

GEOLOGIC MAPPING AND GEOSPATIAL ANALYSIS OF POSSIBLE PINGOS ON CERES

K. H. G. Hughson¹, B. E. Schmidt¹, K. Udell¹, H. G. Sizemore², J. E. C. Scully³, V. Romero¹, P. Schenk⁴, D. Buczkowski⁵, D. A. Williams⁶, J. C. Castillo-Rogez³, C. A. Raymond³, C. T. Russell⁷. ¹School of Earth and Atmospheric Sciences, Georgia Institute of Technology, 311 Ferst Drive, Atlanta, GA 30332 (khughson7@gatech.edu), ²PSI, Tucson, AZ, ³JPL, Pasadena, CA, ⁴LPI, Houston, TX, ⁵JHU-APL, Laurel, MD, ⁶ASU, Phoenix, AZ, ⁷UCLA, Los Angeles, CA.

ABSTRACT

During Dawn's final days the spacecraft was placed into a highly elliptical orbit that brought it within ~30 km of the surface, far closer than it was ever designed to operate. During these dives Dawn's cameras captured images and stereo-topography of the surface with nearly ten times the resolution of what the mission initially expected to achieve (as fine as ~3 m/pixel). These new observations revealed tall conical hills throughout Ceres' enigmatic Occator crater that appear strikingly similar to pingos [1] – ice-cored hills that form from freezing pressurized groundwater in polar regions of the Earth. Possible pingo analogs have also been spotted on Mars [2] but this marks the first time that these features have been observed on an asteroid.

We examined Occator and Urvara craters on Ceres at a scale of 1:10,000 and mapped over 1,000 positive relief features, primarily small mounds, whose origins may be related to pingo-forming processes on Earth. We classified these features based upon appearance and morphology into five categories: conical mounds, domical mounds, caprock mounds, flat topped mounds, and mounds with summit depressions (Figure 1).

We further evaluated the distribution and stratigraphic context of the small mounds in Occator and Urvara using mapped geologic units [3] and cross-cutting relationships to estimate their relative formation timeline within the broader evolution of both of these craters. Additionally, we utilized non-parametric clustering algorithms to identify potential loci of mound formation, establish if these features form groups of similar morphology, and identify any correlations with specific geologic units.

References: [1] Schmidt et al. (*Accepted Nat. Geo.*); [2] Dundas C. M. & McEwen A. S. (2010) *Icarus*, 205, 244-258; [3] Scully J. E. C. et al. (*Accepted Nat. Geo.*)

Acknowledgments: The data used for this analysis were sourced from the Dawn Data Archive on the PDS Small Bodies Node.

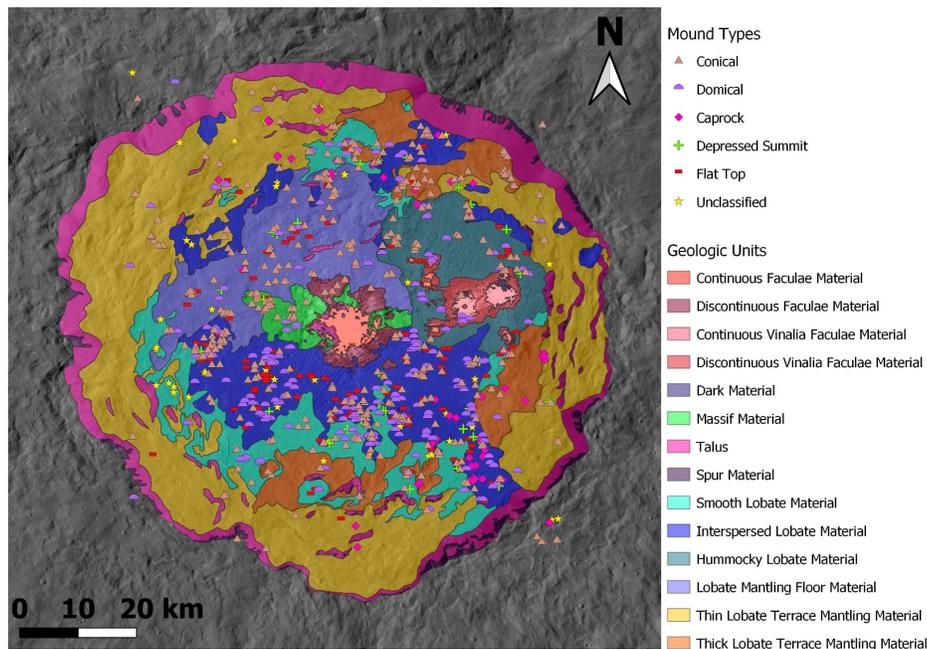


Figure 1: Geologic map of Occator crater with mapped mound features (geologic units from [3]). Mounds that did not cleanly fit into any category were labeled as 'unclassified'.