A GEOLOGIC MAP OF THE CALORIS BASIN, MERCURY. D. L. Buczkowski[1] , E. Goosmann[2], B. W. Denevi[1], C. M. Ernst[1], C. I. Fasset[3] and P. K. Byrne[4], [1]JHU/APL, Laurel, MD 20723, Debra.Buczkowski@jhuapl.edu; [2]University of Washington, Seattle, WA; [3]Marshall Space Flight Center, Hunstville, AL; [4]North Carolina State University, NC.

Introduction: The 1,550 km-diameter Caloris basin, the largest impact structure on Mercury, is a highly complex geologic landform. The basin is floored by light-toned plains [1] that have been determined to be volcanic in nature, and multiple landforms, including volcanic vents and even a possible small shield volcano [e.g. 2,3], have been identified. The basin floor also shows a degree of tectonic diversity that is far greater and more complex than anywhere else on the planet [4]. Also, the nature of the annulus of dark-toned material that surrounds the basin remains unclear [3]. While the hummocks are thought to be ejecta blocks, the smooth, dark, ridged plains interfingering them have been interpreted to be younger than the light-toned plains within the Caloris basin. This would imply a second, plains emplacement event, possibly involving lower albedo volcanic material, which resurfaced the original ejecta deposit. A geologic map of the Caloris basin will serve to synthesize the results of these previous studies into a contextual framework for quickly viewing the thematic research that has been performed on this interesting region.

Caloris basin map: In the mapping scheme designed for Mercury, the Caloris basin crosses four quadrangles: H-3 Shakespeare (21º-66°N, 90º-180°W), H-4 Raditladi (21º-66°N, 180º-270°W), H-8 Tolstoj (21ºS -21°N, 144º-216°W) and H-9 Eminescu (21ºS-21°N, 216°-288º W). In this mapping effort, we proposed to develop a Caloris basin map that ranged from 0º-60°N, 130º-195°E. However, during mapping we realized that the map needed to extend from 125º-200°E to cover both the basin and the entire surrounding dark annulus This areal extent best summarizes the thematic research of the Caloris basin region.

Geologic Units: Two Mercury quadrangle maps based on Mariner 10 data cover the eastern third of the Caloris basin (Fig. 2): H-8 Tolstoj [7] and H-3 Shakespeare [8]. Several terrain units associated with the Caloris basin were identified by [9]. Later, a rock-stratigraphic group consisting of several formations was developed during the 1:5M mapping of the H-8 Tolstoj [7] and H-3 Shakespeare [8] quadrangles and then formalized [10]. The formations of the Caloris group correspond with the morphological units recognized previously [9] (Fig. 2).

The most prominent annular feature surrounding the Caloris basin structure is comprised of smooth-surfaced massifs 1-2 km high and 100-150 km wide. Originally referred to as “mountain terrain” [9], the unit was officially named the Caloris Montes Formation (**cm**) [7,8,10]. The component blocks were interpreted as uplifted bedrock [9].

The depressions between the massifs of the Caloris Montes are mantled by a undulating to smooth unit called the Nevro Formation (**cn**) [7,8,10]. McCauley et al. [10] interpreted these “intermontane plains” [9] as fallback material from the Caloris impact itself, but much of the formation may be impact melt ejected from the excavation cavity of the basin [11].

A new basin rim material was identified during our mapping. Caloris Rim Material (**cr**) are materials that are clearly part of the Caloris rim, but are neither montes nor mantle material. These materials have a dissected appearance that is unique to Caloris units.

Smooth Plains Material (**ps**) is a global Mercury unit found exterior to the Caloris basin. Smooth Plains is interpreted to be volcanic flows. Intercrater Plains Material (**pi**) is a pre-Caloris global Mercury unit interpreted as volcanic flows. The Intercrater Plains are heavily cratered, and thus are mapped as older than **ps**.

An extensive plains unit, similar in appearance to the **ps** material outside of Caloris, covers the floor of the basin. However, the Caloris floor material shows more intense tectonic deformation than the exterior smooth plains, including abundant wrinkle ridges and graben with discrete basin-radial, -concentric, and -oblique orientations [4]. In the Tolstoj and Shakespeare quadrangles the Caloris Floor Plains Material (**cfp**) is mapped as a unit distinct from the Smooth Plains [7,8]. Unable to discern an unequivocal formation mechanism for the **cfp** material, the quadrangle maps suggest that it is either volcanic in origin or a thick impact-melt sheet.

There are two geologic units considered to be facies of Caloris ejecta: the Odin formation and the Van Eyck formation [7-10]. The Van Eyck Formation (**cvl**) includes a lineated terrain extending radially 1000 km from the outer edge of the Caloris Montes and clusters of secondary craters identified by [7]. The long, hilly ridges and grooves comprising the Van Eyck are subradial to the basin proper and are interpreted as ejecta from Caloris secondaries.

