MERCURY'S EUV REFLECTANCE SPECTRUM FROM MARINER 10: SEARCHING FOR CARBON SIGNATURES. F. Vilas[1], A. R. Hendrix[1], E. A. Jensen[1] and D. L. Domingue[1], [1]Planetary Science Institute (1700 E. Fort Lowell Rd., Suite 106, Tucson, AZ 85719; fvilas@psi.edu).

Introduction: Carbon, as graphite, emerged from analyses of MErcury, Surface, Space, ENvironment, GEochemistry, and Ranging (MESSENGER) spectrophotometry and theoretical modeling as a possible source for the darkening component in the Low Reflectance Material (LRM), pervasive across Mercury's equatorial surface. Based on the presence of a 600-nm absorption in the Mercury Dual Imaging System (MDIS) photometry, graphite in amounts consistent with the results from MESSENGER's elemental experiments for the presence of C, was proposed as the most likely darkening component in LRM [1]. Two general theories about the origin of the carbon have been proposed. In one scenario, graphite would be the only buoyant phase in an early magma ocean, and any primary flotation crust would have retained C in the form of graphite [2]. Considering external origins, however, carbon from cometary sources has been proposed to be the darkening material [3]. Alternatively, nanophase and microphase iron (rather than C), produced by impacts into Mercury's crust before and during the late heavy bombardment, could darken the LRM [4]. The global concentration and distribution of carbon on Mercury's surface has been examined (e.g., [5]).

Carbon, in the forms of graphite and anthracite, has distinctive far-UV spectral reflectance features [Fig. 1] [6]. The MESSENGER Mercury Atmospheric and Surface Composition Spectrometer (MASCS) Ultraviolet and Visible Spectrometer (UVVS) did not extend to wavelengths low enough to observe these features. We are re-analyzing Mariner 10 Extreme Ultraviolet (EUV) airglow spectrometer data in a search for this distinctive UV signature of graphite/anthracite across large areas of Mercury's surface.

Study Approach: The Mariner 10 mission to Mercury completed 3 fly-bys of the planet on 29 Mar, 21 Sep 1974 and 16 Mar 1975. The same side of the planet was always observed, and ~45% of the planet's surface was imaged. The Mariner 10 EUV airglow spectrometer observed broad swaths of Mercury in 10 filters at the wavelengths 304, 430, 580, 740, 869, 1048, 1216, 1304, 1480, 1659 Å, each having 20Å passbands. The UV surface observations were obtained at a significant distance from the planet. A slit cutting across the disk in one direction was stepped across the visible portion of the planet's disk. Previous analyses combined all of the available data, with no distinction between incoming or outgoing data, and no correction for varying phase angles.

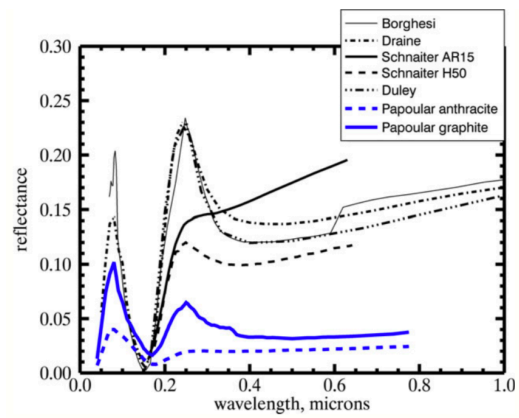

Fig. 1. . Spectral reflectance models of particulate graphites and anthracites based on published optical constants. Grains of 5-µm diameter are assumed. From [6], and references therein.

We approach the analysis of these data beginning with the 1975 fly-by data, looking at individual photometric points. We can correlate the data with the known characteristics of the areas covered from MESSENGER data acquired at longer wavelengths. Updated phase function corrections will be derived and applied to correct for phase angle differences. Our status will be presented at the conference. Mariner 10 EUV data, not currently publicly available, will be put on the upcoming UV Archive for Small Bodies.

Acknowledgments: This material is supported by the National Aeronautics and Space Administration (NASA) through the Solar System Exploration Research Virtual Institute 2016 (SSERVI16) Cooperative Agreement (NNH16ZDA001N) and through a PDART grant (NNX17AL24G).

References:

[1] Murchie S. L. et al. (2015) *Icarus, 254,* 287–305. [2] Vander Kaaden K. E. and McCubbin F. M. (2015) *J. Geo. Res. Planets,* 120, 195-209. [3] Bruck Syal M. et al. (2015) *Nat. Geo.,* 5, 352-356. [4] Gillis-Davis J. et al. (2013) Abstract P1 1A-07, AGU. [5] Klima R. L. et al. (2018) *Geo. Res. L.*, 45, 2945-2953 [6] Hendrix A. R. et al. (2016) *Meteoritics & Planet. Sci.,* 51, 105-115.