The Cataloging of Craters on Enceladus. B. A. Karpes and P. R. Stoddard, Department of Geology and Environmental Geosciences, Northern Illinois University, Davis Hall 312, Normal Rd., DeKalb, Illinois 60115 (bkarpes@niu.edu).

Introduction: The cataloging of craters on Enceladus will be a useful tool in the further study of this enigmatic moon. Enceladus has a unique history in that there is little potential for tidal heating and little radiogenic heating, yet there is much geologic activity [1]. Craters are a very important tool in deciphering surface histories and will therefore contribute a great deal to the further understanding of this activity. Craters can be looked at for evidence of surface strain history, such as has been done on Venus, Mars and currently on Enceladus [2] and aid in determining the thermal history [3]. Preliminary studies showed that Enceladus' surface has varying degrees of crater impact densities ranging from tectonic terrains with little to no cratering to heavily cratered terrains [4][5]. Bray et al. also showed the distribution of craters varies by latitude, with craters being larger and densities being higher to the north [6].

Procedure: The location of craters is being cataloged based on publicly available images from the Cassini Imaging Central Laboratory for Operations (CICLOPS) web site [7]. At this point we have finished cataloging craters on images SE-10 through SE-6 and SE-4 which includes all longitudes between 22°S and 22°N and longitudes 180° - 270°W betweem latitudes of 21°N and 66° N. The images, which range from 70 – 2000+ m/px in resolution, were loaded into Photoshop where they were adjusted for best contrast to allow for easier identification of prominent features. The (x, y)-coordinate of each crater larger than 2.20 km (0.5° in diameter) was recorded and converted to latitude and longitude. The crater locations were then plotted based on size (between 2.2 and 4.4 Km, greater than 4.4 Km and greater than 6.6 Km) and deformation type (non-deformed, rifted (Figure 1A), elongated (Figure 1B) and rifted and elongated).

Discussion: All craters larger than 2.20 km (0.5°) were cataloged. Craters were then highlighted based on their size, less than 4.40 km, greater than 4.40 km and greater than 6.60 km, and deformation (Figure 2). Deformed craters are identified as craters which have been rifted, elongated or both. The highest density of craters, thus far, is located between 216°W and 144°W, and centered nearly around 180°, which corresponds to image (SE-8) which has relatively high resolution (100-700 m/px). The next highest density area lies north of 21°, image SE-4, which is also dominated by high resolution. The largest craters, those over 4.40 km, were almost entirely found in this same area. The high density of craters in this region may be significant and require future study, or it may be due to the lower resolution of the other images. As previously stated [8] it can be argued that the low resolution of some of the images could be a factor in the relative lack of craters, even at resolutions of 2 km/px craters the size of 4 km should take up 4 pixels and be identifiable. While few craters were found in the lowest resolution areas (Figure 3) there are areas (Figure 4) in which there were few craters though resolution of the image is high. This area contains a high degree of rifting and further study will be needed to identify any correlation.

Future Work: We plan to finish the cataloging of the remainder of Enceladus craters, hopefully with the aid of higher resolution images from the recent close flybys of Enceladus [7]. Once all of the craters are mapped we will analyze them according to size and type of deformation. We will investigate carefully the deformational relationships in the high crater-concentration regions. As previously mentioned, there is the possibility the overall lack of craters is due to the lower resolution images but this does not explain the lack of cratering in the high resolution images or the concentration of large craters in the same region and lack thereof elsewhere.

References: [1] Smith et al. (2007) *LPI Contributions,* 6051. [2] Goff-Pochat et al. (2008) *LPS 39* abstract #1773. [3] Schenk (2008) *ScSSI* abstract # 9095. [4] Miller et al. (2007) *LPI Contributions, 1357,* 95-96. [5] Smith et al. (2007) *LPS 38,* Abstract #2237. [6] Bray et al. (2007) *LPS 38,* Abstract #1387. [7] DLR and NASA/JPL/Cassini Imaging Team (2007) http://ciclops.org/view.php?id=2441. [8] Karpes and Stoddard (2008) *LPS 39*, abstract #2100

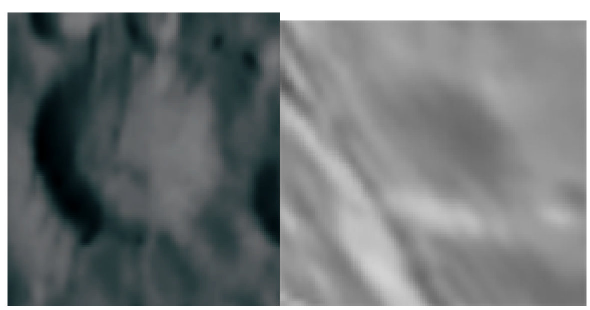

Figure 1A. Example of a rifted crater (left image), location image SE-8 196.64°W 6.39°S.
Figure 1B. Close up of an eliptical crater (right image). Location is image SE-4, 253.82°W, 41.34°N.