The other Caloris ejecta unit is formally named the Odin Formation (**co**) [7,8,10]. Hummocky plains [9], consisting of low hills ranging from 0.3-1 km across and up to a few hundred meters high, encircle the basin in a broad annulus that extends up to many hundreds of kilometers from the Caloris Montes. In some places the

Odin hills are concentric to the rim of the Caloris basin, and the spacing between hills can vary greatly. The outer boundary of the Odin Formation is gradational with the younger Smooth Plains exterior to the Caloris basin, which is similarly surrounded by the older, pre-Caloris Intercrater Plains.

Our crater units are based on the *Kincyzk* classification scheme [11]. The crater classification scheme used by the Mariner 10 quadrangle maps [7,8] was based on degree of crater degradation, in which fresh craters were labeled C_5 and the most degraded craters were identified as C_1 [10]. The older classification system was standardized by utilizing MESSENGER data to develop a consistent Mercury-wide scheme based on clear and uniform morphologic criteria [11]. This new, meticulous classification allows for a comprehensive understanding of the differences between Mercury's craters. According to [11], C_1 craters are pre-Tolstojan in age, C_2 craters are Tolstojan, C_3 are Calorian, C_4 are Mansurian, and C_5 are Kuiperian. added sub-classifications that record whether or not low reflectance material (LRM) has been exposed in the crater ejecta: these sub-classifications are C_2-LRM, C_3-LRM, C_4-LRM and C_5-LRM.

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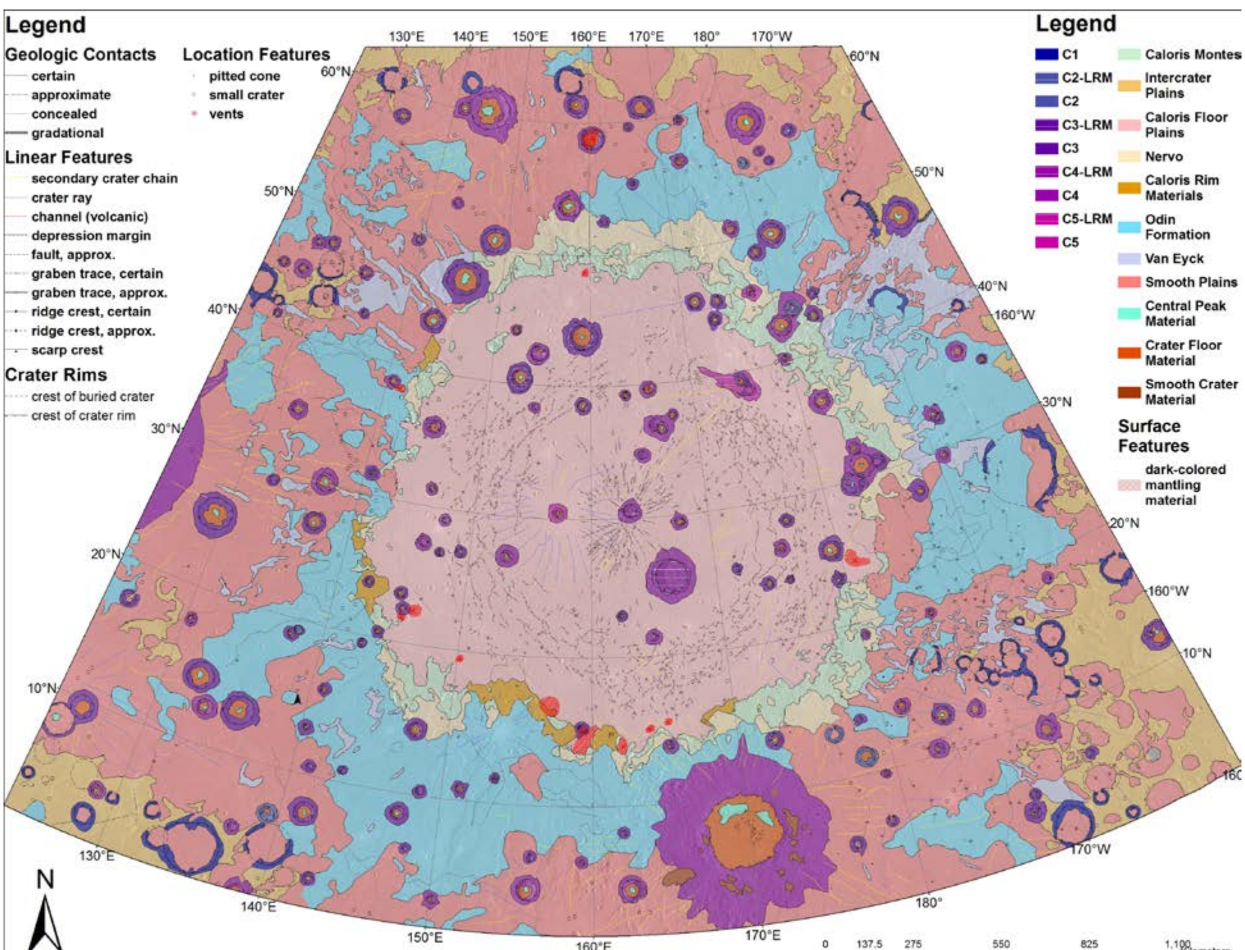

Figure 1. Geologic map of the Caloris basin, Mercury.