AOGS 2005

Cassini-ISS observations of medium-sized Saturnian satellites

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During its first year in orbit around Saturn, the Cassini spacecraft made various flybys of the medium-sized Saturnian satellites, including Enceladus at 500 and 1180km range, Phoebe at 2100km, Tethys at 50000 km, Dione at 72000km, Mimas at 82000km, Iapetus at 123000km, Rhea at 137000km, and Hyperion at 166000km.

For *Dione*, the basic question about the origin of the wispy-streak terrain — volcanic or tectonic origin — has been addressed with data of the Imaging experiment (ISS [1]). The images show no indication of volcanic-style flooding, but an extensive tectonic pattern (*Fig. 1*). There is also evidence of tectonic activity on the leading side where no streak pattern was observed in Voyager data.

The *Iapetus* observations offered various new surface features and new constraints on the dark-side origin [2,3]. Four giant basins (diameters ~390 to ~550km) were detected, and the southern hemisphere has been observed for the first time. A long (up to 2000km) ridge up to 100 km wide and up to 20km high was observed within the dark hemisphere (*Fig. 2*). The dark blanket appears to have been emplaced ballistically, not by any kind of flooding. Within the limits of the data (resolution and coverage), it has not been punctured by any bright-floor or ray craters, indicating a relatively young age compared to crater formation. It is probably less than a kilometer thick, as shown by the absence of visible layers at bright crater walls within the dark terrain.

Enceladus observations revealed large ridge networks, folded ridges, lobate flow patterns, dome and cone-like structures, parallel grooves, rifts, fractures, pits, craters, and other geologic features (*Fig. 3*). Dark freckles, a few hundred meters in size, were detected; these are often aligned in chains parallel to narrow fractures and are so far unexplained. Topographic relief is up to 1.5km and therefore unusually low for such a small object. Color observations revealed spectral differences on ridge slopes compared to regular terrain, possibly due to grain-size variations.

Phoebe was observed at up to 13m/pxl [3]. It's surface is heavily cratered. Some craters are cone-shaped, some exhibit a rim layering, indicating that the dark, upper regolith is up to a few hundred meters thick (*Fig. 4*).

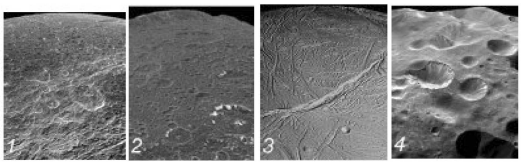

Figure 1: Dione, 880 m/pxl. Figure 2: Iapetus, 860 m/pxl. Figure 3: Enceladus, 520 m/pxl. Figure 4: Phoebe, 180 m/pxl. The size of each image is 200x250 pxl.

References

[1] Porco, C.C. *et al.*, *Space Science Reviews* **115**, 363 (2004).
[2] Denk, T. *et al.*, *Lunar Planet. Sci. Conf.* **36**, abstracts 2262 and 2268 (2005).
[3] Porco, C.C. *et al.*, *Science* **307**, 1237-1242 (2005).