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The surface of Saturn's satellite Dione observed by the Cassini ISS Camera: Geology, ages and topography

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Data base and procedure: More than two decades ago, the cameras aboard the two Voyager spacecraft imaged Saturn's satellite Dione (1124 km in diameter) at spatial resolutions of at least 1 km/pxl. Its surface is characterized by (1) cratered plains, (2) smooth plains which were believed to be volcanic extrusions, and (3) tectonic features possibly originating from early periods of expansion and/or contraction [1][2][3][4]. The trailing hemisphere, imaged only at low resolution ($>$ 5 km/pxl) by Voyager, shows a system of very bright, filament-like linear markings termed *wispy material* [2]. Since the Cassini Orbiter has been inserted into orbit around Saturn (July 1, 2004), image data at resolutions up to 15 m/pxl were obtained by the Cassini ISS camera. These images were used to map geologic units and to compare these units to those mapped on Voyager data. Ages of these units were obtained from crater size-frequency measurements and from application of impact chronology models [5][6][7][8]. Special topics are (a) possible evidence for past cryovolcanic activity and (b) the nature of the wispy terrain seen on the trailing hemisphere. **Results:** Cratered plains are the most extensive and oldest units on Dione, confirming Voyager results [1][2][3]. Unexpectedly, there are no old, degraded impact basins as seen on other icy satellites, such as Rhea, Iapetus, or the Galilean satellite Callisto [9][10][11]. Model ages of this oldest unit are either $>$ 4 b.y. [7] or $>$ 2.5 b.y. [8]. Resurfacing is caused by tectonism rather than cryovolcanism. Also, the wispy material is of tectonic rather than of cryovolcanic origin. At smaller scale (high-resolution), bright lineaments, in some places sets of parallel, densely-spaced lineaments, indicate incipient tectonism where no further displacements have occured. According to crater size-frequency measure-

ments and model ages, tectonic episodes may date back to > 3.7 b.y. [7] or > 1 b.y. [8]. Less densely cratered plains in many cases are associated with younger craters, basin(s) and their ejecta. Only one basin with a diameter of about 400 km was discovered so far. This basin which could be discerned in low-resolution Voyager images [13] is stratigraphically young, with model ages of 3.2 b.y. [7] or 0.33 b.y. [8]. Stereo data revealed that this basin has an inner ring and central peak complex. The youngest units on satellite surfaces are associated with bright ray craters. Such features have not yet been observed on Dione, except for small craters < 2 km. One feature named Cassandra and presumed to be a ray crater turned out to be actually a set of radial scarps radiating away from a point source and exposing bright ice on their slopes. A comparative investigation of Dione and its outer neighbour satellite Rhea is underway. Rhea also shows wispy markings on its surface which could not be seen in detail so far. Moreover, major surface features on Dione and Rhea, such as basins, craters and tectonic structures unnamed so far will be assigned names. **References:** [1] Smith, B. et al. (1981), *Science 212*, 163-191. [2] Plescia, J. (1983), *Icarus 56*, 255-277. [3] Moore, J. (1984), *Icarus 59*, 205-220. [4] Consolmagno, G. (1985), *Icarus 65*, 401-413. [5] Boyce, J. and Plescia, J. (1985), in: *Ices in the Solar System* (D. Reidel Publ.), p. 791-804. [6] Neukum, G. et al., *LPSC XXXVI*, abstr. No. 2034 (CD-Rom). [7] Neukum, G. et al. (2006), *this volume*. [8] Zahnle, K. et al. (2003), *Icarus 163*, 263-289. [9] Wagner, R. et al. (2004), *LPSC XXXV*, abstr. No. 1964 (CD-Rom). [10] Moore, J. et al. (2004), *Icarus 171*, 421-443. [11] Giese, B. et al. (2005), *Bull. Am. Astron. Soc. 37*, abstr. No. 47.08, p. 728. [12] Horner, V. M. and R. Greeley (1982), *Icarus 51*, 549-562. [13] Stooke, P. J. (2002), *LPSC XXXIII*, abstr. No. 1553 (CD-Rom).