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Global, regional and local stratigraphy of dwarf planet (1) Ceres: results from geologic and topographic mapping using images of the Dawn camera

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Since its insertion into orbit around dwarf planet (1) Ceres, the camera aboard the Dawn spacecraft has been acquiring imaging data at increasing spatial resolutions from continuously lower orbit altitudes (Survey orbit, high-altitude and low-altitude mapping orbit (HAMO and LAMO, respectively)). In this paper we use global, regional and local mosaics of images from each of the various orbital phases for geologic mapping and crater counting. Geologic units are mapped according to morphology, topography, and superimposed crater frequency. Topographic information is taken from digital elevation models (DEMs). Stratigraphic positions of geologic and topographic units are obtained from their cumulative crater frequencies. Ceres' globally abundant cratered plains can be subdivided by their topographic position (high, middle, and low level) and by a generally higher or lower crater frequency (densely versus sparsely cratered plains). Large impact features and craters are mapped as separate units. Densely cratered plains were found to be the spatially most abundant units which occur at all three topographic levels, with cratering model ages ranging from ∼3.7 – ∼3.3 Ga. Sparsely cratered plains are on the order of ∼3 Ga old. No correlation between model age and topographic level could be verified. The three large impact features Kerwan, Yalode and Urvara form an age sequence from older to younger, with cratering model ages of ∼2.8 Ga, ∼1.8 Ga, and 0.48 Ga respectively. Kerwan and Urvara can be used as stratigraphic markers to subdivide Ceres' stratigraphic column into the Urvaran (youngest), Kerwanan, and Pre-Kerwanan (oldest) system or period. Currently, the Dawn spacecraft is in the LAMO orbit, providing images with spatial resolutions of ∼35 m/pxl. One of the first target areas to be examined in these data is the ∼6 km high feature Ahuna Mons. Small craters on the summit region were measured and a model age of ∼ 10 Ma was found, based on poor statistics, however. Also it is not clear if this model age reflects the formation of Ahuna Mons or subsequent geologic resurfacing in the summit region. Another target area investigated in LAMO data is crater Oxo (8 km diameter) with a model age on the order of 0.5 – 1 Ma. Currently, mapping and crater counts are being continued in data from Survey, HAMO and LAMO orbits.