EPSC Abstracts
Vol. 12, EPSC2018-972-2, 2018
European Planetary Science Congress 2018


# The investigation of ridge structures in craters on dwarf planet Ceres

**C. Jakob**[1], K. A. Otto[1], K. Krohn[1], R. Jaumann[1], F. Preusker[1], T. Roatsch[1], E. Kersten[1], C. T. Russell[2] and C. A. Raymond[3].
(1) German Aerospace Center, Institute of Planetary Research, Berlin, Germany (katharina.otto@dlr.de), (2) University of California LA, Institute of Geophysics, Los Angeles, CA, USA, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA.

**Introduction:** Ceres is the largest and most massive object in the Main Asteroid Belt**,** with a diameter of about 950 km and a mass of 1/3 of the total mass of the asteroid belt. The intact protoplanet is a key to understand the origin and evolution of the terrestrial planets [5]. Especially of interest is the role of water during planet formation. As a differentiated dwarf planet, Ceres is thought to possess a water rich mantle overlying a rocky core [7].

NASA's Dawn spacecraft arrived in orbit around Ceres on March 6, 2015. In multiple orbital phases different types of image data were collected via the on-board Framing Camera (FC), which enabled geologic mapping of the body's surface [1, 6]. Collected image data revealed a surface defined by craters. Some of these craters have ridge structures in their center (example in figure 1). They may be described as elongated central peaks. With the exception of a longish extent, the central ridges morphologically resemble central peaks on Ceres.

The aim of this investigation is to identify and characterize these crater ridges and to observe if their appearance and their shape, orientation and slope are related to any other crater attributes, such as size or depth. By doing so we aim to better understand the process of the formation of ridges in craters on Ceres.

**Data:** For examination of the crater ridges the high-resolution data from the Low altitude Mapping Orbit (LAMO, 375 km altitude, 5.4 h, FC resolution of 35 m/pixel) and a digital terrain model (DTM) derived from stereo photogrammetry with data from the High Altitude Mapping Orbit (HAMO, 1475 km altitude, 19 h, FC resolution of 140 m/pixel) were used [2, 3, 4].

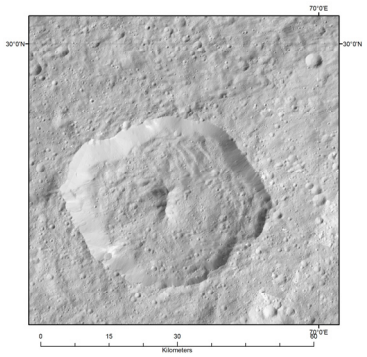

**Figure 1:** Achita is a ~40 km diameter crater located at 25°N and 65°E.

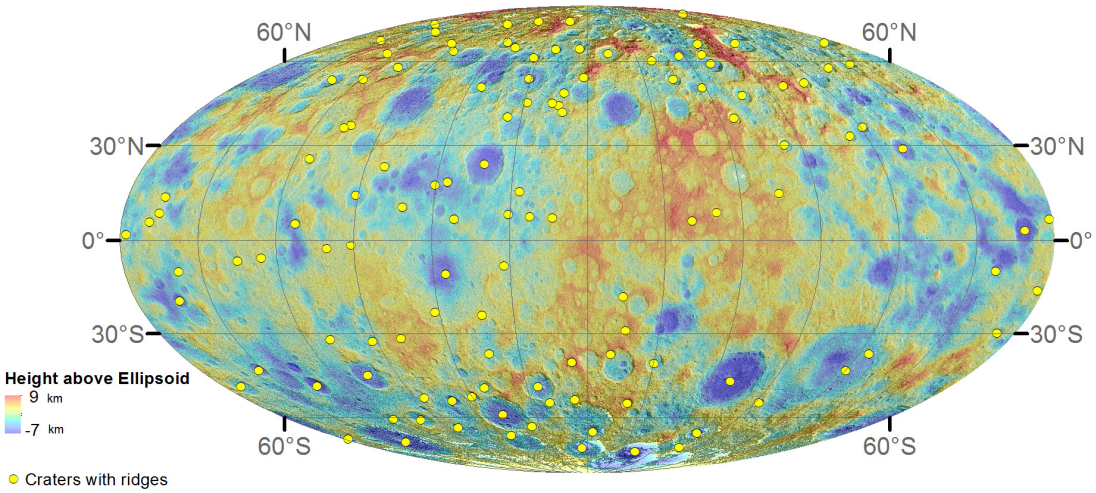


**Figure 2:** The distribution of craters with ridges on Ceres. The digital terrain model is referenced to a 482 x 445 km ellipsoid.

