TESTING MODELS FOR THE FORMATION OF THE EQUATORIAL RIDGE ON SATURN'S MOON IAPETUS VIA CRATER COUNTING. A. L. Damptz and A. J. Dombard, Dept. of Earth and Environmental Sciences, University of Illinois at Chicago, 845 W. Taylor St., Chicago, IL 60607 (adampt2@uic.edu).

Introduction: Iapetus is well known for its oblate spheroidal shape, hemispheric albedo dichotomy, deep impact-basins, and prominent equatorial ridge running most of the way around the equator. The equatorial ridge is unique in the solar system, and the formation of such an astonishing feature is likely attributed to key events in the evolution of Iapetus [1]. Several hypotheses have been proposed for ridge formation, all of which fall under two categories: exogenic and endogenic. Exogenic models include impact generated ridge formation [1, 2] and an ancient ring system [3]. Endogenic models include despinning [4, 5, 6], upwarping of the lithosphere [7, 8, 9], cryovolcanism [10], and planetary contraction [11, 12].

The purpose of this study is to examine the crater population on and around the ridge, test the various models of ridge formation, and assess the age of the ridge. Crater counting is a powerful tool used to understand the evolution of planetary bodies. Because craters are ubiquitous on Iapetus, a catalog of the crater population directly on and adjacent to the ridge can be useful to assess the relative age of the ridge. Each ridge formation model includes predictions about the crater population, which in turn can be used to differentiate these models. To date, one global crater database of Iapetus exists but lacks the detailed information required to test the ridge formation models [13].

Methods: We use two global mosaics of Iapetus: one generated by the Cassini Imaging Science Team using both Cassini and Voyager data, and the second composed solely of Cassini data that was generated in ISIS to contain more high-resolution imagery (courtesy P.M. Schenk). Craters are measured and cataloged in ArcGIS using the *Crater Helper Tool* [14]. A 6-point ellipse is used to generate information for each crater that includes latitude, longitude, diameter, extent, and major and minor axis azimuth. For a ridge that is 200 km wide, all craters counted within 8˚ North and South are considered "on ridge."

It is necessary to create a method of identifying craters in areas of low-resolution and non-optimal lighting where crater rims are often unidentifiable. In most cases, the crater rims in the high-resolution regions are indicated by bright pixels (Fig. 1A). Crater rims can then be identified in low-resolution regions by using the brightest pixels surrounding dark depressions (Fig. 1B). In addition, the image resolution available for Iapetus limits further crater classification (e.g., simple, complex, and multi-ring basin, ejecta deposits, primary and secondary craters, etc.). Some features included in the database are somewhat ambiguous as to whether it is a crater or mass wasting on the ridge. We make use of a recent study that identified large scale landslides [15] to aid further in the proper identification of craters.

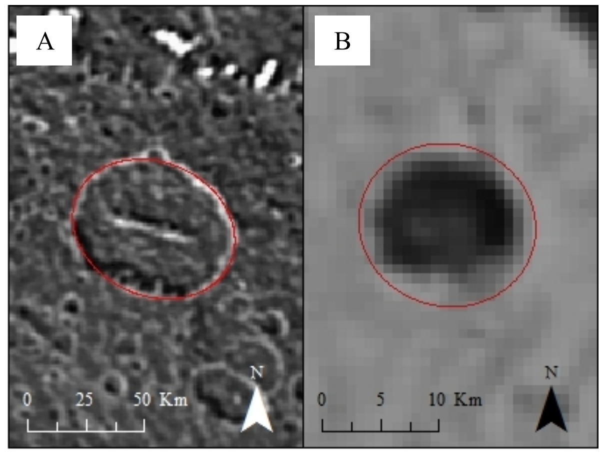

Figure 1. A) Crater rims in high-resolution regions are indicated via bright pixels. B) Crater rims in low-resolution regions are identified by the brightest pixels surrounding dark depressions.

Formation Model Hypotheses: From existing literature, we compile a list of models for ridge formation and the accompanying expectant crater population (see Table 1). The testable predictions include the time frame of ridge formation, crater saturation, and elongated or transformed craters. Each model has established whether the ridge formed early or later in the history of Iapetus. Crater saturation plays a major role in this study and is reached when the crater density becomes constant. If crater saturation is reached on Iapetus's ridge, a lower limit on its age will be obtained.

Several of the models include predictions of craters that have been physically altered. Craters that have been transformed are expected to be reflected in the despinning [4, 5, 6], cryovolcanism [10], and planetary contraction models [11, 12]. A planetary body that has undergone despinning or planetary contraction is expected to have complex tectonic patterns, e.g., a network of thrust faults, for which we will assess for each measured crater. For sufficient amounts of tectonism, the surface can even be effectively resurfaced, such as has been proposed for the grooved terrain of Ganymede. Thus, older craters on a surface that is affected by tectonics may be transformed. Based on the cryovolcanism model proposed, intrusive cryovolcanism has the potential to transform craters, and extrusive cryovolcanism would overprint craters and effectively reset the surface, which might be revealed in a gradation in crater density away from the ridge. The exogenic models have the potential to produce low speed shallow impacts that would generate ragged craters preferentially elongated in the E-W direction [1, 2, 3].

Expected Results: This crater database will document qualitative and quantitative crater characteristics on Iapetus and aid future crater research. Once the database has been completed, a statistical analysis will be performed. The distribution of craters will be examined in latitude bands at 8˚ intervals, spanning ±32˚ latitude and 0-360˚ longitude, to establish characteristics of the craters on and off ridge. Although this study will only span ±32˚ latitude, it will be useful for further studies that examine the morphological characteristics of craters and the surface of Iapetus. Finally, we will use this crater catalog and compiled model information to analyze the formation hypotheses developed by other authors. If the analysis can be correlated with any of the individual ridge formation hypotheses, it has the potential to reveal important information about the formation and evolution of the ridge and history of Iapetus.

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Table 1. Hypothesis Matrix of Formation Models			Predictions[1]			
Class	Model	Author(s)	Early Ridge Formation	Late Ridge Formation	Transformed Craters	E-W Elongated Craters
Exogenic	Giant Impact	[1]	0	1	0	1
		[2]	1	0	0	1
	Ancient Ring System	[3]	1	0	0	1
Exogenic	Despinning	[4]	1	0	1	0
		[5]	1	0	1	0
		[6]	1	0	1	0
	Upwarping of Lithosphere	[7]	1	0	0	0
		[8]	1	0	0	0
		[9]	1	0	x	0
	Cryovolcanism	[10]	1	0	0	0
	Planetary Contraction	[11]	1	0	1	0
		[12]	1	0	1	0

1. Yes (1), No (2), Either/Or (x)