Preliminary Volcanic Feature Analysis of Olympus and Ascraeus Mons, Mars. K.J. Mohr[1], D.A. Williams[1], W.B. Garry[2], and Jacob E. Bleacher[2] [1]School of Earth & Space Exploration, Arizona State University, Tempe, AZ 85282, kyle.mohr@asu.edu, [2]Planetary Geology, Geophysics, and Geochemistry Laboratory, Code 698, NASA Goddard Space Flight Center, Greenbelt, MD 20771.

Introduction/Background: Olympus Mons (OM) and Ascraeus Mons (AM) are two large shield volcanoes found in the Tharsis province on Mars. Both volcanoes have been recently mapped at a 1:1,000,000 scale using high resolution imagery [1,2]. Mapping of Arsia and Pavonis Montes are still in progress. With the completion of the Olympus and Ascraeus Montes maps, direct comparison of volcanic features found on each edifice can be done. Rose diagram analysis shows strong similarities in specific features found on the two large volcanoes, further suggesting a similar formation and evolution.

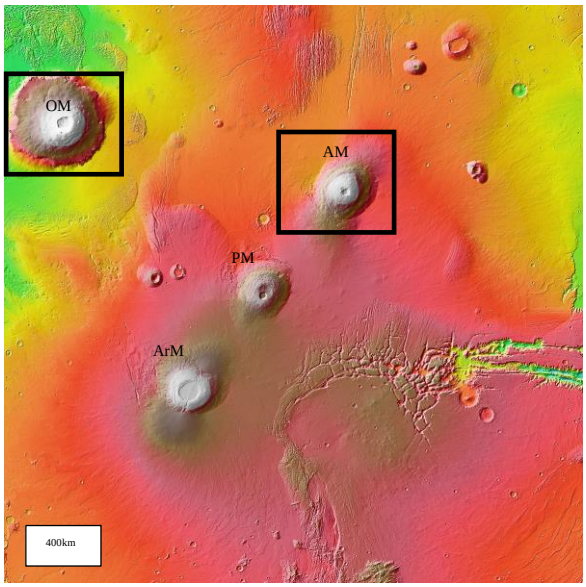


Figure 1. MOLA image of the Tharsis Montes, Olympus Mons and Ascraeus Mons are indicated by the black squares.

Data and Methods: Geologic Maps for Olympus and Ascraeus Montes were prepared in ArcGIS at a 1:1,000,000 scale using CTX, THEMIS, MOLA, and HRSC imagery. Volcanic features such as geologic units, linear features (rilles, volcanic channels, and graben), and location point features (fan apex, small shields, and flank vents) were mapped.

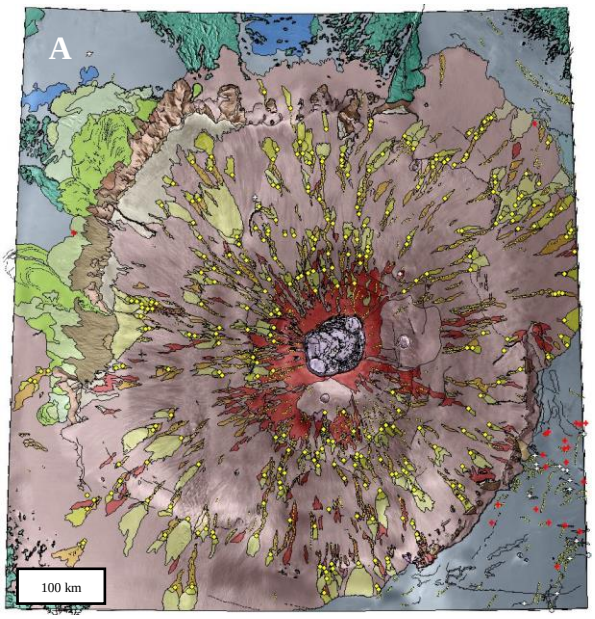
Rose diagrams were then created by first using the Generate Near Tool in ArcGIS to identify where each feature was located from a certain position on the volcano. The center point for each volcano was located at the center of each of the caldera complexes. Flank channel units were not taken into account in the study due to the fact these flows are dominantly found on all flanks of both volcanoes.

Only features observed on the flanks of the volcanoes were used in this study. However, future work will include small shields found on the surrounding plains of each of the Tharsis Montes.

Geologic Observations: Both Olympus Mons and Ascraeus Mons are dominated by flank channel flows that embay older flank ridge flows, suggesting a change in lava properties from a less viscous effusive flow to a more viscous effusive flow [1,2]. Lava fans are also observed on both volcanoes, which are fan-like features where a sudden change in slope allowed for a tube-fed flow or vent to extrude lava into a deltaic shape. These lava fans are dominantly found on flank terraces, (sharp breaks in slope towards the base of the volcano) and have a gentle convex topographic profile [3,4].

