

UNIFIED DAWN LAMO-BASED GLOBAL GEOLOGIC MAP OF CERES. D.A. Williams¹, D.L. Buczkowski², D.A. Crown³, A. Frigeri⁴, K. Hughson⁵, T. Kneissl⁶, K. Krohn⁷, S.C. Mest³, J.H. Pasckert⁸, T. Platz⁹, O. Ruesch¹⁰, F. Schulzeck⁷, J.E.C. Scully¹¹, H.G. Sizemore³, A. Nass⁷, R. Jaumann⁷, C.A. Raymond¹¹, C.T. Russell⁵. ¹School of Earth and Space Exploration, Arizona State University, Box 871404, Tempe, AZ 85287 (David.Williams@asu.edu); ²Johns Hopkins University Applied Physics Laboratory, Laurel, MD; ³Planetary Science Institute, Tucson, AZ; ⁴National Institute for Astrophysics, Rome, Italy; ⁵UCLA, Los Angeles, CA; ⁶Formerly at Freie Universität, Berlin, Germany; ⁷German Aerospace Center (DLR), Berlin, Germany; ⁸University of Münster, Münster, Germany; ⁹MPI for Solar System Research, Goettingen, Germany; ¹⁰ESA-ESTEC, Noordwijk, The Netherlands; ¹¹Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA.

Introduction: The science team from NASA's Dawn mission has completed a geologic mapping campaign for dwarf planet (1) Ceres. The purpose of this abstract is to serve as a citable source for our Low Altitude Mapping Orbit (LAMO)-derived global geologic map of Ceres (**Figure 1**) until a USGS-publishable global map can be completed. The HAMO-based global geologic map and Ceres chronostratigraphy is discussed in Mest et al. [1].

Ceres Mapping Campaign: The geologic mapping campaign for Ceres using Dawn Framing Camera images is described in [2]. In summary, we conducted an iterative mapping campaign using images with increasing spatial resolution from Dawn's Survey orbit, High Altitude Mapping Orbit (HAMO), and LAMO. The first Survey map was published in *Science* [3]. The HAMO map with the chronostratigraphy and geologic timescale for Ceres is currently in review. The 15 individual LAMO quadrangle geologic maps of Ceres are published online and will be in a special issue of *Icarus* coming in 2018 [4-17].

The objectives for geologic mapping using the LAMO mosaics were to investigate geologic features/topics identified from the global mapping in more detail and to refine the geologic history. As discussed in [2], there were challenges with this approach, most significantly coordination of 14 individual mappers and their mapping styles and objectives relative to efforts by other Dawn Science Team members. In the end, for the final published maps and mapping papers, individual quadrangles were combined when needed based on the distributions and extents of geologic units and features on the cerean surface. For example, the Urvara and Yalode quadrangle maps were combined because of the proximity of these two large basins and overlap of their deposits and structures [16]. In all, eleven papers are being published that discuss important cerean geologic features and processes, including the north polar cratered terrain and Yamor Mons [4]; the smooth impact melt-like deposits in Ikapati crater in Coniraya quadrangle [5]; the complex crater materials in Dantu crater [6]; water ice-based lobate flows in Ezinu quadrangle [7]; six possibly cryovolcanic tholi (domes) in Fejokoo quadrangle [8]; the

bright rayed and complex ejecta materials of Haulani crater [9]; the nature of the smooth material around Kerwan, Ceres' oldest impact basin [10]; the diversity of old cratered terrain in Nawish quadrangle [11]; the nature of floor fractures in craters in Occator quadrangle [12]; the interplay of cryovolcanic domes (e.g., Ahuna Mons), Yalode and Haulani ejecta in Rongo quadrangle [13]; the complex stratigraphy of crater materials in the adjacent large basins Urvara and Yalode [15]; and the wide diversity of crater morphologies found in the Sintana, Toharu, and Zadeni quadrangles [14, 16, 17]. These eleven papers along with an introductory paper discussing the Ceres mapping campaign can be accessed at links below, and will be published in an upcoming 2018 special issue of *Icarus*.

References: [1] Mest S.C. et al. (2018, this meeting). [2] Williams D.A. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.05.004>. [3] Buczkowski D.L. et al. (2016) *Science*, 353, <http://dx.doi.org/10.1126/science.aaf4332>. [4] Ruesch O. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.09.036>. [5] Pasckert J.H. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.06.015>. [6] Kneissl T. et al. (2016) 47th LPSC, Abstract #1967. [7] Scully J.E.C. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.10.038>. [8] Hughson K.H.G. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.09.035>. [9] Krohn K. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.09.014>. [10] Williams D.A. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.08.015>. [11] Frigeri, A. et al. (2018) *Icarus*, in revision. [12] Buczkowski D.L. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.05.025>. [13] Platz T. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.08.001>. [14] Schulzeck F. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.12.007>. [15] Mest S.C. et al. (2016) 47th LPSC, Abstract #1561. [16] Crown D.A. et al. (2018) *Icarus*, <https://doi.org/10.1016/j.icarus.2017.08.004>. [17] Platz T. et al. (2016) 47th LPSC, Abstract #2595.

