DETAILED MAPPING OF THE VOLCANIC CENTER ATIRA MONS, BAT REGION, VENUS.

C. H. G. Braga[1], E. G. Antropova[1], R. E. Ernst[1,2], K. L. Buchan[3] and H. El Bilali[2], [1]Faculty of Geology and Geography, Tomsk State University, Tomsk, Russia; carloshenrique_gb@hotmail.com, [2]Department of Earth Sciences, Carleton University, Ottawa, Canada, [3]273 Fifth Ave., Ottawa, Ontario, Canada.

Introduction: Atira Mons is a large volcano with a diameter of ~ 600 km and a central caldera ~100 km across (Fig. 1a). It is centered at 52.2°N, 267.6°E (92.4°W) in the northeastern portion of BAT region between Kawelu and Guinevere Planitiae.

Previous geologic mapping of Atira Mons was carried out as part of Metis Regio (V-6) Quadrangle mapping at a 1:5,000,000 scale by [1]. That study was able to identify rough to smooth lava flows sourced and radially oriented from the summit caldera. In addition, Atira Mons' gravity anomaly was modeled by [2] to estimate lithosphere thickness.

Currently, our work aims to provide a more detailed mapping on a scale 1:400,000 of the volcanic center region, its associated flank lava flows and the additional geological features of the area such as grabens, fractures, fissures, wrinkle ridges, fracture belts, shield volcanoes and lava channels. From this we are reconstructing the geological history of Atira Mons, and will establish age relationships with other volcanic centers in the region through cross-cutting relationships between dykes (underlying grabens) and flows from the different centers. Additionally, we will test for a link between caldera collapse and lateral emplacement of a radiating dyke swarm, traced from ~700-1000 km away from the volcanic center [3].

Methods: Geological mapping is being carried out using full-resolution (75 m/pixel) Magellan SAR images and its altimetry data in ArcGIS ArcMap v. 10.3. In order to enable more accurate and detailed interpretations Java Mission-Planning and Analysis for Remote Sensing (JMARS) [4] and ArcScene (ArcMap v. 10.3) were used to create topographic profiles and digital elevation models (DEMs), respectively. Geological units are distinguished based on changes in radar brightness, topography, morphology and stratigraphic relationships.

Central Summit History: From our mapping in the summit region (Fig. 1b) we propose the following sequence of events: 1) caldera formation with greater collapse on the east side; 2) emplacement of flows on the floor of the caldera, which were later deformed by polygonal fractures [5]; 3) emplacement of younger flows covering part of the summit floor and fed from small shield volcanoes; 4) formation of a set of wrinkle ridges deforming the youngest flows.

Flank Flows: Most of the lavas mapped in Figures 2-4 flow radially downslope away from the summit region (**mA**, Fig. 2) until they reach a topographic barrier such as the fracture belts on the E side (**fbE**, Fig. 2) and on the W and SW sides (**fbW**, Fig. 2). The W, NW and N trending flows start radially from outside the caldera rim, but eventually converge towards a local basin (**bs**, Fig. 2) approximately 300 km NW of Atira Mons' summit. The E flank flows are fed from the eastern side of the caldera interior, crossing its low rim. However, the W and SW flows are not fed from the caldera interior, but more likely from buried circumferential dykes outside the caldera rim. Radar-bright landslides can be seen on the W and NW flank of the caldera, partly covering and obscuring the assumed sources of W trending flank flows. Note that the mapping of lava flows (Fig. 4) is only partially complete, and further mapping is in progress.

The Eastern Arcuate Fracture System and its constraint on Lava Flow Timing: A major arcuate fracture system located on the E flank of Atira Mons, is thought to overlie a circumferential dyke swarm [6]. These could indicate that late in its history the Atira Mons volcanic center started to develop corona-like characteristics. This arcuate fracture system cuts across the majority of the E trending radial flows (**fE**, Fig. 3), which indicates that most of these fractures are younger than the flows. However, the northern end of this arcuate fracture system is completely covered by a younger set of NE trending flank flows (**fNE**, Fig. 3).

Acknowledgments: Magellan SAR images obtained from https://astrogeology.usgs.gov/search/?pmi-target=venus based on the data from https://pdsimaging.jpl.nasa.gov/volumes/magellan.html#mgnFMAP.

References: [1] Dohm, J. M. et al. (2011) *USGS Scientific Investigations*, Map 3158. [2] Kiefer W. S. and Potter E-K. (2000) *LPSC XXXI*, Abstract #1924. [3] Ernst R. E. et al. (2003) *Icarus* 164, 282-316. [4] Christensen, P. R. et al. (2009) *AGU Fall Meeting*, Abstract #IN22A-06. [5] Smrekar S. E. et al. (2002) *JGR*, 107(E11), 8-1 to 8-17. [6] Buchan, K.L. and Ernst, R.E. (2019) *In: Srivastava et al. (eds.) Dyke Swarms of the World – A Modern Perspective. Springer*, p. 1-44.

