

GEOMORPHIC MAPPING OF THE CALORIS BASIN, MERCURY. D.L. Buczkowski, S. Edrich, S. Ackiss and K.D. Seelos, JHU/APL, Laurel, MD 20723, Debra.Buczkowski@jhuapl.edu.

Introduction: Two Mercury quadrangles based on Mariner 10 data cover the eastern third of the Caloris basin: H-8 Tolstoj [1] and H-3 Shakespeare [2]. This abstract outlines the progress associated with a mapping project of the entire Caloris basin and its associated intra-ejecta plains (Fig. 1), intended to improve our knowledge of the geology and geologic history of the basin, and thus facilitate an understanding of the thermal evolution of this region of Mercury.

Previous Caloris basin mapping: The dark annulus identified in MESSENGER data corresponds well to the mapped location of certain formations [3], primarily the Odin Formation. The Odin Formation is described in the quadrangle maps as a unit of low, closely spaced knobs separated by a smooth, plains-like material and was interpreted as ejecta from the Caloris impact. [1] observed that the intra-ejecta plains in the Odin Formation resemble the Smooth Plains unit that was also prevalent in the H-8 and H-3 quadrangles outside of Caloris. They state that these plains were included as part of the Odin Formation for mapping convenience, not because they necessarily shared the same formation mechanism.

A detailed analysis of the Odin Formation performed by [5] noted that the unit is easily recognizable circum-Caloris in the MESSENGER data and concluded that the Odin Formation knobs are Caloris ejecta blocks that have been mostly embayed and buried by younger volcanic deposits. They found that MDIS color data supported this hypothesis and divided the formation into two sub-units: knobby plains and smooth plains. However, recent work by [6] suggests that there is still no definitive proof that the Odin-style plains have either an impact or volcanic origin.

High-resolution mapping of the intra-ejecta dark plains: We use high resolution imaging data from the MDIS instrument to create our geomorphic map of the Caloris basin. We utilize a principle component map [3] to distinguish subtle differences in the color data. In the principle component map green represents the

second principle component (PC2), which reflects variations between light and dark materials. Meanwhile, red is the inverted PC2 and blue is the ratio of normalized reflectance at 480/1000 nm, which highlights fresh ejecta.

We map all contacts between bright and dark materials within the intra-ejecta plains, as determined in the principle component map, as sub-units of the Odin Formation. All knobs are mapped individually and their color (either dark or bright) is noted. Ejecta blankets from local craters (both extent and color) are mapped separately.

The crater classification used in the H-3 and H-8 quadrangles [1,2] and formalized in 1981 [7] was based on degree of crater degradation. Our classification scheme includes both degradation state and level and type of infilling. Current classifications include: 1) blue and pristine, 2) fresh but not blue, 3) intact rim and superposed, 4) intact rim and embayed, 5) degraded rim and superposed, 6) degraded rim and embayed, 7) very degraded and superposed, 8) very degraded and embayed and 9) little to no rim.

Observations: The Odin Formation shows two distinct sub-units: a dark sub-unit and a (relatively) bright sub-unit. The dark sub-unit has a higher concentration of knobs, knobs that are both bright and dark and craters that are both embayed and superposed. Meanwhile, the bright sub-unit has a lower concentration of knobs, knobs that are predominantly bright and craters that are fresh and/or superposed. Outcrops of the bright material can be associated with crater ejecta blankets, but are not always.

References: [1] Schaber and McCauley (1980) USGS Map I-1199 [2] Guest and Greeley (1983) USGS Map I-1408 [3] Murchie et al (2008) *Science* 321, 73-76 [5] Fasset et al (2009) *Earth Planet. Sci Lett* 285, 297-308 [6] Denevi et al (2013) *JGR* doi:10.1002/jgre.20075 [7] McCauley et al (1981) *Icarus* 47, 184-202

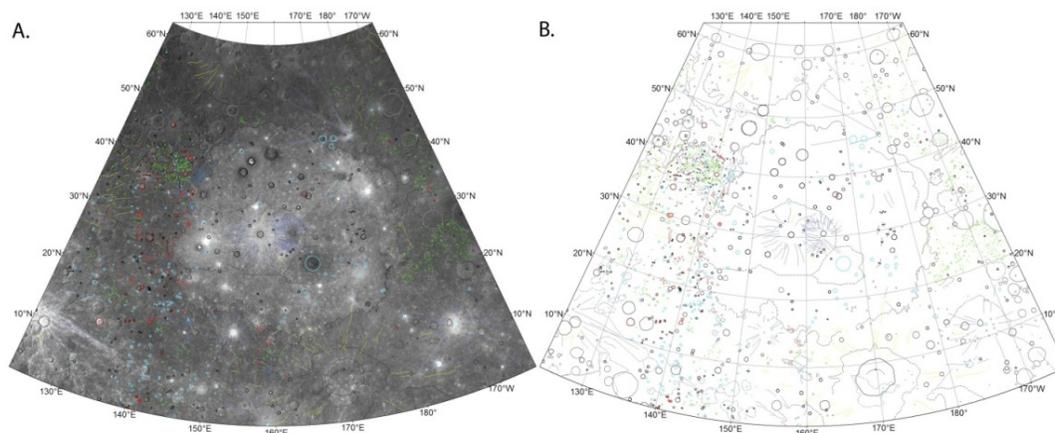


Figure 1. Geomorphic map of the Caloris basin, over the MESSENGER mosaic (A) and with no background image (B).