

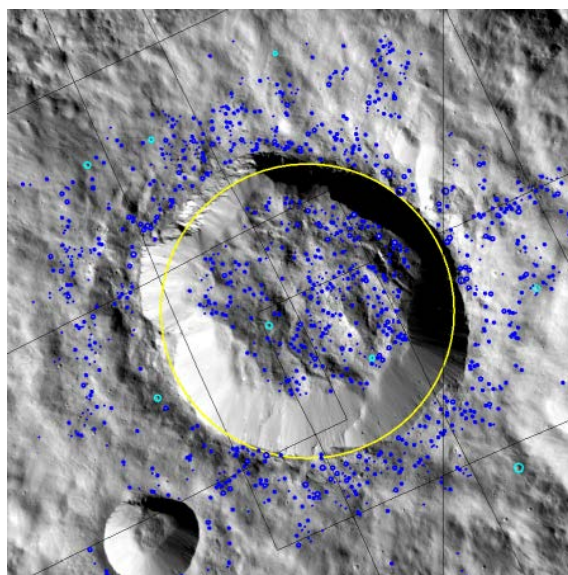
## BOULDERS ON CERES

S. E. Schröder<sup>1</sup>, U. Carsenty<sup>1</sup>, A. Neesemann<sup>2</sup>, R. Jaumann<sup>1</sup>, S. Marchi<sup>3</sup>, L. A. McFadden<sup>4</sup>, K. Otto<sup>1</sup>, P. Schenk<sup>5</sup>, F. Schulzeck<sup>1</sup>, C. A. Raymond<sup>6</sup>, and C. T. Russell<sup>7</sup>

<sup>1</sup>Deutsches Zentrum für Luft- und Raumfahrt, 12489 Berlin, Germany, <sup>2</sup>Freie Universität, 12249 Berlin, Germany, <sup>3</sup>Southwest Research Institute, Boulder, CO 80302, USA, <sup>4</sup>NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA, <sup>5</sup>Lunar and Planetary Institute, Houston, TX 77058, USA <sup>6</sup>Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, USA, <sup>7</sup>University of California, Los Angeles, CA 90095-1567, USA

**Introduction:** In December 2015 the Dawn spacecraft moved into the Low Altitude Mapping Orbit (LAMO) around Ceres, encircling the dwarf planet at a distance of 400 km to the surface below. At this altitude, images of the on-board framing camera have a resolution of 36 meters per pixel, high enough to distinguish large boulders on the surface. Indeed, LAMO images show a multitude of boulders around what seem to be fresh craters. The average lifetime of boulders on Dawn's previous target, Vesta, was estimated to be similar to that of Lunar boulders, as may be expected from the basaltic surface composition [1]. The bulk composition of Ceres may be carbonaceous chondrite-like with significant contributions of clays, salt, and water ice. As such, the abundance and distribution of boulders on Ceres may be different from that on Vesta. We mapped, counted, and measured the diameter of boulders over the entire surface of Ceres. Our analysis of the data in combination with crater age estimates may provide clues to the physical nature and composition of the surface.

**Mapping Boulders:** We are currently in the process of mapping all boulders on the entire Sun-illuminated surface of Ceres (example in Figure 1). This is done by several co-authors simultaneously using different methods, to assess how observer bias affects the detections and boulder diameters. By comparing our counts with age determinations obtained from crater counts, we expect to establish a correlation between boulder density and crater age. Our initial results appear to confirm this. Furthermore, we may uncover correlations between boulder density and geomorphological and/or compositional markers associated with the surface, where we give special attention to craters with marked spectral properties like Haulani, Juling, and Oxo.



**Figure 1.** Mapping boulders in and around a 15 km sized crater with longitude 278°E and latitude 23°S.

The size-frequency distribution of our global boulder counts will be compared with those for Vesta, and other asteroids like Lutetia [2], Eros [3], and Itokawa [4].

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**References:** [1] Schröder S. E. et al. (2016) *Geophys. Res. Abstracts* **18**, EGU2016-12693. [2] Küppers M. et al. (2012) *P&SS* **66**, 71. [3] Chapman C. R. et al. (2002) *Icarus* **155**, 104. [4] Michikami T. (2008) *Earth Planets Space*, **60**, 13. [5] <https://jmars.mars.asu.edu/>.