OCCATOR CRATER, CERES: HIGH RESOLUTION DAWN STEREO & TOPOGRAPHY OF A LARGE TYCHO-CLASS CRATER ON AN ICE-RICH DWARF PLANET. P. Schenk[1], D. Buczkowski[2], J. Scully[3], A. Nathues[4], A. Neesemann[5], C. Pieters[6], J. Castillo-Rogez[3], C. Russell[6], C. Raymond[3], [1]Lunar & Planetary Institute, Houston, TX (schenk@lpi.usra.edu). [2]JHU-APL, Laurel, MD, [3]JPL/Caltech, Pasadena, CA, , [4]MPI for Solar System Research, Goettingen, Ger. , [4]Freie Univ. Berlin, Ger., [6]Brown Univ. Providence, RI, [6]Univ. Calif. LA, CA.

INTRODUCTION: The Dawn XM2 extended mission focused extensively on the 92-km-diameter pristine Occator crater, the 'Tycho' of the Asteroid Belt, with the objective of obtaining high resolution imaging, topography, compositional and gravity measurements over the crater and its unusual bright carbonate deposits [1], and testing hypotheses for their origins. XM2 topography and stratigraphy (as revealed through stereo images and derived DEMs) has proven critical for testing hypotheses how these and other floor deposits formed.

STEREO & TOPOGRAPHY: Global mapping of all of Ceres (including Occator) have been acquired at ~35 m pixel scales and in stereo, with global DEM mapping \ at similar scales. In XM2, hundreds of images were acquired over the eastern 2/3rds of Occator at nominal pixel scales of 2.6 to ~6 m (neglecting smear of 1-2 pixels), a factor of ~10 improvement. Overlapping orbital coverage acquired at variable look angles, and occasional parallel use of both cameras, provides excellent opportunities for stereo analysis and DEM construction, with variable stereo parameters and DEM quality.

Stereo pairs were selected for stereogrammetric processing at LPI based on maximizing stereo parallax, resolution, and finally areal coverage, in that priority. These DEM 'tiles' were then adjusted to match the LAMO-based DEM at 35 m pixel scales by subtracting a best-fit plane to the difference between the new and old maps. The tiles were then merged to construct these interim products. Two primary target areas for production (at present) are the central pit and dome and bright deposits of Cerealia Facula, and the bright deposits on the crater floor at Vinalia Faculae. Individual DEMs have also been produced at isolated sites to focus on features of interest, such as impact melt flows.

LOBATE FLOOR DEPOSITS: The Vinalia bright deposits (Fig. 1) form on a low ridged plain that constitutes most of the northern extension of Occator's lobate floor deposits [2]. The ridges have amplitudes of 50 to 100 m depending on location. The prominent V-shaped fractures that cross this region are 50 to 150 m deep. To the south, relief is low, with shallow pit clusters, low mounds <100 m high, and scarps up to 200 m high. Additional lobate flow features with 10s to >100 m of relief are found across the floor of Occator. These indicate that impact melt deposits are widespread across Occator, but have higher relief than lunar impact melt deposits, likely due to the different (i.e., ice, carbonate and salt rich) composition [3].

VINALIA FACULAE: While proximal to several prominent floor fractures, these appear to post-date the deposits. The 10 or so individual major spots have surprisingly different morphologies. Many of these surfaces are heavily pitted. The three largest bright spots to the west (Figs. 1, 2) are closely correlated with topography and effectively "line" but do not "fill" the depressions in which they form. The eastern spots tend to cover larger areas with little or conflicting preferences for elevation and slope. The only evidence of discrete bright constructional features is a depression ~1 km wide with a 20-m-high lobate dome.

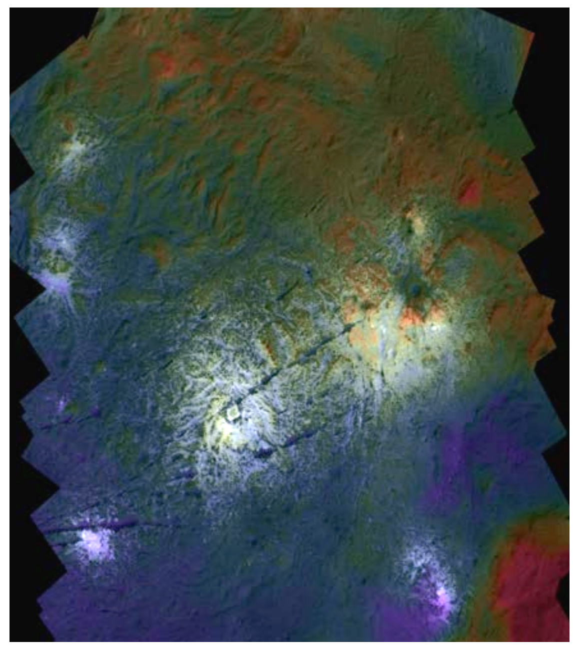

Figure 1. Mosaic of Vinalia Faculae bright spots and central region of lobate floor deposits covering large parts of Occator, color-coded for topography (blue low, red high). Relief shown is ~500 m.

CEREALIA FACULA: The central pit and dome of Occator are topographically complex. The western pit exhibit several peculiar very narrow arcuate benches or 'terraces' at various levels up the outer pit walls, possibly artifacts of the pit formation process. Eastern massifs flanking the pit structure (Fig. 3) include two fractured flat-topped mesas 350 and 600 m high (the inner mesa slopes inward, capped by bright material).

