CRATERS ON SATURNIAN SATELLITES OBSERVED BY CASSINI IMAGING. E. P. Turtle[1], [1]Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723, USA. Elizabeth.Turtle@jhuapl.edu

Introduction: Saturn has more moons than any other planet in the solar system (52 are named) and most, although not all, of these worlds have heavily cratered surfaces, illustrating a variety of impact craters and crater modification processes. The major airless moons, from Hyperion (270km diameter) to Rhea (1530km) exhibit a range of cratering densities and morphologies that recent images from the Cassini spacecraft show in considerable detail. In stark contrast, Titan's surface, like that of the Earth, has undergone significant geological activity which has left few fresh impact craters on its surface.

Hyperion (270 km diameter): This irregular-shaped moon tumbles chaotically in an orbit between Titan and Iapetus. It is characterized by remarkable and uniquely deep craters that give the body a sponge-like appearance. The craters have floors of dark material, perhaps indicating some sort of sublimation process [1].

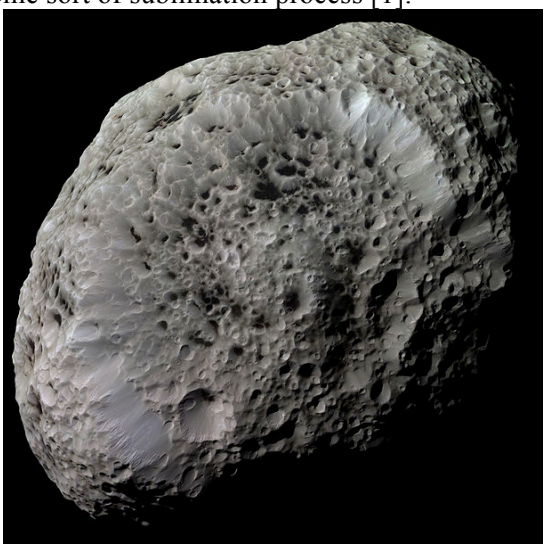

Fig.1 Hyperion.

Mimas (400 km diameter) Mimas' most striking feature is the 130-km crater Herschel, which is ~15km deep [2] with a prominent central peak. The impact must have nearly destroyed Mimas, the innermost major satellite (which therefore experiences the highest impact velocities).

Enceladus (500 km diameter): Enceladus has received considerable attention due to the active jets near its south pole, venting water, salts and organics into space. This activity is also reflected in Enceladus' cratering record. Crater density varies dramatically across the surface, indicating significant regional differences in geologic activity over Enceladus' history [3]. Some regions, like the cryvolcanically active South Polar Terrain [4], have few if any craters. In other areas craters are abundant, although they tend to be heavily modified: many are crossed by tectonic fractures [5], while others show the domed floors characteristic of viscous relaxation [6].

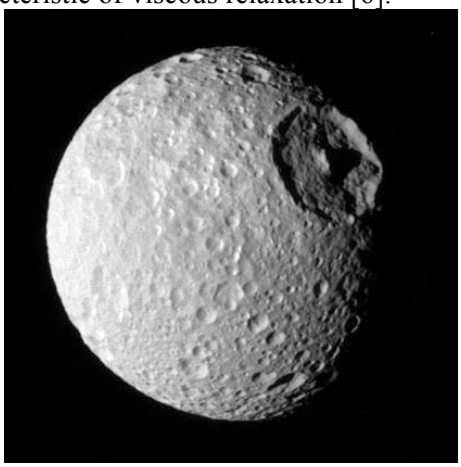

Fig.2. Mimas, showing Herschel.

Fig. 3. Craters Al-Haddar (top), Shahrazad and Dunyazad (bottom, 27 km across) on Enceladus showing domed floor and tectonic fracture.

Tethys (1080 km diameter); Dione (1120 km diameter); and Rhea (1530 km diameter): These satellites are heavily cratered and exhibit little post-impact modification aside from mass wasting processes.

Fig 4. Tethys and the 400 km crater Odysseus.

Iapetus (1440 km diameter): Iapetus has several unusual features: a strongly oblate figure, a high equatorial ridge, and a pronounced leading/trailing-hemisphere albedo asymmetry. The veneer of dark material creating this asymmetry is evidently thin, as it can be penetrated by even small impact features, although the fact that the largest craters are also dark suggests recent or ongoing emplacement [7]. Iapetus also has several ery large impact basins [*e.g.,* 8], which, in striking contrast to tiny Enceladus, show no evidence of viscous relaxation, placing constraints on the permitted temperature gradient of the crust. The craters do show evidence of mass-wasting.

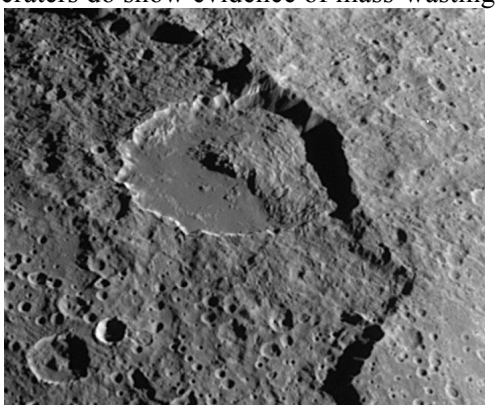

Fig. 5. Landslide material appears to have collapsed from the 15km rim scarp of a 600km wide impact basin on Iapetus. The landslide rubble extends halfway across a the 120-km flat-floored crater that lies just inside the basin scarp.

Titan (5150 km diameter): Saturn's largest satellite, Titan is also the only satellite in the Solar System with an extensive atmosphere. Atmospheric activity (wind and rainstorms [*e.g.* 9], possibly in addition to endogenic geologic activity have heavily modified Titan's surface leaving only a few recognizable craters [*e.g.,* 10].

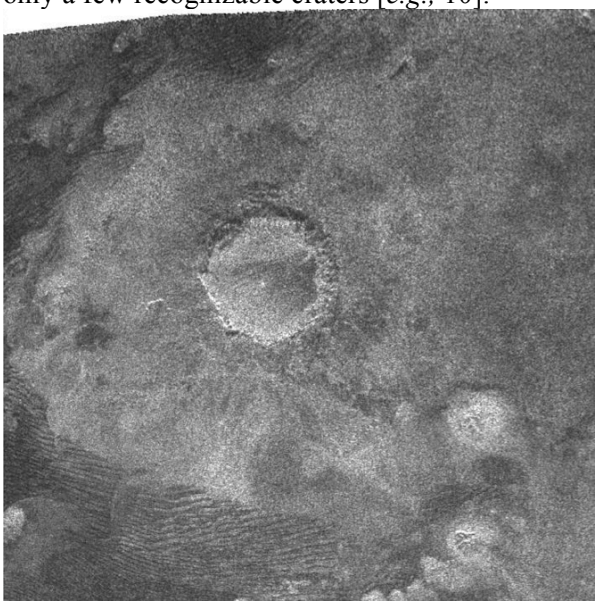

Fig 6. Titan's Sinlap crater (80-km-diameter).

References:

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