1:1M GEOLOGIC MAP OF PAVONIS MONS, MARS. W. B. Garry[1] and D. A. Williams[2], [1]NASA Goddard Space Flight Center, Greenbelt, MD 20771, brent.garry@nasa.gov, [2]School of Engineering and Space Exploration, Arizona State University, Tempe, AZ.

Introduction: Pavonis Mons (1.48°N, -112.96°E) is the central edifice of the three Tharsis Montes volcanoes on Mars and is considered the most underdeveloped of the three [1]. Our 1:1,000,000-scale geologic map of Pavonis Mons investigates the spatial distribution of geomorphic units, interpreted as volcanic and glacial in origin [2]. This new geologic map, based on high-resolution CTX imagery from Mars Orbiter and informed by additional data sets from Mars Reconnaissance Orbiter and Mars Express, highlights the sequence of events and contrasting eruption styles and morphologies [3].

Our science objectives for this map are 1) determine the areal extent and distribution of different lava flow morphologies across Pavonis Mons to provide insight into the identified late Amazonian change in effusive style; 2) determine the areal extent and distribution of any glacial and aeolian deposits on the flanks and nearby plains and investigate their relationship to the lava flows; and 3) characterize the nature of presumed collapse and erosional features, such as rift zone graben and the channel networks, to determine their relationships to mapped volcanic features.

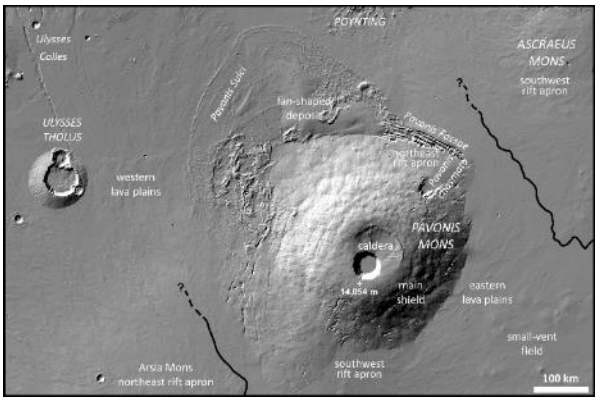

Figure 1. Extent of map boundary for the Pavonis Mons 1:1M geologic map (7.75°N to 3.1°S and 106.5°W to 123.0°W) MOLA hillshade.

Methods and Data: We have made updates to our project software, basemap, and map extent to take advantage of recently released data sets and conform the map to ongoing map projects for Arsia and Ascraeus.

Software Update. Our mapping is now being completed in ESRI's ArcMap 10.6.1, upgraded from 10.3.

Updates to Basemap. Our linework is now drawn on a CTX basemap, changed from THEMIS Daytime IR. We georeferenced 60 tiles of the uncontrolled global CTX mosaic (7 m/px) available from the Bruce Murray Lab at Cal Tech [4] to the controlled THEMIS Daytime IR mosaic (100 m/px).

Map Boundary. The extent of the mapping region (Fig. 1) was expanded to overlap with map boundaries for Arsia and Ascraeus Mons [5], plus cover the western extent of plains lava flows from Pavonis Mons that reach Ulysses Tholus and additional vents in the eastern small-vent field.

Geologic Mapping: The Pavonis Mons map has gone through multiple iterations in the last few months (Figs. 2, 3) to conform to revisions for Arsia and Ascraeus Mons and to correspond to the CTX basemap.

Map units. Our map units and features are geomorphologic units, versus the traditional geologic units based on ages (Fig. 3). Map unit names correspond to specific regions (caldera, shield, apron, fan-shaped deposit, and plains). We are currently revising our description of map units to apply suggested revisions for the 1:1M maps of Arsia and Ascreaus Mons.

Point Features. Five unique features are mapped – cone (pitted), cone (rootless), fan apex, pit, and vent (volcanic), with the latter used for vents on low-shields. While a single 'vent' symbol could have been used, we wanted to differentiate between the geologic context and morphology of each.

Linear Features. Over 25 linear features are mapped, most traditional geologic structural features with solid and dashed versions to indicate certain and approximate for several of them. Our main change is to the symbology and naming for volcanic ridge crest types. We use a combination of red diamonds and line colors to distinguish between lava tubes, rootless cones, and raised, sinuous ridges. In addition, linear vents/fissures, ridge lines for features in the fan-shaped deposits, and wrinkle ridges in the caldera have unique symbols.

Geologic Contacts. Our two main contact types are certain and approximate (Fig.2). Buried/concealed lines are used where the large tabular flow units are partially buried or the upper extent of a feature is concealed. The bold boundary line maps the boundary between flows that originate from the different volcanoes (Figs. 1-3). We draw our lines at 1:50,000 and use a stream tolerance of 250 map units.

Observations from Mapping: Some of our geologic observations based on mapping include: geologically recent eruptions from graben on the flank of the main shield feed extensive lava flows and tube systems

in the lava plains. Extensive flow fields in the lava plains are traced back to single source areas. These flow fields were initially mapped as several individual map features, but CTX images revealed they were connected to a common eruptive event. We are still working on how to combine or subdivide the changes and transitions in flow morphologies associated extensive volcanic features to indicate they are different, but related. The boundary between flows from each volcano is elusive due to the overlapping nature of flow margins, though details of flow directions observed in CTX and contour lines have helped to constrain the contacts.

Future Work: We are finalizing the linework and supportive files (map text, COMU, DOMU) for submission to the USGS this year.

