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The HAMO-Based Global Geologic Map of Ceres

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This abstract discusses current results from the 1:2.5M-scale High Altitude Mapping Orbit (HAMO)-based global geologic mapping effort of Ceres using image, spectral and topographic data from the Dawn mission. Mapping base materials include the Dawn Framing Camera (FC) HAMO mosaic and individual images (~140 m/pixel), the global HAMO DTM (137 m/pixel) derived from FC stereo images, and FC color mosaics (0.44-0.96 μm). These data are used to identify contacts and features, and for unit characterization.

Geologic units are discriminated primarily by differences in albedo and surface texture; FC color images are used to spectrally constrain and characterize units. The map displays contacts and linear features (e.g., structures) represented by polylines, and singular features (e.g., albedo spots) represented by points. Because of map scale, only geologic units greater than 100 km2 in area, impact craters greater than 20 km in diameter, and linear features greater than 20 km in length are shown.

Through geologic mapping we have defined several widespread units: cratered terrain, smooth material, and units of the Urvara/Yalode system. Cratered terrain forms the largest unit exposed on Ceres and contains rugged surfaces derived largely from the structures and deposits of impact features. This unit includes the oldest terrains exposed on Ceres, but the geologic materials likely consist of crustal materials mixed with impact materials. Smooth material forms a large deposit of nearly flat-lying to hummocky plains that fill and surround Kerwan basin, and embay the cratered terrain. Geologic materials related to the Urvara and Yalode basins consist of floor, rim, and ejecta deposits. Urvara ejecta consists of a rugged and a smooth facies; Yalode ejecta is distinguished by its smooth and rolling to stucco-like texture. Stratigraphic relations show that ejecta deposits and structures from Urvara superpose Yalode, indicating it is younger.

Impact craters are the most prevalent features on the surface of Ceres, and appear to have caused most of the visible modification of the surface [1]. Impact craters exhibit sizes ranging from the limits of resolution to larger impact basins such as Urvara (170 km), Yalode (260 km), and Kerwan (284 km). Impact craters also exhibit a range of preservation states. Many craters of all sizes appear morphologically "fresh" to moderately degraded, with nearly circular rims that are raised above the surrounding terrain. Small fresh craters (<15 km) display simple bowl shapes, whereas larger fresh craters display steep walls and flat (sometimes fractured) floors [2], and most contain hummocky or irregular-shaped deposits on their floors. Many craters exhibit irregularly shaped, sometimes scalloped, rim structures, and contain debris lobes on their floors, suggesting instability in surface materials [1].

We are currently engaged in crater-based age dating, determining superposition relations, and using these to interpret Ceres chronostratigraphy, which will be presented at EGU.

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References: [1] Hiesinger H. et al. (2016) Science, 353. [2] Buczkowski D.L. et al. (2016) Science, 353.