GEOLOGIC MAPPING OF DARK MANTLE DEPOSITS IN SINUS AESTUUM AND MARE VAPORUM.

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ABSTRACT

Introduction: The primary objective of this work is to produce a USGS geologic map at 1:1,000,000 (1:1M) scale from 18.5° W to 9.5° E and 0° N to 16° N, which includes the pyroclastic dark mantle deposits (DMDs) in Sinus Aestuum, Rima Bode, and Mare Vaporum. For this mapping project, we are using multiple data sets to better refine the extent of pyroclastics for these three DMDs, map and determine the compositions of the mare and highlands within our study region, perform crater counting to establish ages, explore the geologic setting and history of the mapping region, identify and measure the dimensions of plausible source vents for the DMDs, and attempt to characterize the eruption(s) that emplaced each DMD. An improved understanding of the distribution, geologic setting, and eruptions conditions that produced the pyroclastic deposits that will be gained through stratigraphic, morphologic and mineralogic characterization has the potential to reveal important information about the thermal and volcanic history of the Moon.

Current Status of Map: We have completed one year of mapping on this project (Figure 1) using the Lunar Reconnaissance Orbiter (LRO) Wide Angle Cameras (WAC) basemap at 100 m/pixel scale, with ancillary data from the LRO Laser Altimeter (LOLA) topography, Moon Mineralogy Mapper (M^3) mosaics from Chandrayaan-1, Kaguya Terrain Camera (TC) and Multiband Imager (MI) MAP mosaics, and Arecibo and LRO Miniature Radio Frequency (Mini-RF) radar image data. All craters >500 m in diameter have been mapped, and larger craters have been mapped in detail, including their central peaks, smooth floors, ejecta, and other materials. The DMDs have been mapped using the lower reflectance seen in the WAC and TC images, along with spectral/color difference between the unmantled highlands and those covered by pyroclastics using the MI MAP and M^3 data. The spinel signature observed in M^3 data from the Sinus Aestuum DMD [1] has been used to map and distinguish the DMDs that contain spinel from those that do not. Mare units were mapped where smooth and flat-lying materials are observed, and color differences between highlands and mare units in MI MAP and M^3 images supported mapping unit contacts. Different mare units were distinguished based on color differences related to variations in TiO_2 and FeO abundance. Several highland units were mapped based on roughness, topography, relative brightness, and presence or absence of lineations, comparable to those mapped previously [e.g., 2]. Surface features mapped include secondary craters and crater rays marked by bright ejecta. Numerous linear features were mapped, such as sinuous rilles, wrinkle ridges, and grabens. Irregular craters that could be volcanic vents from which the DMDs erupted were also identified and we intend to characterize these in more detail in the next year of this project.

References: [1] Weitz, C.M. et al. (2017) *JGR, 122,* 2013-2033. [2] Willems, D.E. (1968) *USGS Survey Map I-548*.

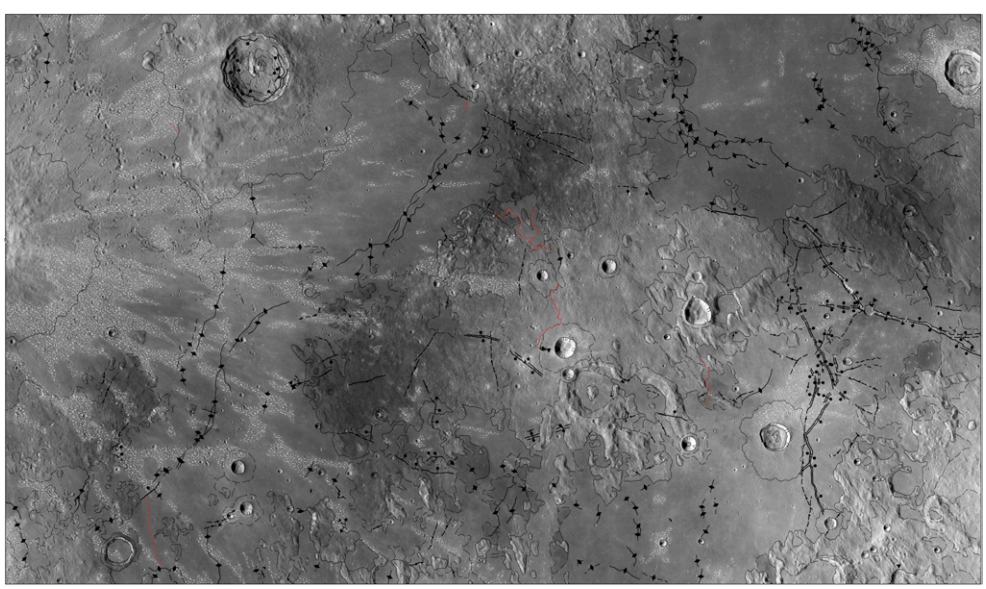

Figure 1: Line work showing surface and linear features, and geologic contacts of our mapping region.