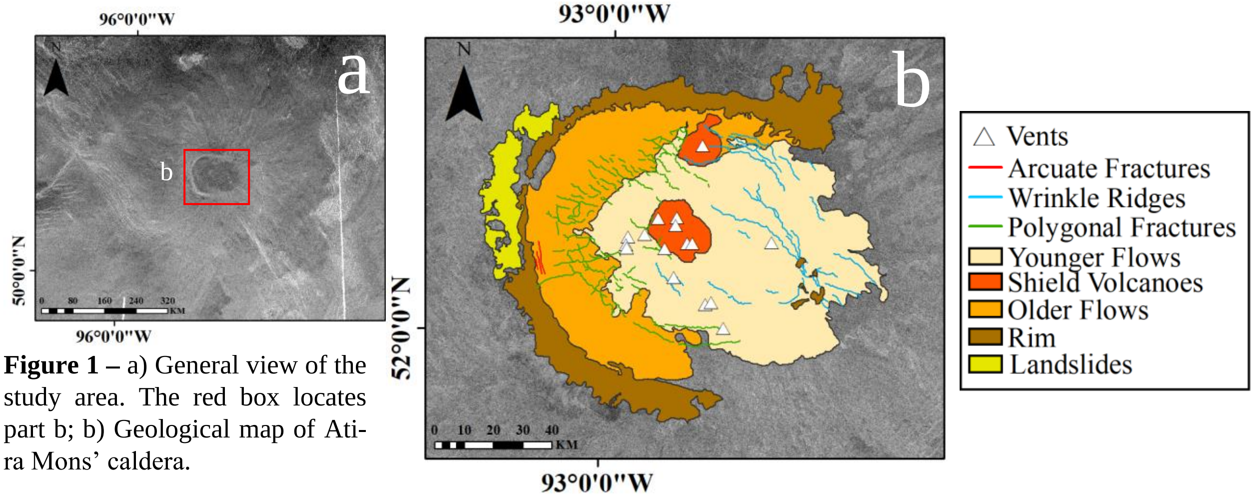

Figure 1 – a) General view of the study area. The red box locates part b; b) Geological map of Atira Mons' caldera.

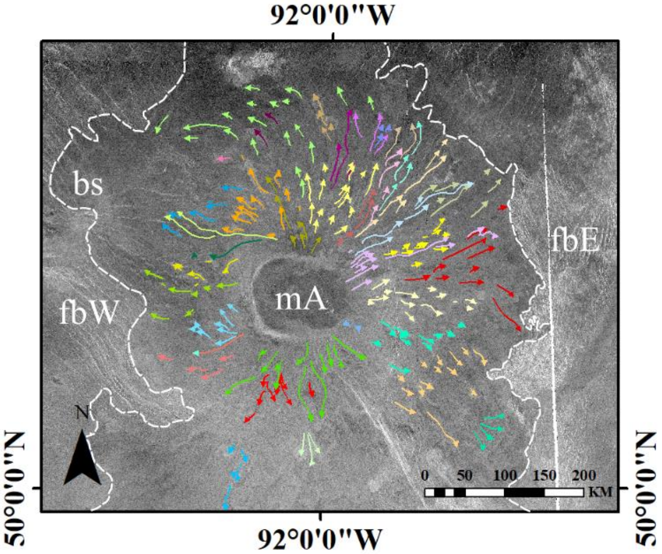

Figure 2 – Flows on the flanks of Atira Mons. Colors indicate different generations of flows mapped on the basis of cross-cutting relationships. The dashed line shows the full extent of the flows. **mA** – Atira Mons' summit; **fbW** – Western fracture belt; **fbE** – Eastern fracture belt; **bs** – local basin.

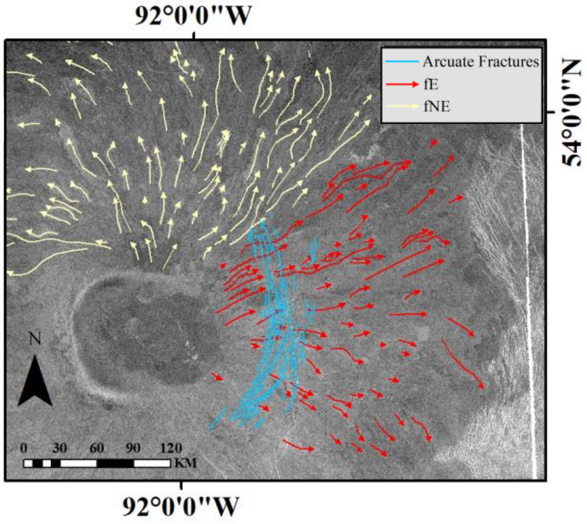

Figure 3 – Eastern arcuate fracture system (blue lines) cutting older E trending flank flows (**fE**) but cut by younger N-NE trending flank flows (**fNE**).

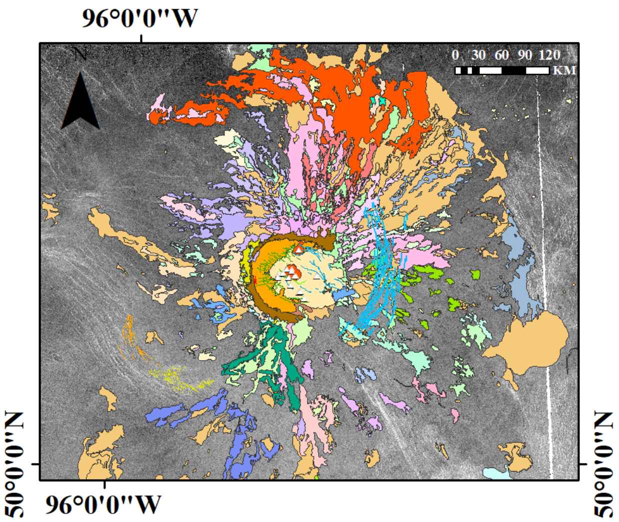

Figure 4 – Currently mapped geological units.