COMPOSITIONAL HETEROGENEITY OF MERCURY'S CRUST. M.S. Robinson[1], B.R. Hawke[2], P.G. Lucey[2], G.J. Taylor[2], P.D. Spudis[3], [1]Northwestem University, 1847 Sheridan Rd, Evanston IL., 60208 robinson@earth.nwu.edu; [2]Hawaii Institute of Geophysics and Planetology, Honolulu, Hawaii, [3]Lunar and Planetary Institute, Houston, TX.

Newly calibrated UV (375 nm) and orange (575 nm) Mariner 10 mosaics [1,2] allow us to investigate compositional heterogeneities in the mercurian crust. We interpret these newly available color data in terms of the color-reflectance paradigm for Mercury and the Moon articulated by Hapke and others [3,4,6]. This view holds that ferrous iron lowers the albedo and reddens (relative decrease in the UV/visible ratio) a lunar or mercurian soil. Soil maturation has a similar effect with increasing maturity, darkening and reddening a soil with addition of submicroscopic iron metal. In contrast, addition of spectrally neutral opaque minerals (i.e. ilmenite) results in a behavior that is nearly perpendicular to that of iron and maturity: opaque minerals lower the albedo and *increase* the UV/visible ratio [3,4,6]. In lunar data the orthogonal effects of opaques and iron/maturity are manifest in two trends on a plot of reflectance vs. UV-ratio, one comprising the mare basalts which vary in ilmenite along the trend, and the highlands which vary both in iron and maturity along the perpendicular trend [6].

We have transformed the Mariner 10 color data (UV and orange mosaics) using the lunar coordinate rotation that allows the separation of the two perpendicular trends (opaque mineral abundance from maturity-plus-iron) into two separate images [2,6]. The rotation clearly separates maturity effects from compositional units on Mercury [Fig 1.]. From these data we investigate units based on orange albedo, UV/orange ratio, opaque index, and maturity-plus-iron index. Plains associated with Rudaki crater [2°S,55°W], Tolstoj basin [16°S,163°W], and Degas crater [33°N,133°W] can each be distinguished by their low opaque index relative to their corresponding basement materials [Fig 1.]. In all three cases the basement material is bluer (higher UV/orange ratio), is enriched in opaques, and none show a distinct plains boundary in the maturity-plus-iron image. It is noteworthy that the maturity-plus-iron data do not exhibit unit boundaries corresponding to the morphologic plains boundaries, thus indicating that there are no large differences in iron content between the overlying plains materials and basement material (see below). In the case of Tolstoj basin, a distinct mappable opaque index unit corresponds with the distinct asymmetrical NE-SW trending ejecta pattern of the basin (the Goya formation [7,8]). This stratigraphic relation implies that formation of the Tolstoj basin (~500 km diameter) resulted in excavation of anomalously opaque rich material from within the crust. The Goya formation does not show up as a mappable unit in the maturity-plus-iron image, indicating that its FeO content does not vary significantly from the local (and hemispheric) average.

The key observation here is that the mercurian crust is not homogeneous in the color image (UV/orange) and opaque index. The exact composition of the units seen in these data can only be inferred from lunar analogy as no samples or other relevant compositional data exist for Mercury. Regarding the smooth plains discussed here, the observation that they do show boundaries in the opaque index image strongly supports the previous morphological interpretation that some mercurian plains units are indeed volcanic in origin [8,9,10,11] and not basin ejecta emplaced during the Caloris basin forming event [12]. Additionally, these volcanic units are not identifiable in the maturity-plus-iron image, indicating that they have very similar FeO contents as the rest of the mercurian crust imaged by Mariner 10 (assuming a lunar-like Mercury). From this interpretation it is useful to speculate on the nature of the mercurian magma source regions. The FeO abundance of mantle source regions corresponds, to a first order, to the erupted magma. This follows from the observation that the partition coefficient for FeO is close to 1 for mafic magmas [13]. The observation that volcanics identified on both hemispheres of Mercury do not have FeO abundances differing greatly from the hemispheric average indicates that the mercurian mantle source of these volcanics is not enriched in FeO relative to the crust [1], in contrast to the Moon (mare lavas vs. anorthositic crust). The global crustal abundance of FeO on Mercury has been estimated to be less than 6 wt.% from remote sensing data [14-20]. The Mariner 10 data and our analysis indicate that the mantle source regions roughly share the crustal FeO composition, and so supports the idea that Mercury is highly reduced and most of its iron is in the metallic core [20].