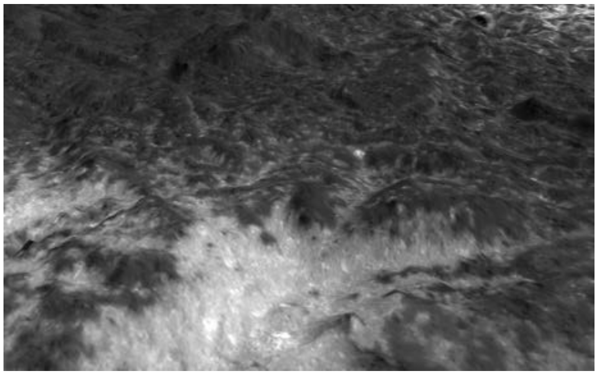

Figure 2. Perspective view across bright deposits in western portion of Vinalia Faculae. Foreground shows bright material lining the surface of a shallow irregular depression in lobate floor material ~100 m deep.

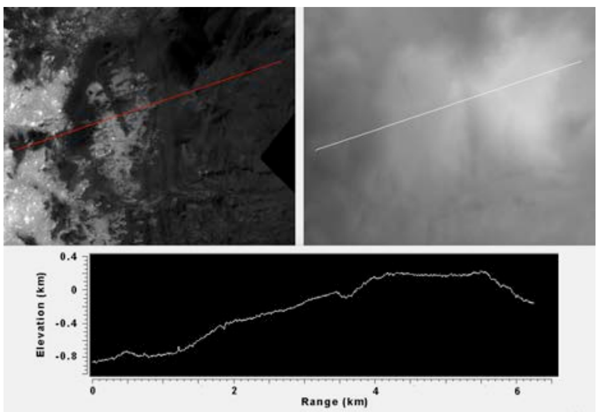

Figure 3. High-resolution DEM of massifs flanking the eastern central pit and Cerealia Facula bright spots in Occator. Relief shown is ~1000 m.

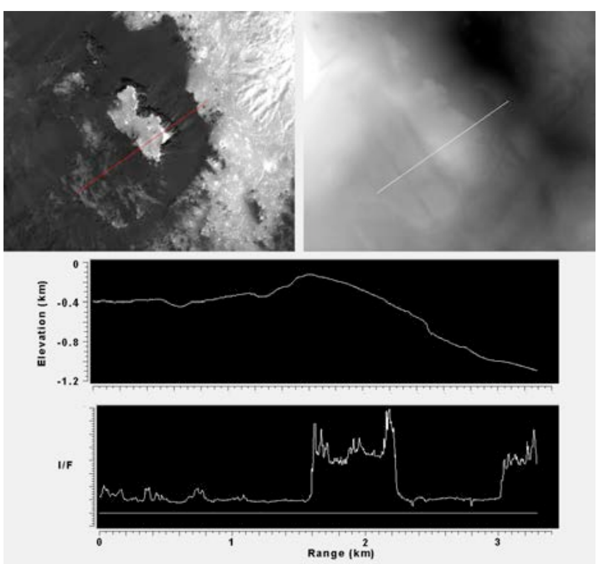

Figure 4. High-resolution DEM of massif flanking the western central pit and Cerealia Facula bright spots in Occator. Lower profile shows I/F brightness indicating the edges of the bright material. Relief shown is ~1500 m.

Bright materials of Cerealia Facula are found on the tops of fault blocks across the outer central pit, some of which are tilted. The most prominent of these is the 0.7 by 1.3 km wide ledge or plateau complex SW from the central dome (Fig. 4). A contiguous bright deposit covers ~75% of this structure, and correlates with the outer edge but not the inner edge (which forms a series of lobate features), indicating a thickness of only a few meters at most.

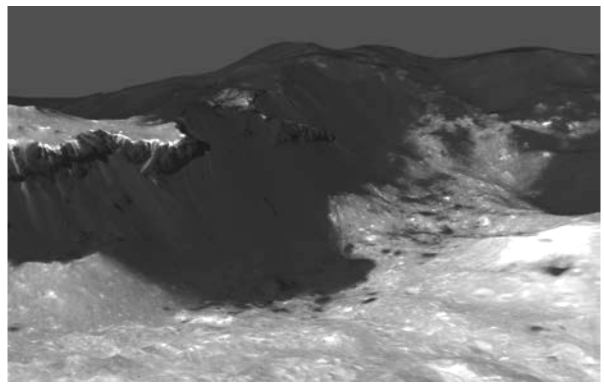

Figure 5. Perspective view of western margins of Cerealia Facula and central pit of Occator, showing bright covered ledge described in text (left) and how bright material partially flanks the lower pit walls.

Dark materials within Cerealia Facula form both negative and positive relief features. The negative relief features are generally associated with downslope mass wasting, positive features may be either uncovered remnant pit structures or constructional edifices.

OBSERVATIONS: Dawn XM2 observations of Occator reveal a wealth of features related to large impact formation in an ice-rich, partially differentiationed body. While these features share morphologies and patterns similar to those of fresh lunar craters such as Jackson and Tycho, major differences are also evident. The thicker flow morphologies at Occator are suggestive of higher yield strengths. Bright and dark material stratigraphy is complex, with indications that both materials may be constructional in many areas. Spatial relationships are consistent with localized deposition from minerals dissolved in ground waters extruded onto the surface, and that flow gradients might have been locally asymmetric, leading to asymmetric deposition with respect to local topography. Asymmetric formation due to ballistic emplacement is also not ruled out in some areas.

References: [1] Castillo, J., et al., EPSC, EPSC-2018-612, 2018. [2] Scully, J., et al., *Icarus*, in press, 2019.