

Geologic Mapping of Arsia and Pavonis Montes, Mars

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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 3 of the project [3].

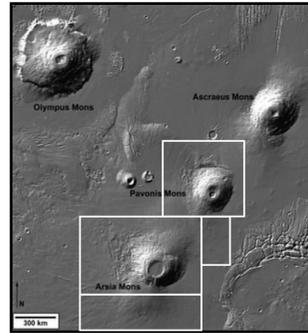


Figure 1. Mapping Area

Project Objectives:

- 1) Map Arsia and Pavonis at 1:1,000,000 map scale (1:2,000,000 to fit on the poster)
- 2) Show the areal extent, distribution, and stratigraphic relationships
- 3) Map the long lava flows along Arsia's SW Rift Apron

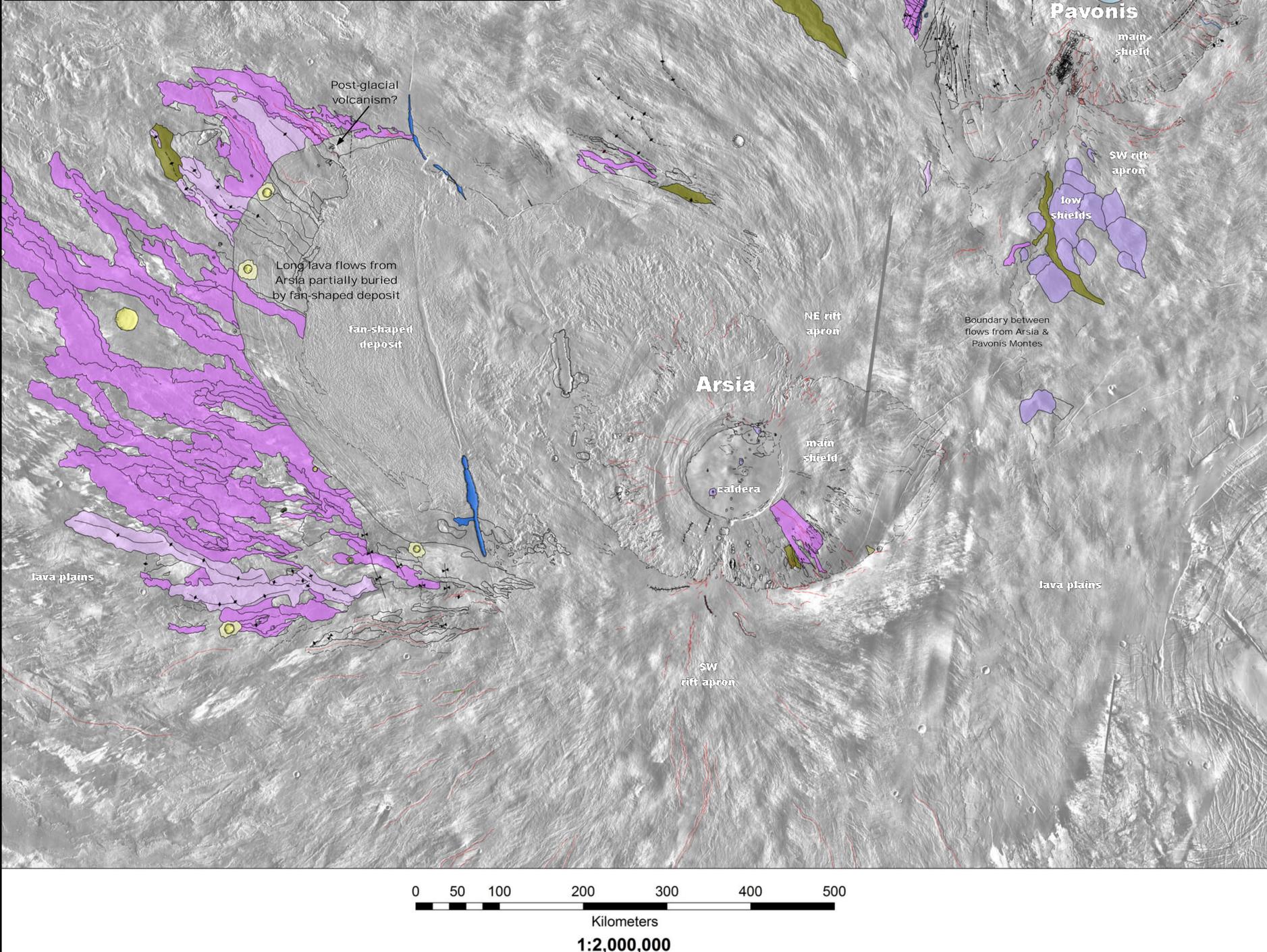
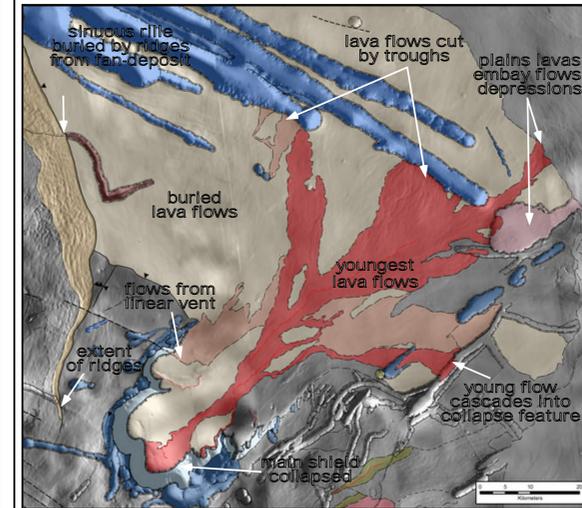


