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PRELIMINARY INVESTIGATION OF LINEAR STRUCTURES ON CERES

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NASA's Dawn spacecraft began orbiting the dwarf planet Ceres in April 2015. Framing Camera data from the Approach (1.3 km/px) and Survey (415 m/px) orbits, including clear filter and color images and digital terrain models derived from stereo images, have enabled an initial characterization of the surface. Linear structures - including grooves, pit crater chains, fractures and troughs - cross much of the eastern hemisphere of Ceres. Some of these structures appear to be radial to the large basins Urvara and Yalode, and most likely formed due to impact processes. However, a set of regional linear structures (RLS) do not have any obvious relationship to impact craters and may represent internally driven tectonics. Many of the longer RLS are comprised of smaller structures that have linked together, suggestive of en echelon fractures. Polygonal craters, theorized to form when pervasive subsurface fracturing affects crater formation [1], are widespread on Ceres, and those proximal to the RLS have straight crater rims aligned with the grooves and troughs. This alignment suggests that the RLS are in fact fracture systems, not ejecta scour or secondary craters. Many of the RLS are crosscut by the linear features radial to Urvara and Yalode, indicating they are not fractures formed due to stresses released during those impact events.

The Occator crater has a scalloped rim that is cut by the RLS. A cross-section of one structure is displayed in FC images of the crater wall. These images show 1) that the structure dips ~60º and 2) there is downward motion on the hanging wall, strongly implying normal faulting. Analog models of domal uplift in areas of regional extension [2] predict patterns of linear structures similar to those observed in the RLS near Occator. We assess the relationship between the RLS and nearby domes and topographic high regions to try to determine the mechanism by which the RLS may have formed.

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[1] Thomas, P.C. et al. (1999) Icarus, doi: 10.1006/icar.1999.6121; [2] Sims et al. (2013) AAPG Bulletin, doi: 10.1306/02101209136

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