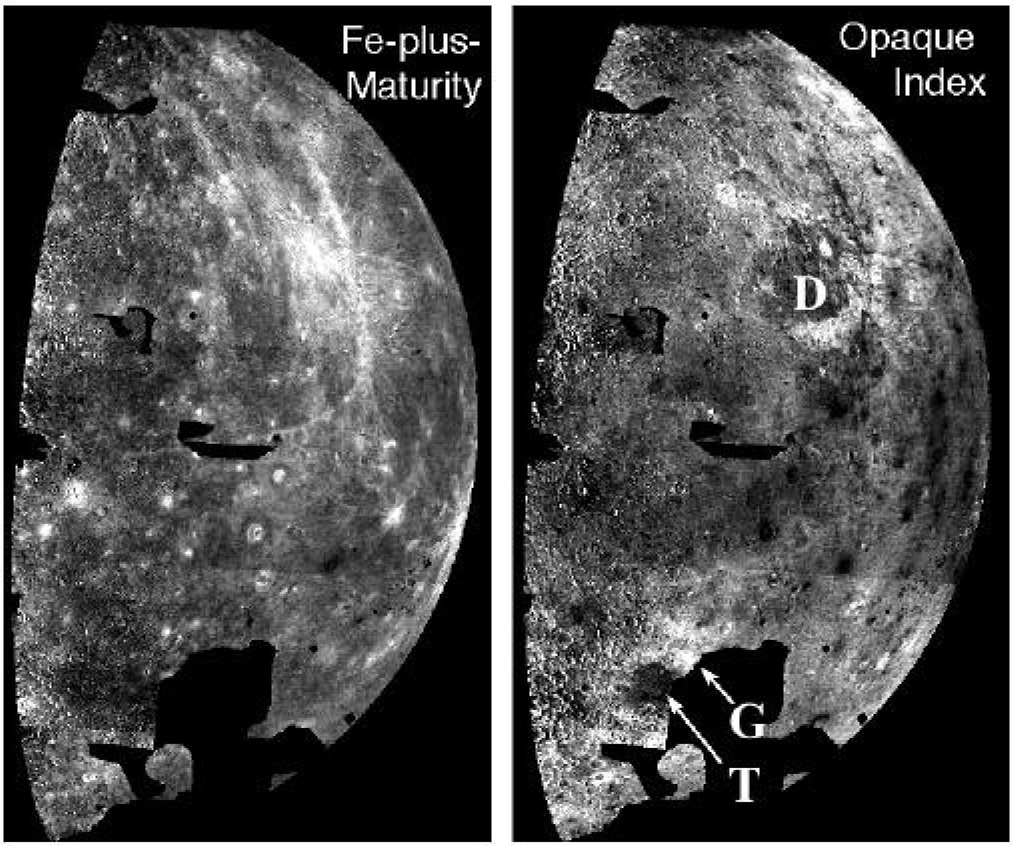

Figure 1. On the **left** is the maturity-plus-iron index image of Mercury's outgoing hemisphere higher values indicate increased immaturity or low iron content. Note the clear separation of immature crater ejecta related materials. On the **right** is the opaque-index image, high values represent relatively abundant opaque content while low values indicate a paucity of opaque component. T=Tolstoj plains, G=Goya fm., D=Degas plains (see [2] for incoming hemisphere and location of Rudaki plains).

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