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Topography and geomorphology of possible cryo-process related features on Ceres

Ralf Jaumann (2), Katrin Stephan (1), Katrin Krohn (1), Isabel von der Gathen (1), Franziska Schulzeck (1), Frank Preusker (1), Stefan Schröder (1), Debra Buczkowski (3), Jennifer E.-C. Scully (4), Nico Schmedemann (2), Carol A. Raymond (4), Chris T. Russell (5), and Ottaviano Ruesch (6)

(1) DLR, Institute of Planetary Research, Berlin, Germany, (2) Freie Universität Berlin, Germany, (3) Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA, (4) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA, (5) UCLA, Institute of Geophysics, Los Angeles, CA, USA, (6) NASA Goddard, Greenbelt, MD, USA

The potential presence of ice within Ceres' crust raises the prospect of geological processes similar to differentiated icy bodies. Stereo-photogrammetric analysis of Ceres yields an overall relief from -7.5km to 7.5km [1]. The observed relief to size ratio of 3.6% is high compared to other icy bodies, indicating crustal dynamics and related steep slopes. Thermal models suggest that Ceres is at least partially differentiated and could have undergone tectonic and cryovolcanic processes [e.g.2]. The potential for a relatively thin hydrosphere on Ceres could give rise to a connection between endogenic activity and surface features. Extended smooth plains cover the interior of a number of craters such as Ikapati, Occator and Haulani [e.g.1,3,4]. Ikapati shows smooth plains on different topographic levels associated with pits and flow-like features that overrun crater rims [1]. The material forming these plains, ponds in depressions and smaller craters and cover the pre-existing surface creating a distinct geological boundary. The interior of Occator also exhibits extended plains of ponded material, multiple flows originating from the center overwhelming the mass wasting deposits from the rim, a central pit, dome-like features, vents cracks and fissures [5]. The plains material covers an area of about 4750km2 with an average depth of about 250m resulting in a body of plains material of about 1200km3 [5] while the central pit has a volume of 15km3. The plains material is slightly younger than the impact event and the bright deposits are even younger than the plains material [6]. Post impact processes might be due to impact melt, hydrothermal alteration, or cryovolcanic crater filling. Furthermore, crater densities on Occator's floor are lower than those on the ejecta blanket indicating a post-impact formation age of the interior. Haulani also shows flows running from the crater rim outwards to the surrounding area covering the pre-existing surface as indicated by an obvious geological boundary similarly to the observation in the Ikapati region [3]. Another special feature is Ahuna Mons. Over 5000 m high it exhibits step flanks of relatively fresh material [7]. Compositionally those materials show a bluish spectral slope [8] and various spectral absorption bands indicating phyllosilicates and as well as carbon-bearing compounds [9,10]. Plain materials indicates either a feeding zone that pushes flow forward by supplying low-viscosity material or extended subsidence of crater centers, possibly after discharging subsurface reservoirs. Crater counts indicate that the plains material rank among the youngest features on Ceres (< 0.5 Ga) [6].
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