GEOLOGIC MAPPING OF THE AC-H-11 SINTANA QUADRANGLE OF CERES FROM NASA’S DAWN MISSION. F. Schulzeck1, K. Krohn1, R. Jaumann1, D. A. Williams2, D. L. Buczkowski3, S. C. Mest4, J. E. C. Scully5, I. v. d. Gathen6, E. Kersten7, K.-D. Matz8, A. Naß9, K. Otto1, C. M. Pieters3, F. Preusker1, T. Rolsch1, M. C. De Sanctis1, P. Schenk8, S. Schröder1, K. Stephan1, R. Wagner1, C. A. Raymond6, C. T. Russell9, 1DLR, Berlin, Germany; 2School of Earth & Space Exploration, Arizona State University, Tempe, AZ, USA; 3JHU-APL, Laurel, MD, USA; 4Planetary Science Institute, Tucson, AZ, USA; 5Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA; 6Department of Earth, Environmental, and Planetary Sciences Brown University, Providence, RI, USA; 7National Institute of Astrophysics, Rome, Italy; 8Lunar and Planetary Institute, Houston, TX, USA; 9UCLA, Los Angeles, CA, USA

Introduction: NASA’s Dawn spacecraft arrived at Ceres on March 5, 2015, and has been studying the dwarf planet through a series of successively lower orbits, obtaining morphological & topographical image, mineralogical, elemental, and gravity data. The Dawn Science Team is conducting a geologic mapping campaign for Ceres similar to that done for Vesta [1, 2], including production of a Survey- and High Altitude Mapping Orbit (HAMO)-based global map, and a series of 15 Low Altitude Mapping Orbit (LAMO)-based quadrangle maps. In this abstract we discuss the geologic evolution of the Ac-H-11 Sintana quadrangle (Figure 1).

Mapping Data: At the time of this writing LAMO images (35 m/pixel) are just becoming available. Thus, our geologic maps are based on HAMO mosaics and images [3] (140 m/pixel) and Survey (400 m/pixel) digital terrain models [4] (for topographic information). Dawn Framing Camera (FC) color images and color composites are also used to provide context for map unit identification. The maps to be presented as posters will be updated from analyses of LAMO images.

Results: The Sintana quadrangle is located in Ceres’ southern hemisphere between 21-66°S and 0-90°E. The area is dominated by a moderate topography. Most of the quadrangle is covered by cratered terrain. Moreover, a unit of smooth material is deposited in the northern part of the quadrangle. The escarpment Niman Rupes defines its boundary to the northwest. The smooth unit, with just a minimum of topographical variation, is characterized by a low crater density. Therefore, it is most likely younger than the cratered terrain. More of the same unit was found in other quadrangles of Ceres’ eastern hemisphere. The mapping area is geologically dominated by craters; some exceed 50 km in diameter. A key finding is the diversity of crater shapes. Many craters reveal asymmetric rim degradation. We observe partial terracing and regional varying steepness of the crater walls’ slope. Hamori for example has terraced walls only on its northeastern crater rim. Several mass wasting features, which partly cause the observed asymmetries, have been identified. Next to multiple collapsed rims, we observe landslides due to later cratering on the primary crater rim. Annona crater features both characteristics. Whereas collapse structures are mostly blocky, Annona’s landslide, triggered by a younger crater on its rim, is characterized by lobate margins. The occurrence of mass movements and the type of mass wasting feature might therefore hint to compositional differences. For complex craters, such as Darzamat and Mondamin, we observe many different inner crater structures, like relaxed crater floors, ridges, central peaks, mounds and smooth plains. The correlation of crater size and inner structure is not strictly linear. Some of the smaller craters reveal central peaks, whereas some of the larger ones lack them. As a result, processes like mass wasting and relaxation must have modified a lot of craters. In addition to their distinct morphology, fresh craters, like Tupo crater, can be identified with color composite images, which reveal fresh ejecta material. Most craters though lack visible ejecta blankets. Another interesting structure is a low-albedo feature on Jarimba’s rim, which is elevated, compared to surrounding terrain. Its outline is lobate shaped and hints to some type of mass movement, but its definite origin will be examined with more resolved data. Secondary crater chains are spread over most of the area. It is not possible to trace back secondaries to their primary craters. Predominant directions, if present, vary across the quadrangle. On the contrary, at current resolution, the Sintana quadrangle lacks linear structures that are of tectonic origin.

Discussion: Little variation in Ceres’ surface colors and structure, specifically in the area of the Sintana quadrangle, make the identification of unit boundaries extremely difficult. Especially the boundaries of the smooth unit need to be revised as new data is becoming available. Not all linear structures can be distinguished for certain. Some crater chains, interpreted as secondary craters, might turn out to be chains of tectonic pits. To this moment, no results of spectral data are included. Secondary craters complicate the age determination by the method of crater counting. LAMO data will help to refine unit boundaries and to distinguish linear features, inner crater structures and mass wasting processes.


Figure 1: Geologic map of the Ac-H-11 Sintana quadrangle of dwarf planet Ceres. Mapping base is Dawn FC HAMO mosaic (courtesy DLR).