GEOLOGIC MAPPING OF ARSIA AND PAVONIS MONTES, MARS. W. B. Garry[1], D. A. Williams[2], and J. E. Bleacher[1] [1]Planetary Geodynamics Laboratory, Code 698, NASA Goddard Space Flight Center, Greenbelt, MD 20771, brent.garry@nasa.gov, [2]School of Earth and Space Exploration, Arizona State University, PO Box 871404, Tempe, AZ 85287.

Introduction: Arsia and Pavonis Montes are two of the three large shield volcanoes that comprise the Tharsis Montes on Mars. Detailed mapping of a limited area of these volcanoes using HRSC images (13-25 m/pixel) revealed a diverse distribution of volcanic landforms within the calderas, and along the flanks, rift aprons, and surrounding plains **[1]**. We are funded by NASA's Mars Data Analysis Program to complete digital geologic maps of both Arsia and Pavonis Montes based on the mapping style defined by **[1,2]**. Here, we report on the progress from year 4 of the project **[3]**.

Data and Methods: We are mapping the two volcanoes in ArcMap 10.2 at 1:1,000,000 scale to produce two geologic maps for the USGS. A CTX mosaic serves as the primary basemap, supplemented by HRSC, THEMIS daytime IR, HiRISE, and MOLA data. Our primary objective is to show the areal extent, distribution, and stratigraphic relations of the different lava flow morphologies across each volcano to better understand their evolution and geologic history.

Geologic Observations: Our main objectives this year were to map the contacts between different volcanic features on the main shield and rift aprons then define the morphologic units on each edifice **(Fig. 1)**. Recent efforts have focused on the northern flank of Pavonis Mons **(Fig. 2)** because the rift apron is confined by the main shield, the surficial fan deposit, and the plains lava flows, providing a control area to create a preliminary geologic map.

Main Shield. The northern region on the main shield of Pavonis Mons (the area west of the rift apron) is comprised of a field of lava fans that begin ~20 km from the edge of the caldera and extend to the base of the shield **(Fig. 2)**. The morphology of the lava fans are characterized by a topographic high at an upslope apex that transitions to a series of flows that spread out downslope. Lava fans appear to either embay or may serve as the source for fans downslope. The fans are more prominent in the THEMIS daytime IR basemap. CTX mosaic shows that the fans are covered in dust.

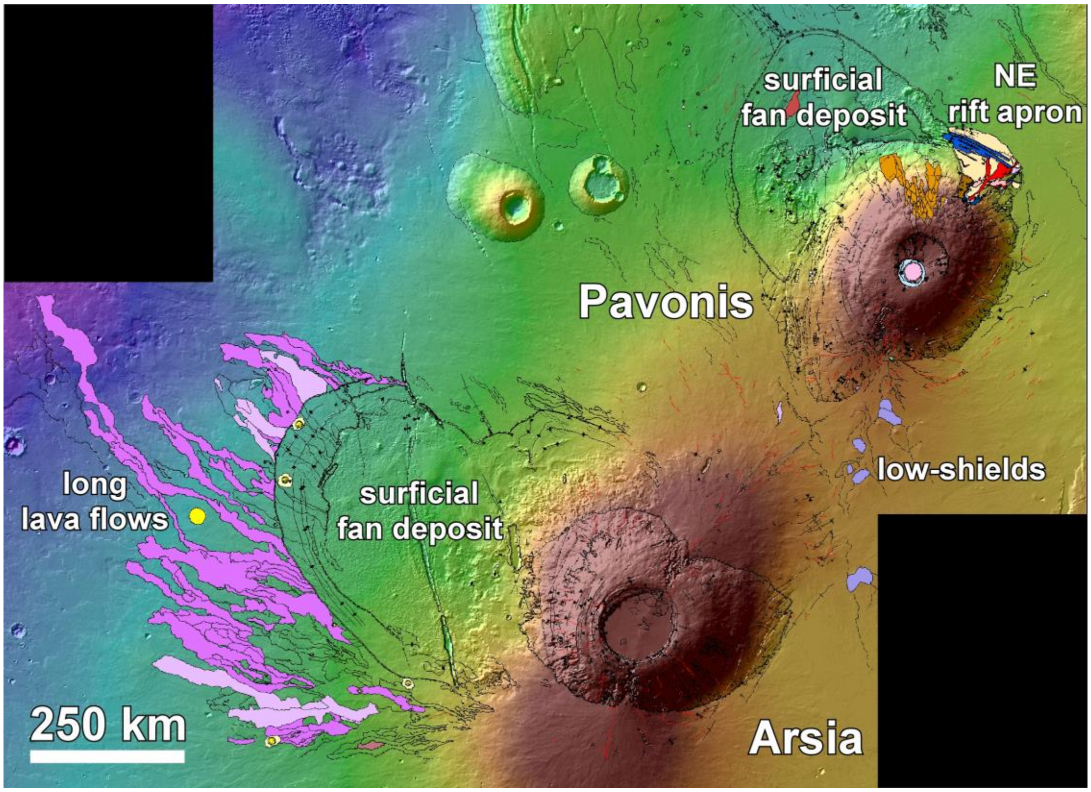

Figure 1. Current progress of the 1:1M geologic maps of Pavonis Mons and Arsia Mons, Mars. Basemap is MOLA colorized and shaded relief topography. Recent mapping efforts have focused on detailing the flow features on the main shield and rift aprons of Pavonis Mons.

