

Examining the Presence of Cryovolcanism on Enceladus and Europa Through Surface and Crustal Comparisons. Timothy Cole, Andrew Manchester, and Sierra Schuman. Klein High School, Spring, TX.

Introduction: Diverting from Mars to focus more on the outer planets of Jupiter and Saturn, Klein High Europa Enceladus Student Imaging Project (EESIP) intended to examine the physical relationship between Europa and Enceladus and their respective planets. We questioned further to see how these relationships would affect the presence and absence of cryovolcanism on the two moons. Throughout our studies, we found similarities between these two moons such as their youthful appearances and similar resurfacing processes. Europa and Enceladus also share icy surfaces, each fractured by unique cracks. On Enceladus, four specific regions contain cracks that create a distinct tiger-stripe feature along the southern pole: Alexandria Sulcus, Damascus Sulcus, Baghdad Sulcus, and Cairo Sulcus. These regions have also been cited to hold cryovolcanic plumes. As for Europa, dark spots have already been cited along Rhadamanthys Linea. It has been recently discovered that Europa may contain active plumes when the moon is near apocenter.

By focusing on the latitude and longitude of the cracks, dark spots, or geysers, the width of the cracks, the areas and radii of each dark spot or geyser, and the length between the geysers, we also hope to support the hypothesis that there may be active geysers on Europa.

Experimental Setup: Using the Voyager and Galileo spacecrafts for Europa and the Cassini spacecraft for Enceladus, we studied five distinct regions: four on Enceladus, and one on Europa. On Enceladus, we looked at Alexandria Sulcus, Damascus Sulcus, Baghdad Sulcus, and Cairo Sulcus. On Europa, we looked at Rhadamanthys Linea.

This experimental procedure was designed with the intent to expose possible factors of cryovolcanic activity through a generally systematic setup that compares the areas of cryovolcanic activity on Enceladus with the areas of possible cryovolcanic activity on Europa.

Procedural steps were as follows:

1) Mark along the chosen linea or sulcus features in 10 kilometer increments by recording latitude and longitude for both Enceladus and Europa.

2) At each mark, measure the distance across the linea or sulcus features on a line perpendicular to the general direction of each feature; for both Enceladus and Europa.

3) Mark the dark spots on Europa (the areas where cryovolcanic activity may exist) and the areas where

cryovolcanic activity exists on Enceladus that lie on the linea or sulcus features by recording latitude and longitude.

4) Measure the distance between the dark spots as well as the distance between the areas of cryovolcanic activity.

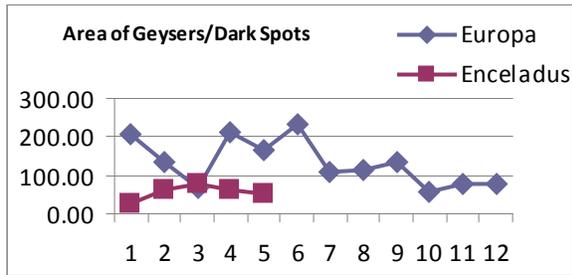
5) Measure the radius and calculate the area of each dark spot that has been marked as well as each area of cryovolcanic activity that has been marked.

Results and Discussion: How the physical relationships would affect the presence and absence of cryovolcanism on both moons is determined by the area of the dark spots and plumes along all of the lines. Both Europa and Enceladus share an inverse relationship between the area of the geysers/dark spots and the width of the cracks. This may indicate that as the width of the cracks increases, the area decreases. This suggests that a smaller crack could create a build up of pressure that causes the substances to spread out further upon release.

When compared to Enceladus' cracks, Europa's cracks seem to be wider in Rhadamanthys Linea. This could suggest that more powerful forces such as greater tidal forces or interior thermal forces may be at work. On Europa, the latitude and the width of the cracks appear to share an inverse relationship. The data seems to indicate that the width of the cracks increases towards the equator but decreases towards the poles. However, on Enceladus, all of the cracks are at the southern pole, which makes it difficult or impossible to compare this factor productively with Europa. The measured areas of the geysers/dark spots on Europa are highly variable while the areas of the geysers on Enceladus lie within a specific range. Because of the variability of the areas of dark spots on Europa, this factor may or may not have relevance to the presence or absence of actual geysers, if any, on the moon.

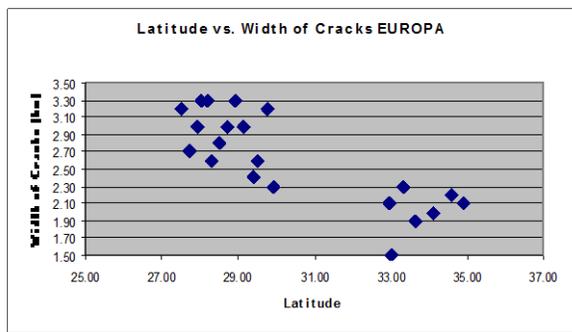
In the future, we hope to gather more data in other regions of Europa that may potentially contain active plumes. We are also interested in pursuing data from the regions of Cairo Sulcus and Alexandria Sulcus on Enceladus. This information may contribute to the future exploration of Enceladus and Europa as potential hosts for life.

Figure 1:



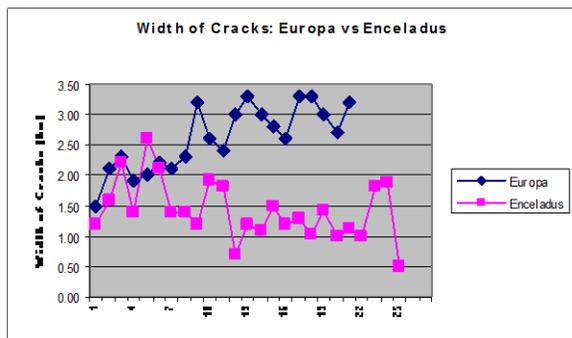
Areas of all of the geysers/dark spots in the regions studied on Europa (Rhodamanthys Linea) and Enceladus (Baghdad Sulcus and Damascus Sulcus).

Figure 2:



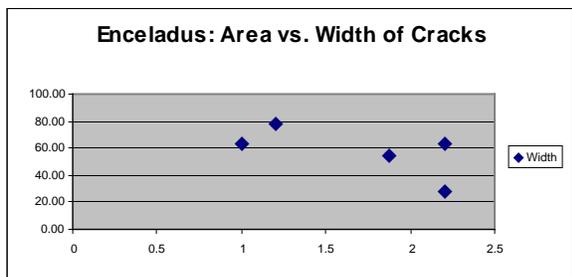
Latitude and the width of the cracks on Europa, as the latitude increases, cracks appear to become narrower.

Figure 3:



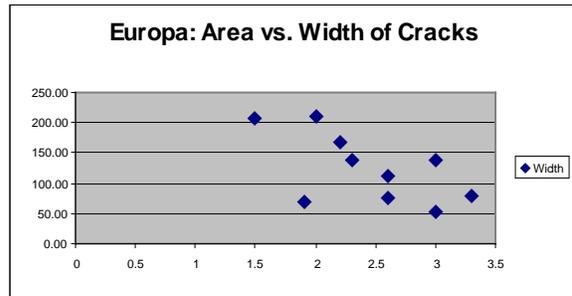
Width of the cracks (in km) on Europa and Enceladus. The X-axis contains the number of points used.

Figure 4:



Area of the cryovolcanic activation sites in comparison to the width of the cracks on Enceladus.

Figure 5:



Area of the dark spots to the width of cracks Europa.

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