CAN THE INTERCRATER PLAINS UNIT ON MERCURY BE MEANINGFULLY SUBDIVIDED?: CHARACTERIZATION OF THE DERAIN (H-10) QUADRANGLE INTERCRATER PLAINS. J. L. Whitten[1], C. I. Fassett[2], and L. R. Ostrach[3], [1]Department of Earth and Environmental Sciences, Tulane University, New Orleans, LA 70118, (jwhitten1@tulane.edu), [2]NASA Marshall Space Flight Center, Huntsville, AL 35805, [3]U.S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, AZ 86001.

Introduction: The intercrater plains are the most complex and extensive geologic unit on Mercury [1, 2]. Generally, the intercrater plains are identified as gently rolling plains with a high density of superposed craters <15 km in diameter [1]. Analyses of the current crater population indicate that the intercrater plains experienced a complex record of ancient resurfacing [3, 4] (i.e., craters 20–100 km in diameter are missing). This dearth of larger impact craters could have been caused by volcanism or impact-related processes. Various formation mechanisms have been proposed for the intercrater plains, including volcanic eruptions and basin ejecta emplacement [1, 5–10].

The major difficulty with mapping the intercrater plains is the diversity of its morphology. USGS geologic maps produced using the Mariner 10 data used a variety of geologic unit names to describe the same materials, most frequently intercrater plains, cratered plains materials, and intermediate plains. An example of the confusion surrounding materials with an intercrater plains morphology, the Kuiper (H-6) quadrangle contains both an intercrater and crater plains materials unit [11]. Victoria quadrangle (H-2) also contains both units, so that along the border with H-6 intercrater plains are mapped as cratered plains materials and the rest of this morphologic unit is mapped as intercrater plains; in H-2 cratered plains materials are interpreted as intercrater plains. Cratered plains materials have also been interpreted as intermediate plains [12], bringing this unit definition full circle. Clearly, there was and continues to be little agreement about the definition of intercrater and intermediate plains.

It appears that previous researchers were looking for a way to divide up the massive intercrater plains unit by mapping an intermediate unit. This seems like a good idea, however, there was no quantitative measure or definitive characteristic used to divide the intercrater plains from the intermediate plains. Qualitatively, these two geologic units differ in their density of secondary craters and their morphology. Intermediate plains have a more muted appearance and have been interpreted as older smooth plains [13]. All of the plains units on Mercury appear gradational with one another in many locations on the surface (more often the smooth plains have distinct boundaries).

More recently, researchers have used the higher resolution MErcury Surface, Space ENvironment, Geochemistry, and Ranging (MESSENGER) datasets, to assess the intercrater plains [10]. Despite the higher resolution data, there are still no characteristics in spectral data (MDIS color, VIRS) that can be used to qualitatively subdivide the intercrater plains. The global resolution of topographic data is 64 ppd and the MLA track data are sparse and spaced far apart in the southern hemisphere, which leads to measures of roughness not being very useful. Areal crater density measurements of Mariner 10-mapped intercrater and intermediate plains *N*(10) and *N*(20) values [see 14] are completely intermixed, meaning that at the larger crater diameters (i.e. >10 and >20 km in diameter) there is no distinct age

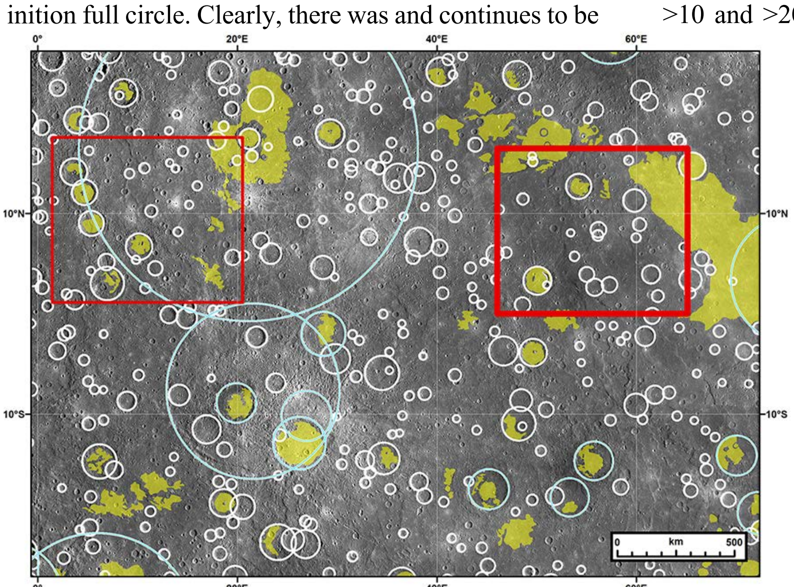

Figure 1. View of the Derain (H-10) quadrangle. Red boxes show the location of mapped sub-regions used to define intercrater plains unit. The bold red region (rightmost box) map is shown in Figure 2. Smooth plains mapped by [7] are in yellow. Craters ≥30 km in diameter are shown in white and those >150 km are also outlined in blue. MDIS monochrome (750 nm) 166 m/pixel global mosaic.

differences that correspond to a coherent area of the surface of Mercury [10]. Thus, we have to look to the smaller-scale morphologic differences to subdivide the intercrater plains.

