Geophysical Research Abstracts,
Vol. 11, EGU2009-9059-1, 2009
EGU General Assembly 2009

Modelling of ice-filled craters at mid-northern latitudes on Mars

A. Reufer (1), W. Benz (1), S. Byrne (2), M. Searls (3), N. Thomas (1), V. Bray (2), A. McEwen (2), and C. Dundas (2)

(1) University of Bern, Physiscs Institute, Theoretical Astrophysics and planetary science, Bern, Switzerland (andreas.reufer@space.unibe.ch), (2) University of Arizona, Lunar and Planetary Lab, Tuscon AZ, USA, (3) University of Colorado, Laboratory for Atmospheric and Space Physics, Boulder CO, USA

Recent observations by HiRISE [Byrne et al., LPSC Abstract, 2009] show impact craters with a clean, flat, and bright bottoms. This is in contrast to the curved crater interiors which result from impacts in the strength regime into single material targets. Following the discovery of water ice at the Phoenix landing site and the detection of near-surface hydrogen with the gamma-ray spectrometer on Mars Odyssey (e.g. Feldman et al., JGR, 2004), it is assumed that these bright crater bottoms are composed of water ice. The flat-bottomed water ice crater surface has to be the result of a process not occuring in impacts into single material targets.

We simulate impacts into a target with a surface layer composed of dunite and a sub-surface water ice layer. We use a solid-state smoothed particle hydrodynamics (SPH) code with the failure model by Benz & Asphaug (1995). As a proxy for the martian surface, we use pre-damaged dunite. For the subsurface ice layer we assume pure water ice. The ANEOS equations of state (Thompson and Lauson 1984) are used for both materials.

The simulations show that enough energy gets deposited in the ice layer, for the ice to melt. Impacts of projectiles composed of dunite and with masses in the range of tens of kilograms and velocities between 5 and 10km/s lead to craters with sizes comparable to the observed ones. We show that in such events considerable amounts of liquid water can be produced by melting of the subsurface ice layer.