References: [1] Crumpler L. S. and Aubele J. C. (1978) *Icarus*, 34, 496-511. [2] Scott D. H., Dohm J. M., and Zimbelman J. R. (1998) *USGS*, I-2561, 1:1M. [3] Bleacher J. E. et al. (2007) *JGR*, 112. [4] Dickson J. L. et al. (2018) *49th LPSC*, Abstract 2480. [5] Mohr K. J. et al. (2018) *49th LPSC*, Abstract 2407. [6] Williams D. A. et al. (2018) *GSA*, Abstract 67-10.

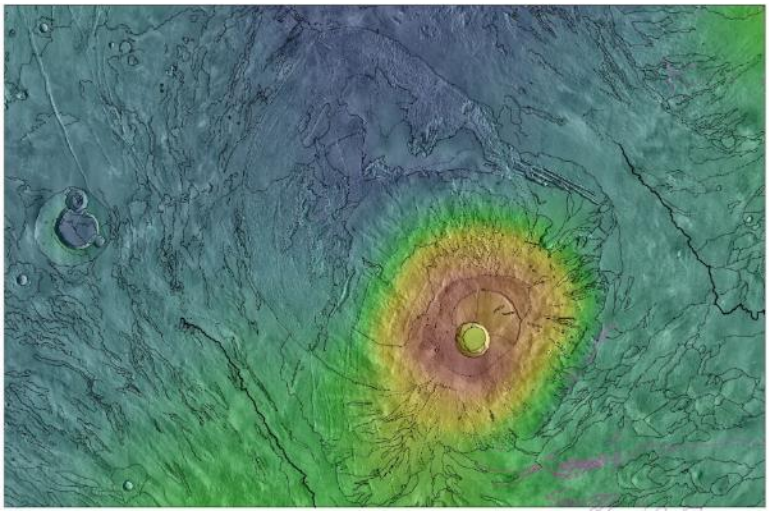

Figure 2. Current progress (as of April 4, 2019) on the geologic contacts mapped to the new CTX basemap.

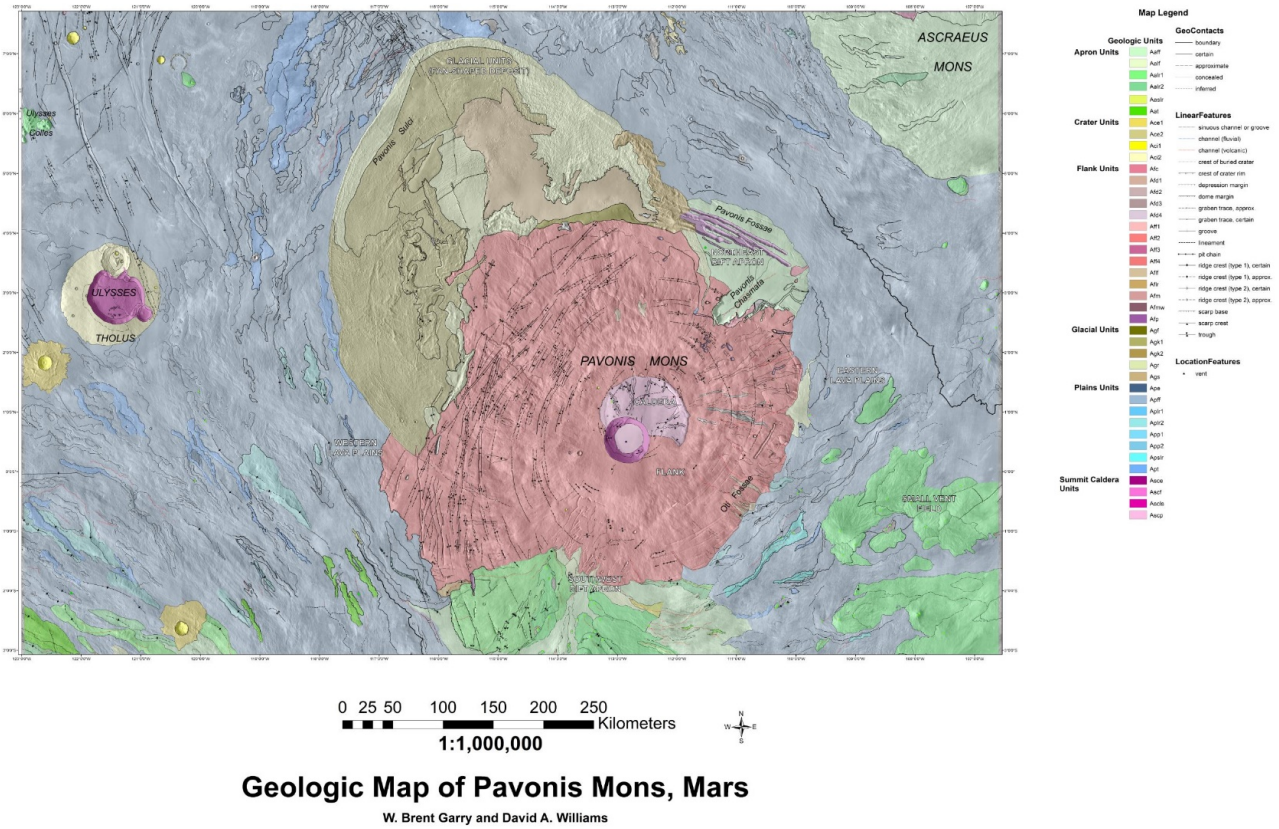

Figure 3. Draft of the Pavonis Mon 1:1M geologic map presented at GSA (Nov. 2018) [6].