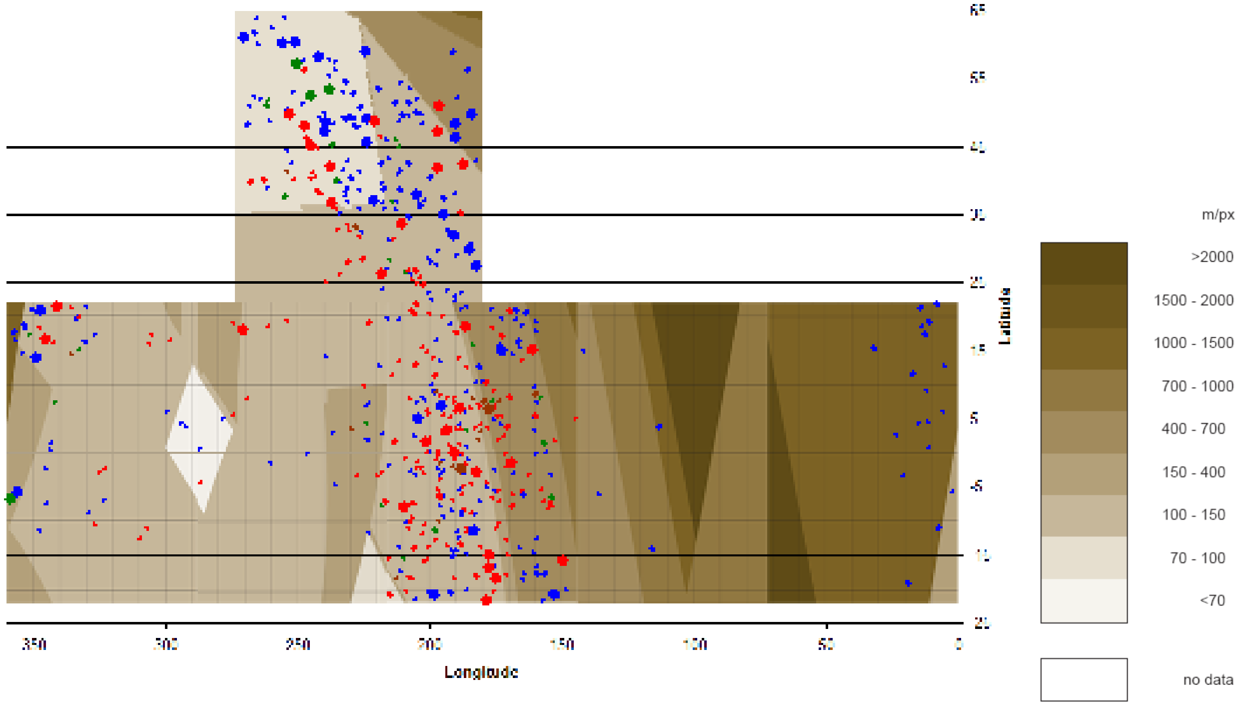

Figure 2. Crater locations plotted by Longitude and Latitude. Blue represents non-deformed craters, red represents rifted craters, green represents elongated craters and brown represents craters that are rifted and elongated. Small dots indicated craters from 2.2-4.4 Km, medium size indicate >4.4 Km and the largest dots represent craters >6.6 Km. The colored areas represent resolution with the darkest areas representing the lowest resolution, white areas represent areas that have not been plotted at this time.

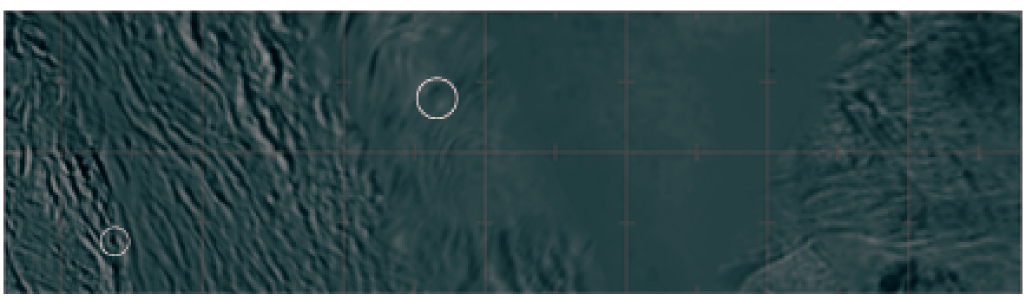

Figure 3. Image SE-7, this is an example of a low resolution image with the resolution ranging from 400 – 2000+ m/px, approximately 80% of this image is 700 m/px or worse. Only 2 craters (circled) could be identified from this image. Image ranges from 10°N to 10°S latitude and 144°W to 72° W longitudes.

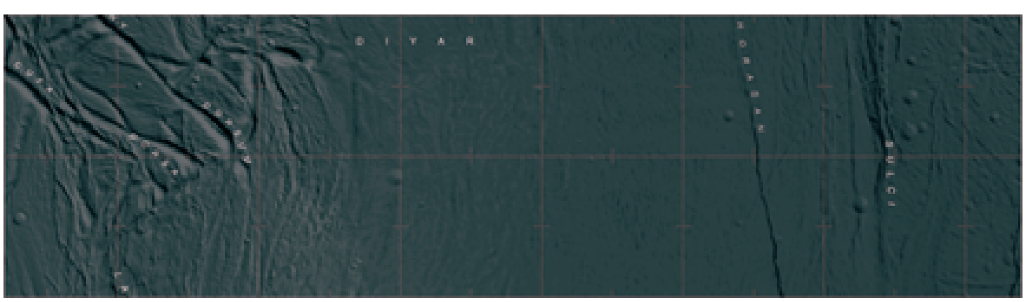

Figure 4. CICLOPS image SE-9 with resolution ranging from < 70 – 400 m/px. This high-resolution image contains few craters especially on the left side where there is a high degree of tectonic activity.