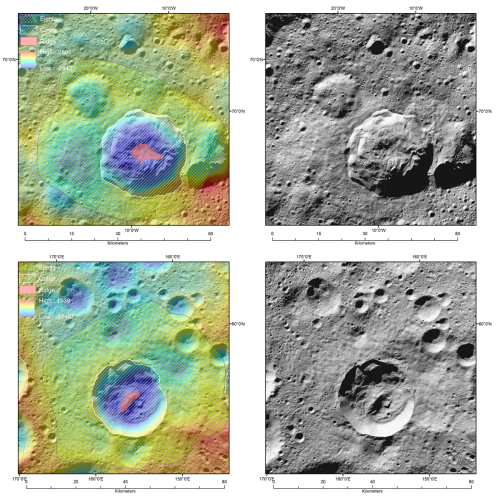

**Figure 3:** Examples of mapped craters, ridges and ejecta blankets on Ceres.

**Results:** In total 122 craters with ridges and 29 ejecta blankets have been identified.

The study shows that density distribution of craters with ridges on Ceres is heterogeneously (figure 4). The highest crater density on each hemisphere is found between latitude 60-90°. Highest density in total is found near the polar region on the northern hemisphere.

Length, width and height of ridges tend to become larger with increasing crater diameter. The depth of the craters also correlates with the height of the ridges, length and width of the ridges (figure 5).

The slopes of the ridges correlate with the height of the ridges and also with the width of the ridges. Steeper slopes may indicate younger ridges. Figure 4 shows the distribution of three different intervals of slopes on Ceres.

The analysis of the orientation of a ridge together with the preferential direction of the ejecta deposit of individual craters shows a correlation between both features (figure 6). This investigation suggests that the orientation of a ridge is sensitive to the direction of the impactor hitting Ceres.

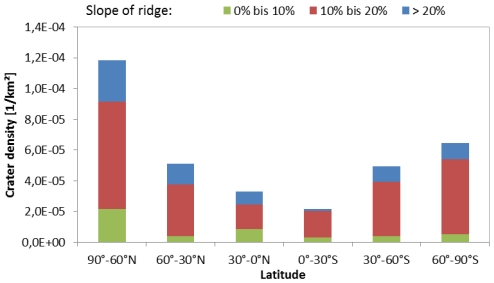


**Figure 4:** Crater density distribution including distribution of three slope intervals on Ceres.

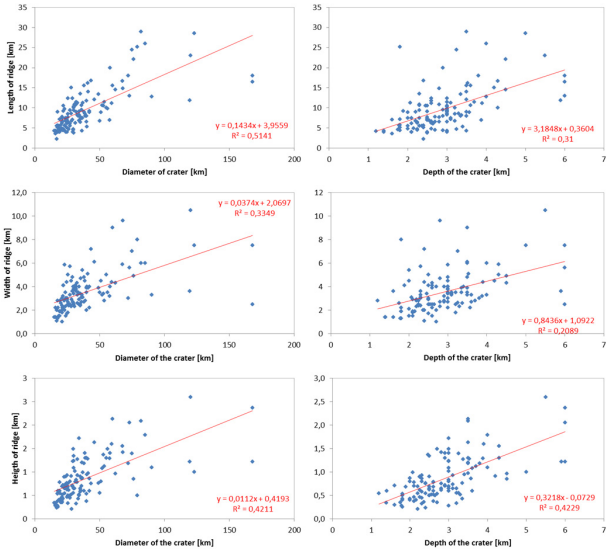


**Figure 5:** Correlation between size of the ridges and size of the craters.

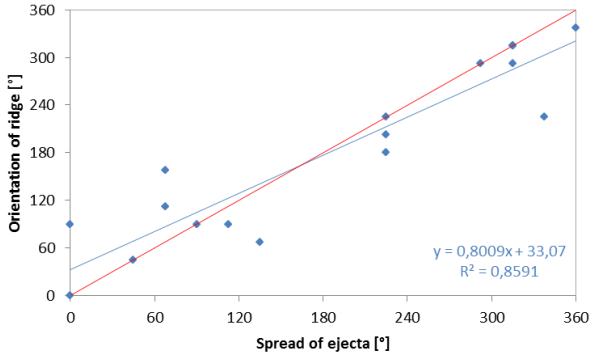


**Figure 6:** Correlation between the orientation of ridges and the preferential direction of the ejecta deposit. Shown in red is the line of perfect correlation, blue is a linear fit to the data.

## References:


[1] Williams, D. A. et al.: Introduction: The geologic mapping of Ceres, Icarus, 2017.

[2] Preusker et al.: Dawn at Ceres: Shape model and rotational state, 47th Lunar and Planetary Science Conference, 2016.

[3] Roatsch, T. et al.: High-resolution Ceres Low Altitude Mapping Orbit Atlas derived from Dawn Framing Camera images, PSS, Vol. 140, pp. 74-792, 2017.

[4] Roatsch, T. et al.: High-resolution Ceres High Altitude Mapping Orbit atlas derived from Dawn Framing Camera images, PSS, Vol. 129, pp. 103-107, 2016.

[5] Russell, C. T. et al.: Dawn: A journey in space and time, PSS, Vol. 52, pp. 465-489, 2004.

[6] Russell, C. T. et al.: Dawn arrives at Ceres: exploration of a small volatile-rich world, Science, 2016.

[7] Thomas, P. C. et al.: Differentiation of the asteroid Ceres as revealed by its shape, Nature, Vol. 437, pp. 224-226, 2005.