CRATERING ON ICE – A COLD LABORATORY. P.M. Schenk, Lunar and Planetary Institute, 3600 Bay Area Blvd., Houston, TX 77058 (schenk@lpi.usra.edu).

Introduction: When Voyager first saw the icy satellites of the outer planets it discovered a rich canvas of new and unusual impact landforms. The intervening decades of study, and two major orbital missions, have shown that these landforms are related directly to the fact of icy crustal and lithospheric composition and the thermal structure of these diverse bodies. These studies have shown that impact crater landforms are inherently different on icy bodies, and are also subject to unusually high degrees of post-impact modification. The rolling of time has also shown that our understanding of ice rheology *under planetary conditions* has grown only drudgingly. Although we are on the cusp of physically realistic modeling of impact crater formation and modification on icy worlds, much work remains to be done.

Impact: Impact crater morphology can be a very useful tool for probing planetary interiors, but nowhere in the solar system is a greater variety of crater morphologies observed than on the large icy Galilean satellites Ganymede and Callisto [e. g., 1, 2]. With increasing size, these same craters become less like their counterparts on the rocky planets. Several impact landforms and structures (multiring furrows, palimpsests, and central domes, for example) have no obvious analogs on any other planets. Further, several studies [e.g., 3, 4, 5] have drawn attention to impact landforms on Europa which are unusual, even by Galilean satellite standards, and these may be related to the liquid water ocean possibly lurking beneath a thin warm outer ice shell. As such, large impact structures are important probes of the interior structure of these bodies over time.

Post-Impact: Post-impact creep or relaxation of impact crater topography on icy surfaces allows us to see into the mechanical state and thermal history of large icy satellites such as Ganymede and Callisto [e.g., 1], and smaller satellites such as Enceladus and Dione (ongoing). Relaxation is due to the strong dependence of ice flow on lithospheric temperatures. Recent advances in our understanding of ice rheology [e.g., 6, 7] and the mechanics of lithospheric deformation [8] have sharpened our understanding of the relaxation of topography on large icy satellites.

Future: Understanding of the impact formation and post-impact modification of craters depends critically on our understanding of ice rheology. Issues concern deformation mechanisms, role of non-ice components, porosity, degree of fracturing, and extrapolation from laboratory conditions and time-scales. Major advances have been made in the past 3 decades, but a major question concerns the degree of correlation between experimental insights into ice behavior and the actual physical state of the icy lithospheres of these bodies.

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