GEOLOGIC MAPPING OF ARSIA AND PAVONIS MONTES. D.A. Williams[1], W.B. Garry[2], J.E. Bleacher[3], D. Shean[4], R. Greeley[1*]. [1]School of Earth & Space Exploration, Arizona State University, Tempe, AZ 85287 (David.Williams@asu.edu); [2]Planetary Science Institute, Tucson, AZ; [3]Planetary Geodynamics Division, NASA Goddard Spaceflight Center, Laurel, MD; [3]University of Washington, Seattle, WA. [*]Deceased.

Introduction: We are funded by the NASA Mars Data Analysis Program (MDAP) to produce 1:1,000,000 scale geologic maps of Arsia Mons and Pavonis Mons, as well as conduct mapping of surrounding regions. In this abstract we discuss progress made during years 1 and 2 of the 4-year project.

Objectives: The *scientific objectives* of this mapping project include: 1) Determining the areal extent, distribution, and age relationships of different lava flow morphologies (**Fig. 1, next page**) on the main flanks, rift aprons, and associated small-vent fields of Arsia and Pavonis Montes to identify and understand changes in effusive style across each volcano, and to provide insight into Martian magma production rates. This work builds on a preliminary study performed by Co-I Bleacher as part of his Ph.D. dissertation [1]. Results will provide insight into the overall volcanic evolution of each structure, enable comparisons between volcanoes, and determine the extent of each shield's contribution to the Tharsis plains; 2) Determining the areal extent and distribution of purported glacial and aeolian deposits on the flanks of each shield and their relationship to the lava flows. Results will establish a volcano-wide understanding of the nature of potential lava-ice interactions and the contribution of aeolian cover to the current form of the shields, enabling comparison among the shields potentially in different stages of development; and 3) Characterizing erosional and tectonic features, such as rift zone graben, flank terraces, and channel networks present on the flanks, rift aprons, and small-vent fields (**Fig. 2, next page**), to determine their relationships to volcanic materials and processes.

Results: We are completing our year 2 objectives on schedule. Our objectives for year 2 include: 1) Review and refine the mapping of structural features over both Arsia and Pavonis Montes volcanoes (**Fig. 3a,b, next page**); 2) Determine the material units to be mapped on Arsia and Pavonis Montes, using the mapping of Olympus Mons as a template [2]; and 3) Begin mapping long lava flows throughout the map area and develop criteria to determine the stratigraphy of overlapping lava flows. In Fall 2012 we will apply the material unit definition and characterization methodology for the Olympus Mons to the Tharsis Montes, and begin unit mapping. Material unit mapping will be the primary tasks of years 3 and 4.

Long Lava Flow Mapping on Arsia Mons: The southwest rift apron on Arsia Mons is comprised of several lava flows tens to hundreds of kilometers long. One aspect of this project is to map the lengths and area of these lava flows (Fig. 4). Thirty-five lava flows have been mapped to date. They range in length from 21 to 228 km and area from 65 to 2685 km^2. These values represent a minimum because the flows are partially buried by other flows, concealing their true dimensions and source areas. From our preliminary mapping, these flows are typically leveed flows, and the flows with shorter length and lower area are observed closer to the chasmata on the flank of Arsia Mons, a potential source area for lava flows on the apron.

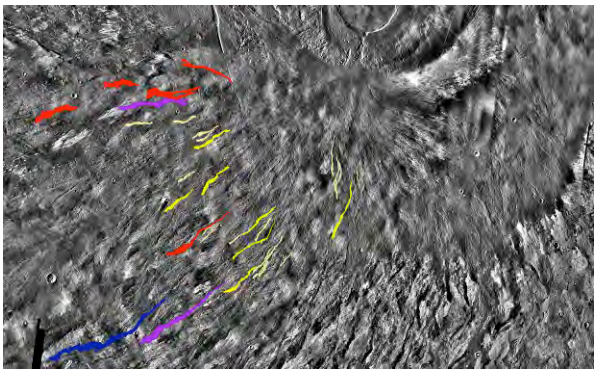

Figure 4. Lava flows mapped on the southwest rift apron of Arsia Mons, color coded by polygon area on the THEMIS daytime basemap. Light Yellow: 65-271 km^2, Dark Yellow: 272-491 km^2, Red: 492-968 km^2, Purple: 969-1596 km^2, Blue: 1597-2685 km^2. Part of Arsia Mons caldera is visible at the top of the image.