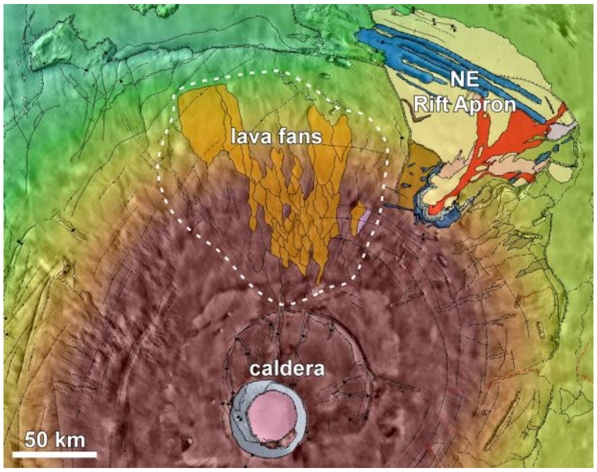

Figure 2. Northern flank of Pavonis Mons and the NE rift apron. White dashed line marks the area on the main shield dominated by lava fans (orange unit). CTX basemap overlain by MOLA topography.

Distinct flow features on the lava fans are difficult to determine because they are mantled by dust. No sinuous channels or collapse features are associated with or present along any topographic crests within this particular group of lava fans. These lava fans are morphologically similar to ones identified on Olympus Mons that were not associated with a lava-tube origin **[4]**. Several lava fans are cross-cut by circumferential graben in that region, indicating these fans were part of the main shield building phase of Pavonis Mons.

Rift Aprons. The NE rift apron on Pavonis Mons is confined on either side by the main shield and surficial fan deposit **[5-7]**, plus it is truncated downslope by lava flows that extend from the SW rift apron **(Fig. 3)**. The collapse terrain in this area is not as complex as the other rift aprons. Collapse features have coalesced to form an approximately 25 km-wide, horseshoe-shaped, amphitheater surrounded by additional collapse pits and sinuous channels on the main shield. The majority of the flows present on the apron are muted by dust cover. The younger flow fields (e.g., less dust cover, well-defined flow features) create a channel-fed flow field with individual channels ≤150 m wide. These flows extend from partially buried linear vents and sinuous, rille-like channels at the apex of the collapse terrain. The young flows appear to cascade into some of the collapse features to the east, but these flows are cross-cut by the prominent, circumferential graben at the base of the apron, which are subsequently partially buried by the surficial fan deposit **[5-7]**. Additional mapping will reveal the spatial relationship and relative timing of eruptions to the surrounding plains lava flows and with the other rift aprons.

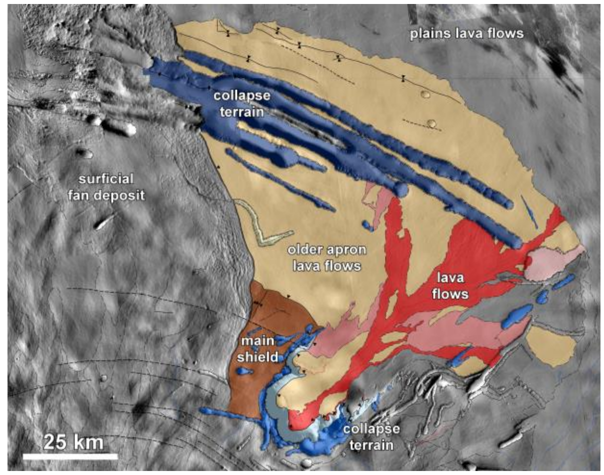

Figure 3. Preliminary geologic map of the NE rift apron on Pavonis Mons overlain on the CTX basemap. The apparent youngest lava flows are in dark red and light red. Relatively older lava flows on the apron are in light yellow. Collapse terrain is in dark blue.

Discussion: Mapping reveals a similar sequence of events for the evolution of both volcanoes that agrees with **[1,2,8]**: 1) main shield forms, 2) eruptions from the NE/SW rifts emplace long lava flows that surround the main flank, 3) eruptions wane and build up the rift aprons and shield fields, 4) glaciers deposit surficial fan deposit material **[5-7]**, and 5) localized recent eruptions along the main flanks, in the calderas, and within the fan-shaped glacial deposits. One of our ongoing questions is whether or not there were eruptions along the flanks of the main shield that coincide with eruptions at the rift aprons. Initial mapping results reveal eruptions that originate along circumferential graben at the base of Pavonis Mons that appear to merge with the plains lava flows. Further mapping will reveal the relative geologic timing of eruptive units on the main shield and provide a more complete analysis of the spatial distribution of tube-fed versus channel-fed flows as originally discussed by **[1]**.

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Acknowledgements: This research is funded by NASA's Mars Data Analysis Program (MDAP) grant NNX10AO15G awarded to D.A. Williams (Arizona State University).