Figure 2. Current progress on geologic mapping of Arsia and Pavonis Montes

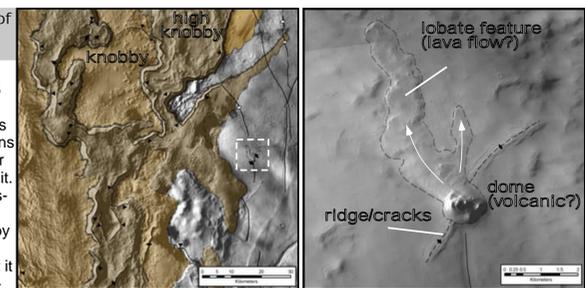
Discussion



What are the relative geologic relationships of Pavonis NE rift apron?
 Figure 3. Collapse features have coalesced to form a 25 km-wide, horseshoe-shaped, amphitheater. The majority of the rift apron is covered by buried flows with no distinct margins. The younger flow fields are less dust cover, have channels (~150 m wide), originate at linear vents. However, the circumferential troughs at the base of the apron cut off the edges of the lava flows, indicating they are younger structural features. These troughs are partially buried by ridges and knobby material from the fan-shaped deposit, (Fig. 2) which means both the troughs and lava flows are pre-glaciation. Detailed mapping of the high resolution CTX images (6m/px) allows the relative geologic history of these volcanoes to be reconstructed.

Is this dome evidence of post-glacial volcanism on Pavonis?

Figure 4. A dome (1.5 km diameter) & lobate feature (5 km) are mapped in the fan deposit. The dome cross-cuts a 5 km long ridge that contains preserved cracks that appear to disturb the surrounding unit. The morphologies are consistent with a volcanic dome & lava flow. The lack of burial by fan-deposit units and well-defined ridge cracks suggest it is a post-glacial eruption feature (<100 Ma) [4,5,6].



Mapping Units

GeoContacts	Mapping Units
<all other values>	<all other values>
TYPE	TYPE
— certain	Fan-Shaped Deposit (FSD)
- - - approximate	FSD - high knobby facies
⋯ concealed	FSD - knobby facies
▬ gradational	FSD - ridge & knobby
⋯ inferred	FSD - ridged facies
Linear Features	FSD - smooth facies
<all other values>	apron - buried
TYPE	apron - flows
— pit chain	apron - smooth
— sinuous channel or groove	caldera
— channel (fluvial)	channel network
— channel (volcanic)	channel-fed flow
— crest of buried crater	collapse terrain
— crest of crater rim	cone
— depression margin	crater cavity
— dome margin	crater ejecta
— fault, certain	depression
- - - fault, approx.	fissure-fed flow
— graben trace, approx.	hummocky (not mapped)
— graben trace, certain	low shield
— groove	mottled (not mapped)
— lineament	plains knobby
— normal fault, approx.	plains smooth/platy
- - - normal fault, certain	raised ridge
— reverse fault, certain	scarp / wall
- - - reverse fault, approx.	smooth (not mapped)
— ridge crest (type 1), certain	tabular flow
— ridge crest (type 1), approx.	tube-fed flow
— ridge crest (type 2), certain	volcanic - lava fan
— ridge crest (type 2), approx.	volcanic - sinuous channel
— scarp base	
— scarp crest	
— small crater rim	
— trough	

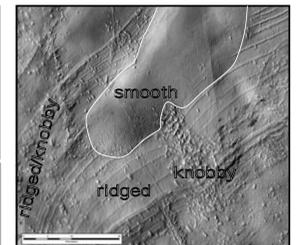


Figure 5. Examples of mapping units in the Fan Shaped Deposit on Pavonis Montes (based on units defined by [6]).

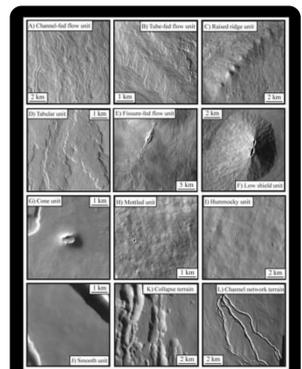


Figure 6. Example of mapping units defined in preliminary mapping by [1,2].

References: [1] Bleacher J. E. et al. (2007) JGR, 112, E04003, doi:10.1029/2006JE002826. [2] Bleacher J. E. et al. (2007) JGR, 112, E09005, doi:10.1029/2006JE002873. [3] William D. A. et al. (2012) LPSC 43, Abstract 1528. [4] Shean D.E. et al. (2007) JGR, 112, E03004, doi:10.1029/2006JE002761. [5] Shean D.E. et al. (2005) JGR, 110, E05001, doi:10.1029/2004JE002360. [6] Head J.W. and Marchant D. R. (2003) Geology, 31, 641-644. [7] Robbins et al. (2011) Icarus, 1179-1203. [8] Crumpler & Aubele, 1978, Icarus, 34, 496-511. Acknowledgements: This research is funded by a NASA Mars Data Analysis Program (MDAP) grant to D.A. Williams.