected from each site. Scatter plots were created for each site and analyzed and we attempted to show if there was a linear relationship between lunar rille width and depth as well as sinuosity and length.

Introduction



Lunar rille located at one of the study sites.

Although there are many interesting features on the Moon, we were interested in the sinuous rilles. Lunar rilles are lava channels on the surface of the moon. They usually originate at impact craters. Impact craters are large basins formed when a planet's surface is struck by a meteoroid. A majority of the lunar rilles are located near impact craters (http://www.lpi.usra.edu/lunar/rilles/) . We grouped the lunar rilles by location to see whether the rille characteristics were similar at each basin. By looking at the data from Hurwitz et al. (2013), we were able to determine if there were correlations between the width, depth, length, and sinuosity of the lunar rilles on the Moon.

Methods

1) Selected the following lunar rille locations to focus our research on: *Serenitatis*, *Sinus Aestuum*, *Imbrium*, *Orientale*, and *Procellarum*.

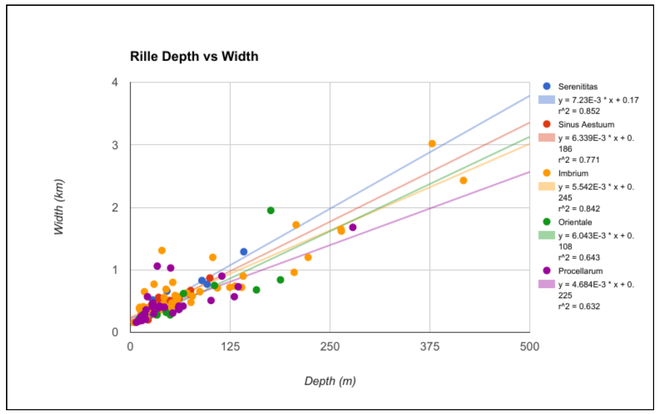
2) Collected data on rille sinuosity, length, width, and depth from Hurwitz et al. (2013) excel data sheet.

3) Created scatter plots for sinuosity vs. length and depth vs. width.

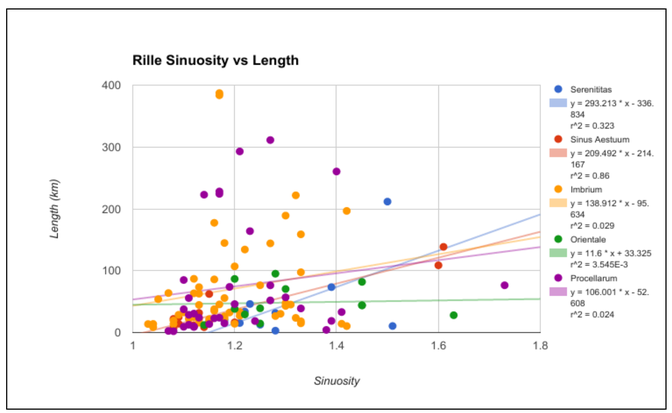
4) Analyzed data to determine if there was a linear relationship.

5) Formed a conclusion based on our data analysis.

Data and Analysis



Analysis of the scatter plot for Rille Depth vs Width reveals that there is a linear relationship between the width of the rille and its corresponding depth at each of the five studied locations. Linear relationship in this graph (and in the one following) was determined by using the r^2 value. If the value was closer to 1 it was more linear.



Analysis of the scatter plot for Rille Sinuosity vs. Length reveals that three of the sites showed no linear relationship between sinuosity vs. length (*Serenitatis*, *Imbrium*, and *Procellarum*), while two sites (*Sinus Aestuum* and *Orientale*) both showed a linear relationship.

Conclusion

For Lunar Rille Width vs Depth, there was definitely a linear relationship. Factors that could possibly effect the width and depth of lunar rille formation could be elevation of rille, proximity of impact crater, type of magma that created the rille, and the terrain that the magma had to travel through. Proximity to a large impact crater would provide ample supply of magma. Magma high in silica would result in a magma that would be less viscous and therefore would flow more readily. Elevation would also increase the speed of the flow. All of the above factors would have an effect on the depth of the rille and its corresponding width. If the magma cooled at the surface quickly creating a "tube" then the width and depth of the rille would be restricted. The magma would retain some of its heat and flow for a longer distance . Based on the graphed data, lunar rilles with a width of 1-2 km had an average depth in the range of 0 - 125 meters, with a few that were wider and deeper.

The data for lunar rille Sinuosity and length had mixed results. Three of the sites showed no linear relationship between the sinuosity of the rille and its length while the remaining two sites (Sinus Aestuum and Orientale) *did* show a linear relationship with one site (Orientale) being quite high with a r^2 value of 3.5. One possible cause for these two different results could be the geography of the two locations. There are large impact craters near both of these sites as well as a mountain range near Sinus Aestuum. Elevation gradients, type of terrain, and magma composition could also be factors that would have an effect on the length of the rille and its sinuosity. A majority of the study sites had a length of 0 - 200 km in length with a sinuosity range of 1.0 - 1.3. Sinuosity values are as follows: 1.0 is considered straight, 1.0-1.5 is sinuous, and anything above a 1.5 is meandering.

Data Resource ~ Citations

Reference: Hurwitz, D. M., J. W. Head, and H. Hiesinger (2013), Lunar sinuous rilles: Distribution, characteristics, and implications for their origin, Planetary and Space Science, 79-80, p. 1-38.

L. (n.d.). Atlas of Lunar Sinuous Rilles. Retrieved April 19, 2017, from http://www.lpi.usra.edu/lunar/rilles/

Image: LROC, http://lroc.sese.asu.edu/posts/108

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