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Geological Mapping of the Ac-H-4 Ezinu Quadrangle of Ceres from NASA's Dawn Misssion

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NASA's Dawn spacecraft is currently orbiting Ceres, a dwarf planet and the largest object in the asteroid belt (diameter of ~940 km). Ceres science data are primarily acquired during three orbits of decreasing altitude: Survey, High Altitude Mapping Orbit (HAMO) and Low Altitude Mapping Orbit (LAMO). The Dawn Science Team is conducting a geologic mapping campaign for Ceres similar to that undertaken at Vesta [1]. Thus, Ceres' surface is divided into fifteen quadrangles to facilitate systematic HAMO-based and LAMO-based geological mapping. Here we present the LAMO-based geologic map of Ezinu quadrangle (21-66 °N, 180-270 °E). Acquisition of Survey and HAMO data was completed by the submission of this abstract, along with the collection of initial LAMO data. Thus, the current geologic map is based on HAMO (~140 m/pixel) and Survey (~400 m/pixel) mosaics of clear filter Framing Camera images [2]. Framing Camera color images and topography data, derived from the Framing Camera images, are also used to inform the geologic mapping. Updated mapping will be undertaken before the conference, using ~35 m/pixel LAMO Framing Camera mosaics. The key geologic features in Ezinu quadrangle are: linear features, Occator crater, Ezinu crater, Datan and Geshtin craters, and Erntedank Planum. We propose that linear features radial to impact craters (e.g. Occator) are ejecta ray systems, which commonly form as secondary material is ejected during impact crater formation. There is also a prominent set of grooves and chains of pits/craters that are centered near Erntedank Planum (topographically high region) and are cross-cut by ejecta from Occator crater. We interpret these grooves and chains of pits/craters as the surface expression of sub-surface fractures [3, 4]. Occator is a geologically fresh impact crater, and contains the brightest bright spots on Ceres [5], along with bright lobate material, undivided lobate material, hummocky crater floor material, smooth material and smooth crater wall material. Ezinu crater is cross-cut by clusters of craters and contains distinctive sets of linear features, which we provisionally name intra-crater grooves. Datan crater cross cuts Geshtin crater, is almost entirely filled by hummocky crater floor material is the source of a flow, which we map as undivided lobate material. Numerous bright spots are visible in the floor of Geshtin crater. Based on our current geologic mapping, we have developed the following preliminary geologic history: (1) the cratered terrain, grooves and pit chains, and Ezinu and Geshtin craters form early, and (2) more recently, the undivided crater material, Occator ejecta ray system, and Occator and Datan craters, form. Before the conference, we will refine and expand upon this geologic history, and also conduct research into: (i) whether subsurface fractures are conduits for the Occator-bright-spot-forming material, (ii) the formation mechanism of the intra-crater grooves, (iii) types of mass wasting, and (iv) whether the Occator and Geshtin crater bright spots are related.

References: [1] Williams et al. (2014) Icarus. [2] Roatsch et al. (2015) Planetary and Space Science. [3] Buczkowski D. L. (2015) AGU, #P44B-05. [4] Scully et al. (2016) LPSC. [5] Nathues et al. (2015) Nature.