Polygonal Impact Craters on Ceres: Morphology and Distribution.

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Introduction: The Dawn spacecraft arrived at Ceres in March 2015. There, the on-board Framing Camera (FC) collects image data with a resolution of up to 35 m/pixel, which reveal a large variety of impact crater morphologies including polygonal craters. Polygonal craters show straight rim sections aligned to form an angular shape. They are observed on many planetary surfaces including the Earth [1], the Moon [2], Mars [3], Mercury [4] and Dione [5] and are commonly associated with fractures in the target material, which may be preserved as linear structures on Ceres [6, 7].

Data: We use FC images and mosaics of the Low Altitude Mapping Orbit (LAMO, 35 m/pixel) to interpret the distribution and geology of polygonal craters at the highest available resolution. Additionally, we support the identification of polygonal craters with a Digital Terrain Model (DTM) of ~140 m/pixel spatial resolution [8].

Observations: On Ceres, we find polygonal craters with a size ranging between 5 km and 280 km in diameter. However, the majority of polygonal craters have diameters ranging between 10 km and 50 km diameter with a mean diameter of 21 km. A preferential hexagonal shape is observed and some polygonal craters exhibit central peaks or relaxed crater floors.

On average, there are three to four polygonal craters per 10,000 km², however the northern latitudes have a slightly higher and the southern latitudes a slightly lower polygonal crater density. This may hint at an older and younger age of the northern (> 60° N) and southern regions (> 60° S) compared to the mid latitudes, respectively. Additionally, the average polygonal crater size increases with increasing latitudes. The relaxation of craters may be advanced in the mid latitudes which are generally warmer than the poles and thus support the relaxation of depressions, leaving relatively young, small polygonal craters. Also, the southern region harbors large impact basins which may have altered or destroyed preexisting structures in the crust which are necessary for the formation of polygonal craters.

Areas of increased polygonal crater density agree with the general increase of craters on Ceres. These areas are associated with elevated terrains or Regional Linear Features [6]. Straight rim sections and edges of polygonal craters often align with linear features associated with Ceres's tectonics. In contrast, polygonal craters are also present in areas with no obvious tectonic features. These polygonal craters may be produced by subresolution or subsurface fractures.

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