

Comparison of the Production Size-Frequency Distribution (SFD) of Craters on Saturnian Satellites with the Lunar Crater SFD and Asteroid Diameter SFD

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Introduction: The understanding of the geologic history of the saturnian satellites (and hence of the history of the solar system) is a major goal for us as part of the Cassini imaging experiment (ISS) team. For this reason, the SFDs of craters on Saturn's medium-sized moons have been analyzed and compared with the goal to determine the sources of the primary impactors on the saturnian satellites.

Comparison of SFDs: The lunar SFD was derived by Neukum (1983). Multiple measurements of the crater production SFD on the saturnian satellites have shown a high similarity to the lunar curve (Neukum et al., 2006). From measurements on Iapetus, crater counts over 4 orders of magnitude in crater diameter are available now. Those measurements fit nicely to the velocity-corrected lunar curve for crater diameters below ~60 km. By analyzing the body-diameter SFD of main-belt asteroids (data source: MPC web site, <http://cfa-www.harvard.edu/iau/mpc.html>, July 2008), a strong similarity with respect to the lunar curve is found as well. Hence, there are good reasons for the conclusion that asteroidal impactors captured by Saturn are responsible for the cratering record measured on the saturnian satellites.

References and notes:

Magnitude-to-diameter conversion of asteroids:

$$D = \sqrt{\frac{1}{P_v} * 10^{6.247-0.4*H}} \quad (\text{Fowler \& Chillemi, 1992})$$

H: absolute magnitude

P_v: geometric albedo

Neukum, G. (1983): *Meteoritenbombardement und Datierung planetarer Oberflächen*. Habilitation Dissertation for Faculty Membership, Ludwig-Maximilians Univ. München, Munich, Germany, 186 pp.

Neukum, G.; Wagner, R.; Wolf, U.; Denk, T. (2006): *The Cratering Record and Cratering Chronologies of the Saturnian Satellites and the Origin of Impactors: Results from Cassini ISS Data*. European Planetary Science Congress (EPSC) 2006, Berlin, Germany, 18-22 September 2006, p.610.

Fowler, J.W.; Chillemi, J.R. (1992): IRAS asteroid data processing. In: Tedesco, E.F., Veeder, G.J., Fowler, J.W., Chillemi, J.R. (eds.): *The IRAS Minor Planet Survey*. Technical Report PL-TR-92-2049, Phillips Laboratory, Hanscom AF Base, MA.