IMPACT CRATER MORPHOLOGY ON SATURNIAN SATELLITES - FIRST RESULTS: P.M. Schenk, Lunar and Planetary Institute, Houston, TX 77058 (schenk@lpi.usra.edu)

Introduction: The middle-sized icy satellites of Saturn occupy an important niche in solar system studies. This is true also in our understanding of impact crater formation, where the low to moderate surface gravity (g ~ 8-to-30 g/cm3) of these satellites gives us the opportunity to study the role of surface gravity in crater modification on ice-rich targets (in much the same way that study of the large asteroids Ceres and Vesta will allow us to study modification on silicate-rich targets). Important Cassini imaging data are just now becoming available on the PDS. Geometric calibration and control are required to make use of these data for accurate measurements of impact crater features, and are in progress.

Previous work on Saturnian satellite impact crater morphology and morphometry [1, 2, 3] has shown the first order differences in crater morphology on icy targets and highlighted several important tests to be made by Cassini. Schenk [1] showed that simple craters are shallower on icy satellites, although Galileo data showed that the resolution of the Voyager images of Ganymede were not sufficient to resolve simple craters and that simple craters have similar depths to those on silicate-rich targets [4]. Whether the original observations remain true for Saturn as well will be easily tested with Cassini data. Chapman and McKinnon [2] reported that the simple-complex at transition diameters on Saturnian satellites followed an inverse gravity trend with the larger Galilean satellites. Improved resolution, areal coverage, and topographic mapping (as well as new data for the Galilean satellites [5]) will improve our knowledge of transition diameters at Saturn. Major exceptions to this rule were Mimas and Enceladus [2]. Where reported transition diameters were similar to those on larger Tethys and Dione. In the case of Enceladus, this could be explained by post-impact modification of simple craters [e.g., 6, a prediction that can now be tested)], but Mimas has experienced no geologic activity. Possibilities include anomalous internal structure (such as high porosity [7]) or failure of gravity modification at very low surface gravity.

Additional issues concern the formation of continuous ejecta and pedestal (or pancake) deposits in particular on icy satellites and the importance of liquid water in their formation [8, 9]. Viscous relaxation has also been of importance for understanding the possible importance of high heat flows, but has been documented only for Dione [1, 3]. The depth/diameter curves for the satellites (based on Voyager analysis) are only partially complete. New Cassini data will be important for determining the full depth/diameter curves on these satellites in order that the magnitude of crater relaxation can be actually measured and used for modeling of heat flux.

Quite a few large impact features have been discovered by Cassini, including two on Titan. These features may be analogous to peak ring or central pit craters on silicate-rich targets or the Galilean satellites [3], and are certainly important for evaluating the significance of viscous process. Mapping of large basin antipodal regions and possible associated fracture networks will also be important for understanding satellite interiors [e.g., 3]. Morphologic and topographic mapping will be undertaken to constrain these issues.

References: [1] Schenk, P, JGR, 94, 3813, 1989. [2] Chapman, C, and W. McKinnon, in *Satellites*, Univ. Ariz. Press, 1986. [3] Moore, J., et al., Icarus, 171, 421, 2004. [4] Schenk, P., et al., in *Jupiter*, Cambridge Press, 2004. [5] Schenk, P., Nature, 417, 419, 2002. [6] Schenk, P., and J. Moore, JGR, 100, 19009, 1995. [7] Demott, S., and P. Thomas, Icarus, 73, 25, 1988; Eluszkiewicz, J., Icarus, 84, 215, 1990. [8] Horner, V, and R. Greeley, Icarus, 51, 549, 1982. [9] Schenk, P., and F. Ridolfi, GRL, 29, 31(1), 2002.