ALBEDO FEATURES OF MERCURY. E. "T". Hughes[1] and W. M. Vaughan[2], [1]Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey 08854, USA. [2]Department of Geological Sciences, Brown University, Providence, RI 02912, USA, Will_Vaughan@brown.edu.

Introduction: The telescopic observation of lunar albedo features reveals the fundamental mare / highlands dichotomy of the Moon's crust. Similarly, telescopic observations of martian albedo features reveal the mutability of large-scale surface features on Mars, particularly the advance and retreat of the martian ice caps. One may therefore anticipate that telescopic observations of mercurian albedo features are similarly revealing. Unfortunately, such observations are notoriously difficult [1], and many early (pre-1965) maps of Mercury (e.g., [2]) are in error due to a misinterpretation of Mercury's rotation period [3].

In the last twenty years, however, amateurs [4] and professionals [1] alike have converged on telescopic albedo maps of Mercury that resolve albedo features as small as 200 km. The full registration of mapped albedo features to real mercurian features was, until recently, not possible: Mariner 10 imaged only ~45% of the mercurian surface [5]. In the last four years, the MESSENGER spacecraft [6] has, in flyby and from orbit, imaged almost all of the surface of Mercury at resolutions of up to ~20 m/px. It has finally become possible to register all albedo features observed telescopically from Earth to surface features observed from Mercury orbit. We do not perform a detailed registration in this abstract; instead, we consider two classes of albedo features observed on Mercury and their correspondence to surface features in order to better understand the significance of mercurian albedo features.

Albedo features of Mercury: We reproduce a recent mercurian albedo map [1] and a publicly available map of the surface features of Mercury produced from MESSENGER spacecraft flyby imagery (Fig. 1). The correspondence between these two maps is evident. We now consider two classes of mercurian albedo features and their surface expression.

Very high albedo features. Circular to sub-circular very high albedo patches likely correspond to impact craters and their ejecta and ray systems (as has been suggested by [1]). However, the nature of this correspondence is probably more uniquely mercurian than has been previously realized. For example, the relatively faint bright patch centered at 34 °S, 347.5 °W corresponds to the bright-rayed crater Debussy. However, the patch at 11 °S, 31.5 °W, which corresponds to the bright-rayed crater Kuiper, is several times brighter, particularly at its center. Moreover, a bright feature centered at 11 °N, 246 °W may correspond to the peak-ring basin Eminescu, which does not have extensive ejecta or bright rays. Kuiper and Eminescu may be made especially bright by high-reflectance material associated with hollows [7], an unusual mercurian surface feature.

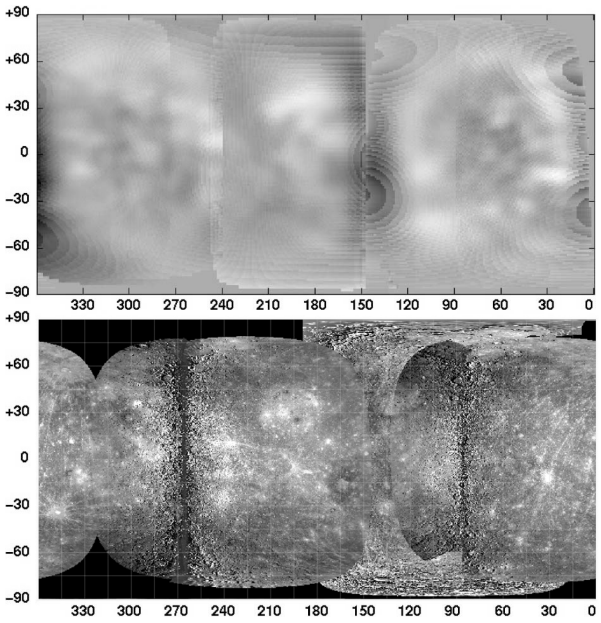

Figure 1. Telescopic albedo map of Mercury (top, reproduced from [1]) vs. flyby map of Mercury (bottom).

Large high and low albedo features. Large high albedo features (for example, the bright patch at latitudes >60 °N and the background of the Caloris basin, centered roughly at 30 °N, 190 °W) and low albedo features (the dark stripe at 45 °N, 230 °W) likely correspond to high-reflectance plains [8], probably volcanic [9], and low-reflectance material [8], probably ancient mercurian primary or near-primary crust. The relative reflectances are reversed with respect to lunar mare and highlands, in accordance with chemical evidence that mercurian volcanics are poorer in mafic minerals and richer in anorthite than mean mercurian crust [10].

In summary, the albedo features of Mercury have broadly similar origins to those of the Moon (impact cratering, crustal composition dichotomies) but nevertheless reflect unique mercurian crustal chemistry and volatile-related surface processes.

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