References: [1] Bleacher, J.E., R. Greeley, D.A. Williams, S.R. Cave, and G. Neukum (2007), Trends in effusive style at the Tharsis Montes, Mars, and implications for the development of the Tharsis province, *J. Geophys. Res., 112,* E09005, doi:10.1029/2006JE 002873. [2] Bleacher et al. (2012), this meeting 1805.

Figure 1 (next page). Type examples of volcanic units mapped in the Tharsis Montes, using HRSC and THEMIS data. From left to right, top to bottom: A) channel-fed flows (CFF), B) tube-fed flows (TFF), C) raised ridges, D) tabular flows, E) fissure-fed flow fields, F) low shields, G) cones, H) a mottled unit, I) a hummocky unit, J) a smooth unit, K) collapse of non-impact origin, and L) channel network terrain. Modified from [1].

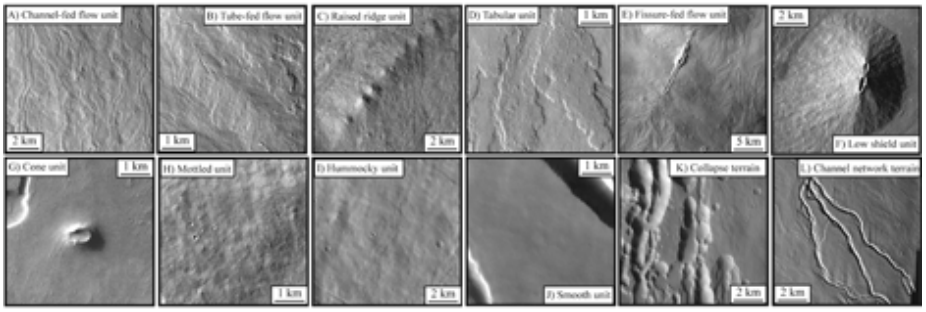

Figure 2 (below). Color-coded altimetry map of the central Tharsis region of Mars showing our mapping regions and the area of our mapping coverage (derived from the ArcGIS™ project provided by the USGS). This map shows superposed CTX coverage (6 m/pixel, bottom image), which almost fully covers the primary mapping regions (smaller solid black rectangles). Supplemental mapping regions include the rift aprons and shield fields (solid white rectangles) and a region of long lava flows (dashed white rectangle).

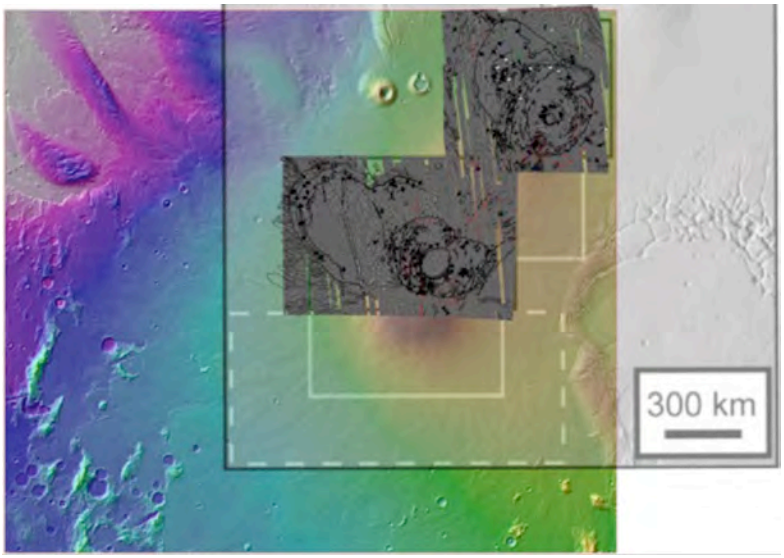

Fig. 3a (below, left). Structural mapping of Arsia Mons superposed on CTX coverage (6 m/pixel) and MOLA color map. **Fig. 3b (below, right).** Structural mapping of Pavonis Mons on the same basemap. Red lines mark the trace of volcanic lava channels and/or the traces of lava tubes. Linear features with white diamond symbols mark the locations of linear/sub-linear features that could be subvolcanic dikes, medial moraines, and/or eskers. Figures derived from the ArcGIS™ project provided by the USGS.