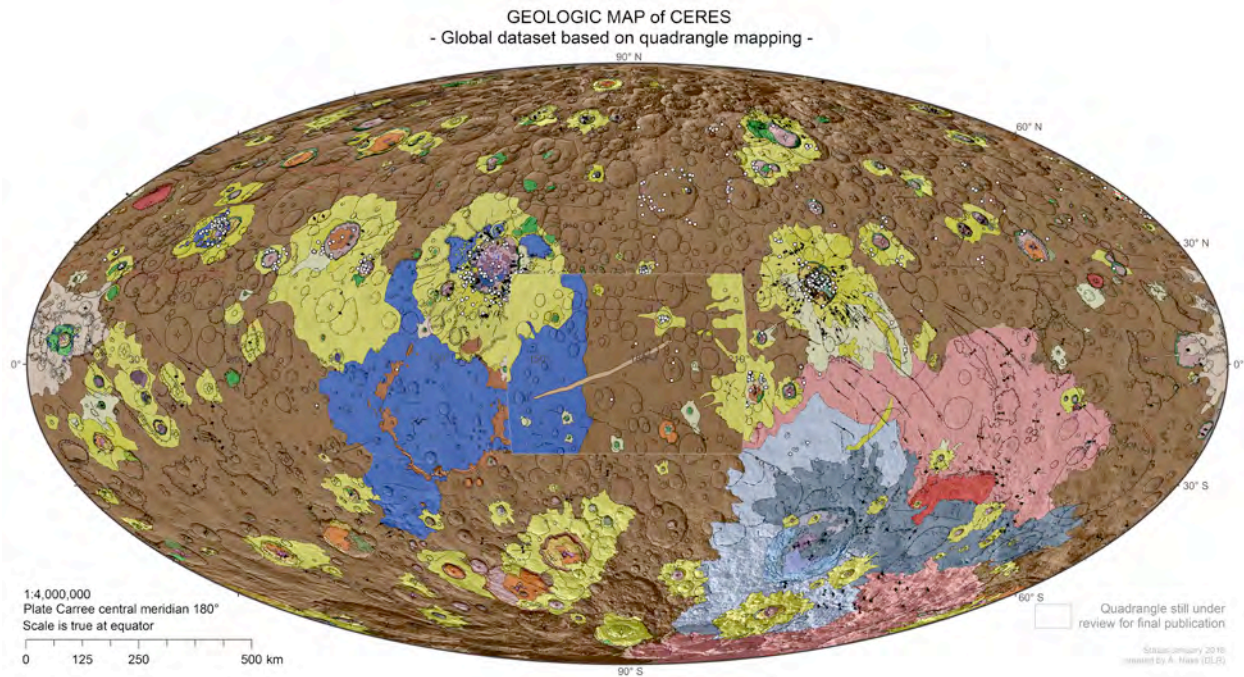


Figure 1a. Draft LAMO-derived global geologic map of dwarf planet (1) Ceres (Mollweide projection, center long. = 180°, IAU-approved Dawn Kait coord. system). This map was produced using ArcGIS™ software through integration of 15 individual quadrangle maps produced by the coauthors. Central Nawish quadrangle geologic map is in revision [11]. GIS and cartographic issues, as well as the shown figures are supported by Andrea Nass, DLR. The final version of the map will be presented at LPSC. For citation of the Dawn Ceres LAMO-based map, please use this abstract. For a poster-sized version of the final map, please contact David Williams (David.Williams@asu.edu).

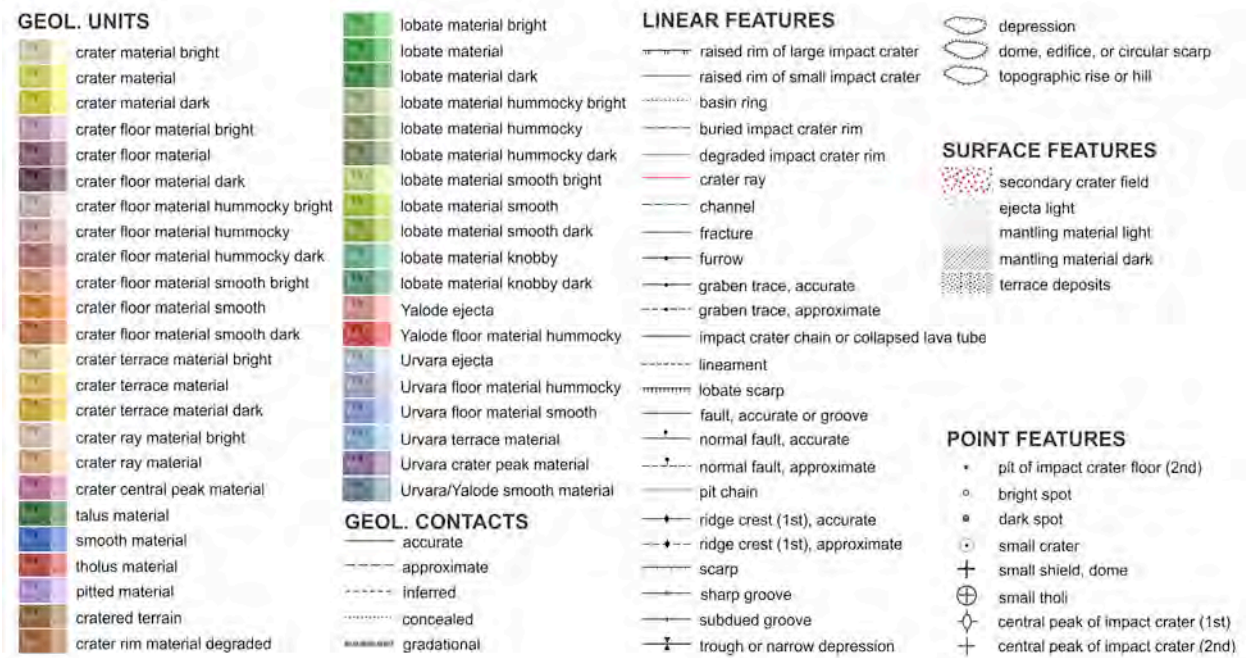


Figure 1b. Legend for Ceres unified LAMO geologic map. After [2].