IAPETUS: CONSTRUCTION AND ANALYSIS OF A GLOBAL CRATER DATABASE. E. S. Martin[1] and D. M. Jurdy[2], [1]Dept. of Geological Sciences, University of Idaho, Moscow, ID (mart5652@vandals.uidaho.edu), [2]Dept. of Earth and Planetary Science, Northwestern University, Evanston, IL (donna@earth.northwestern.edu).

Introduction: Notwithstanding in-depth studies focused on Iapetus, no global digital database of craters exists. This work has mapped and recorded the location and diameter of craters (>1 km) on Iapetus into a global crater database. A method for measuring crater diameters is presented that matches well with previously published crater diameters. Digitization of craters allows spatial analysis to be conducted on a global scale. Although simple in nature including only coordinates and crater diameter, the database can be built upon for future work, including morphological classification and characteristics of craters. On a global scale what does the distribution of craters reveal about Iapetus? Few other varieties of features manifest themselves on the surface of Iapetus. Thus craters are relied upon heavily for studies of the surface. It is therefore important to understand the distribution of craters sizes found on Iapetus.

Building the Database: A global mosaic produced by The Cassini Imaging Science Team (also see [1]) and released in May 2008 was used as the base map. The map is composed primarily of Cassini data with some Voyager data. Craters were traced by hand using ArcGIS, and were stored as polygons. The latitude and longitude recorded for each crater is the center point of the crater [2]. To date ~6700 craters have been mapped and recorded in the database with their corresponding diameters and locations.

Measuring Crater Diameters: Although each polygon was not exactly circular, a diameter was calculated under the assumption that each polygon was circular. The area of each polygon was determined, and thus the diameter was calculated [2]. Iapetus is not a perfect sphere but an oblate spheroid, with the a axis measured at 747.4km and the c axis measuring 712.4 km [3]. A mean radius of 735.6 km was used to convert the crater diameters from degrees into kilometers (12.83 km per degree).

To validate the calculated crater diameters, published diameters of large basins were compared to those in the database (see Table 1). Although there are some differences between the calculated diameters and published crater diameters, the results are largely consistent with each other. Thus the differences do not invalidate the assumptions made when the crater diameters were calculated in the database.

Table 1: Comparison of crater diameters calculated within the crater database with published measurements from multiple sources

Location	Diameters in km			
	[4]	[5]	[6]	Database
15ºN, 30ºW	550	590	580	588.5
35ºN, 80ºW	400	340	424	476.3
12ºN, 83ºE	-	50x70	64	65
-40ºN, 264ºE	-	-	504	544.4

Spatial Analysis: Figure 1 shows the completed database. Mapped craters range in size from 1.2 km to 589 km in diameter with the majority of craters ranging 5-20 km in size. Craters <5 km on the bright, trailing hemisphere appear most abundant, and craters that are slightly larger (10-20 km) appear to dominate the crater population on the leading hemisphere (see Figure 1). The total crater count for the leading and trailing hemisphere is 3124 and 3585 respectively. The hypothesis that a crater asymmetry would perhaps follow the albedo dichotomy is thus rejected. Although there is a difference of approximately 400 craters between the sides, this difference is not significant when considering resolution differences throughout the mosaic. It was predicted that there would be no cratering asyemmetry on Iapetus by [7], and our results confirm this.

Because Iapetus is so heavily cratered, analyses were done both with and without craters <5 km to determine the robustness of the distribution. Craters in certain sections of the basemap are more resolvable than others due to the resolution of individual images used in the mosaic. For example, the distribution of craters between ±60º latitude were examined in longitudinal bands at 10º intervals. The highest crater counts appeared at the centers of both the leading and trailing hemispheres. To verify this trend, all craters <5 km were removed from the analysis to eliminate any possible resolution constraints. An anomalously large crater population around 115º longitude was thus eliminated, showing that overall the distribution of crater counts are best represented by the craters >5 km. The distributions also reveal that for the leading hemisphere, the maximum crater density is slightly south of the equator (-10° latitude) and the maximum crater density on the trailing hemisphere is further

north at 30°. The same analysis was completed by excluding all craters <5 km and these observations persist. Although there are fewer craters in the total crater count, it is clear that the highs and lows of the leading and trailing hemispheres are real.

The northern and southern hemispheres were examined similarly as the leading and trailing hemispheres. There are more craters total in the northern hemisphere (4409) almost double the number of total craters in the southern hemisphere (2302). This pattern persists when the northern and southern hemispheres are divided into leading and trailing hemispheres.