Here, we discuss an in-progress 1:5M USGS map of the Derain (H-10) Quadrangle of Mercury (Figure 1) as a means to assess whether the intercrater plains unit can be meaningfully subdivided and what it can reveal about the importance of impact melt and other ejecta materials on the resurfacing history of Mercury.

Data: MESSENGER mission image data are the primary dataset being used to produce the H-10 quadrangle map, specifically the Mercury Dual Imaging System (MDIS) monochrome mosaic at 166 m/pixel. Mapping is being done at a map scale of 1:1.25M. Supplemental datasets include the MDIS color mosaic (665 m/pixel), and MDIS East and West Illumination mosaics (166 m/pixel).

Approach and Current Progress: The intercrater plains boundary is typically difficult to define because in many locations on Mercury the morphology can transition from smooth plains to muted hummocky plains to plains with a high density of secondary craters (Figure 3). In H-10 we map the least complicated materials first, such as the smooth plains and crater materials (e.g., Figure 2). The remaining materials are almost all intercrater plains, having a variable morphology across the map area. Co-Is Ostrach and Fassett have identified an 'intermediate' plains unit that has a more muted hummocky appearance than mapped intercrater plains and is generally located between smooth and intercrater plains. Their mapped units generally overlap, so there is some consistency between mappers. The challenge that remains is to subdivide the intercrater plains in a consistent way, either as two separate units or one unit with two or more different facies (depending on how many distinct intercrater plains morphologies can be identified across H-10).

Two subsets of the H-10 quadrangle (Figure 1) have been mapped by the proposal team (e.g. Figure 2). This mapping effort was conducted in order to assess how each team member defines the intercrater plains. From these efforts it is clear that subdividing the intercrater plains is favored, but the exact method is not yet agreed upon. A preliminary Description of Map Units has been assembled.

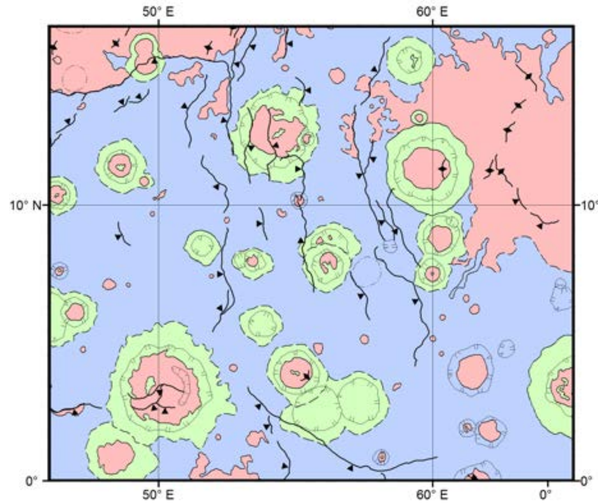

Figure 2. Geologic map of H-10 sub-region (see Figure 1, right red box). Pink polygons are smooth plains, green polygons are crater materials (ejecta, crater walls, central peaks), and blue denotes intercrater plains. Linear features, such as lobate scarps (lines with triangles), are mapped. MDIS monochrome (750 nm) 166 m/pixel global mosaic.

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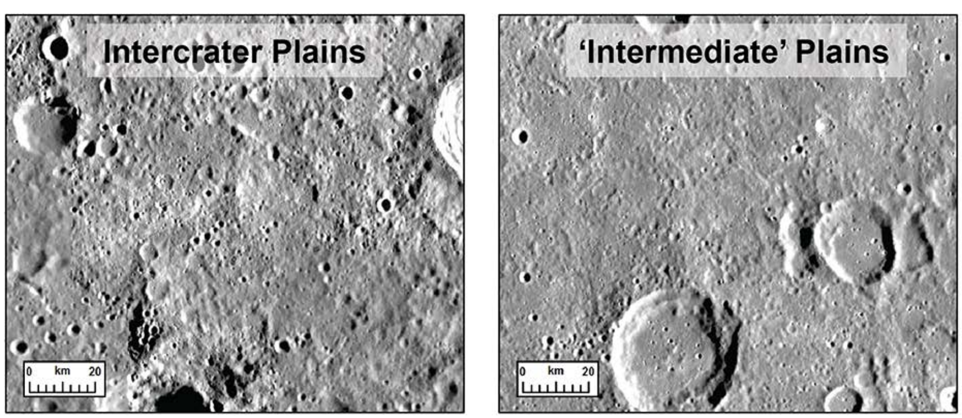

Figure 3. Two different intercrater plains morphologies, including a higher density of fresh secondary craters (left image) and more muted (right image) hummocky surface textures.