Lava fans and flank ridge flows are dominantly found on the northwest and southeast flanks of both OM and AM. The NW and SE flanks are also where terraces are more commonly observed [4]. Flank terraces are believed to form by the flexure of the underlying lithosphere due to the overbearing weight of the material comprising the main shields [4,5].

It has been suggested that OM has been spreading apart in a NW/SE orientation [1]. There has been debate over whether or not AM is also spreading in a NW/SE direction [5,6]. Preliminary work using rose diagram analysis of the volcanic features on both volcanoes shows a very strong correlation of where these features



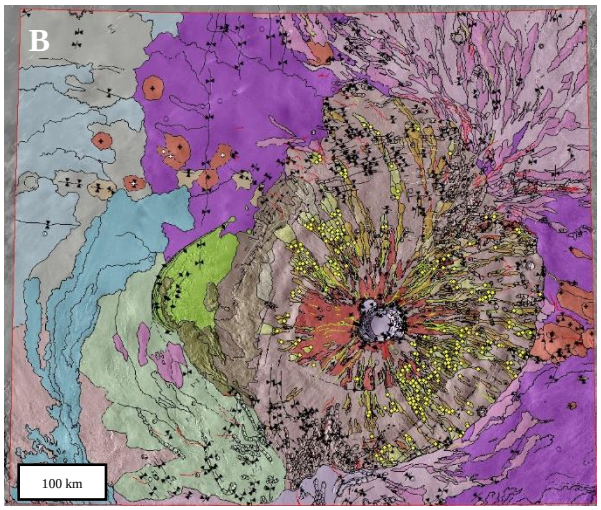


Figure 2. A) 1:1M scale geologic map of Olympus Mons. B) 1:1M scale geologic map of Ascraeus Mons. Yellow dots indicate a fan apex.

are observed on the flanks of each volcano. This observation suggests that Ascraeus Mons in fact may be spreading similarly to Olympus Mons.

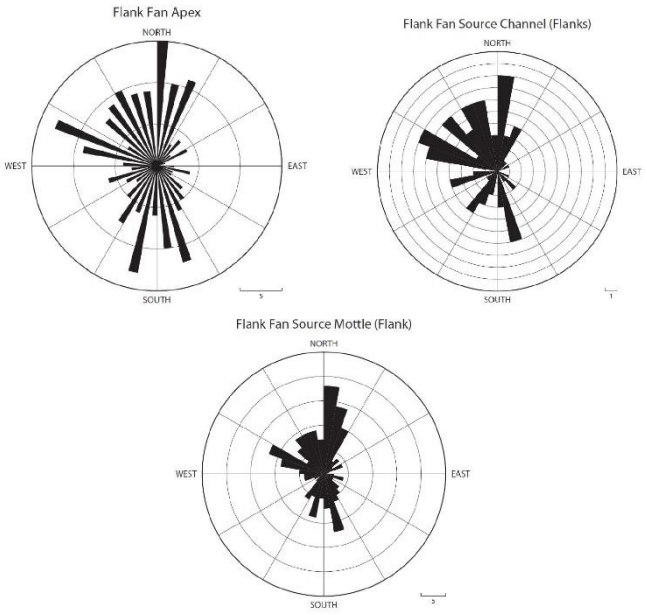


Figure 3. Rose diagrams showing the distribution of features on Olympus Mons. The Fan Apex diagram shows the distribution of all the fan apex on the flank of OM. The Flank Fan Source Channel and Mottle break up the Fan Apex into the two types of fans located on OM.

Discussion: Newly finished mapping of Olympus Mons and Ascraeus Mons at a 1:1,000,000 scale allows for a direct comparison analysis for the volcanic features observed on both volcanoes. The similarities in location where many of these features are found on each volcano further suggests that a similar evolution and formation process for the two volcanoes. Future investigation of the two volcanoes will include low shield volcanoes located off the NW and SE flanks of the two volcanoes. The dense location of these low shields, as well as the superposition ages of these features, suggests that they may have formed due to overbearing weight of the flanks causing pre-existing dikes to propagate off the flanks and onto the surrounding plains. When mapping is finished for Arsia and Pavonis Montes a similar study will be done to compare the four larges Tharsis volcanoes.

References: [1] Bleacher J. E. et al. (2007) JGR, 112, E04003, doi:10.1029/2006JE002826. [2] Mohr et al. (2017) LPSC 48 #1306. [3] Thomas et al. (1990), JGR 95, 14345-14355. [4] Byrne et al. (2009) Earth and Planetary Science Letters 281, 1-13. [5] Byrne et al. (2012) JGR, 117, E01004, doi:10.1029/2011JE003825. [6] McGovern and Morgan (2009) Geology, 37, 139-142, doi:10.1130/G25180A.1.