Finally the distribution of craters around the equatorial ridge was examined. Craters were binned into latitudinal bands at intervals of 1° within ± 10° of the ridge for both the leading and trailing hemispheres. Because the ridge is more prominent on the dark, leading hemisphere we speculated that a difference in crater densities would exist close to the ridge. If cratering played a role in razing parts of the ridge on the trailing hemisphere, there should be a difference in crater numbers. No prominent patterns in crater distribution to support this hypothesis.

Conclusions: A digitized database of craters illustrates spatial distribution both qualitatively and quantitatively, examining closely crater distribution with and size. Creating a shareable, expandable database will allow continued analysis focused on the unanswered questions about Iapetus. A leading/trailing hemispherical crater asymmetry was not observed and in fact, the number of craters on each side is remarkably even. There also appears to be a slightly lower crater density within close proximity to the ridge, which suggests that it may be slightly younger than the surrounding terrain.

As new data becomes available, it will be necessary to update the crater database, as it will be an important factor in evaluating spatial patterns of craters on a global scale.

References: [1] Roatsch T. et al. (2006) *Planet. Space Sci, 54,* 1137-1145. [2] Greene R. P. and Pick J. B. (2006) Prentice Hall. [3] Thomas P. C. (2007) *Icarus, 190*, 573-584. [4] Porco C. C. (2005) *Science, 307.* [5] Giese B. et al. (2008) *Icarus, 193,* 359-371. [6] USGS: http://planetarynames.wr.usgs.gov/index.html [7] Zahnle K. et al. (2001) *Icarus, 153,* 111-129.

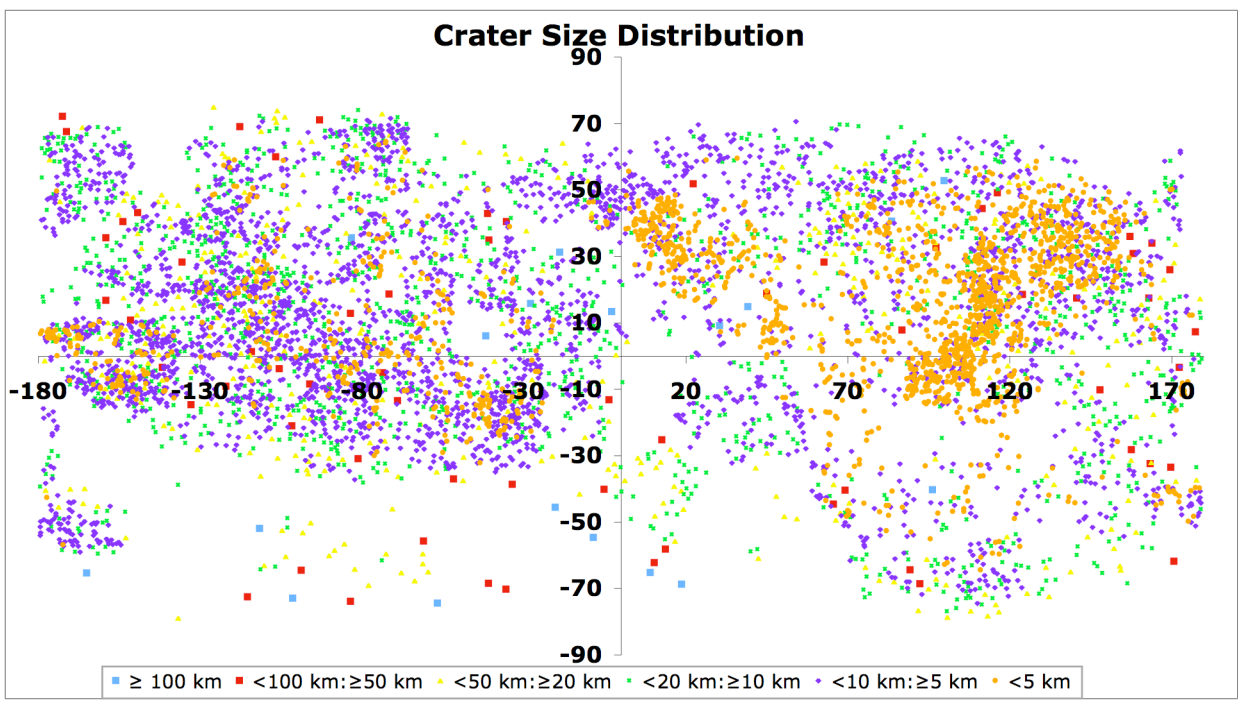

Figure 1: Completed crater database totaling 6700 craters.