MAAT MONS, ATLA REGIO, VENUS: MAGMATIC AND TECTONIC HISTORY FROM DETAILED MAPPING. H. El Bilali[1], R.E. Ernst[1,2], and K.L. Buchan[3]. [1]Department of Earth Sciences, Carleton University, Ottawa, Canada; [2]Faculty of Geology and Geography, Tomsk State University, Tomsk, Russia; [3]273 Fifth Ave., Ottawa, Ontario, Canada.

Introduction: Maat Mons is the highest volcano on Venus, with relief of >8 km. It belongs to Atla Regio, which is a locus of multiple magmatic centres (Ozza, Maat, Sapas, Ongwuti Mons, and smaller unnamed centres) and is associated with triple junction rifting, likely above a still active mantle plume [1-3].

Previous mapping of Maat Mons [1] identified a 26×30 km caldera complex at the summit. The multiple centres of collapse were interpreted to be linked with the eruption of flank lava flows of which four types were distinguished: digitate, sheet, fan and filamentary.

The goal of our research is to develop a detailed geological history of Maat Mons through detailed mapping at a scale of 1:400,000, much finer than the ~1:2.5 M scale of earlier mapping (Fig. 7 of [1]). We also aim to identify the specific source areas for each flow.

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. 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.

Preliminary geological map: A preliminary geological map (with about 50 units identified so far) is shown in Figure 1. The large number of flow units illustrates the complexity of geological evolution of Maat Mons. Local flow directions are shown throughout the area. Maat Mons comprises two summits, which we refer to as the southern summit (SS; elevation ~9600 m) and the northern summit (NS; ~9200 m) separated by a "saddle" (9000 m). SS exhibits a clear circular caldera-like structure (green line in Fig. 1; [1]), whereas NS appear to be plateau-like. In addition, there is limited evidence of a much larger caldera rim encircling the entire summit region (white line). There is a smaller shield volcano on the northern flank (FV). Most of the lavas flow radially away from SS down the flanks. However, lavas that are sourced from the north side of SS flow northward into the saddle, where they are deflected around either side of NS before flowing down the flanks. Lavas on the northern flank of NS flow north before being deflected around either side of FV.

Sources of Maat Mons lava flows: There are two main types of sources for Maat Mons flows as described below.

Fed from caldera collapse: The main flank flows seem to trace back to summit SS, and were fed either from magma expelled during caldera collapse [1] or from central vents. In the former case, these flows could have erupted from circumferential fractures associated with caldera collapse [5]. Alternatively, they could be fed by lateral dyke injection from an underlying magma chamber (see Icelandic example in [6]). In this case the flows would be expected to start lower on the flanks. In our mapping we aim to clarify which of these alternatives applies.

Fed from grabens (overlying dykes): On the distal flanks there are numerous examples of flows that are fed directly from dykes (Fig. 2), some of which could be radiating from SS. This supports the idea that flank flows could be fed by dykes laterally emplaced from a magma chamber beneath SS.

Shield field fed from dyke swarm: There are many small shield volcanoes in the area. They are most numerous in the plains to the west of Maat Mons where they comprise a shield field. Many of the shields in this field lie along NE-trending grabens (dykes) (Fig. 3). This provides evidence that some shield fields on Venus can be fed via dyke swarms. In this case, it is not clear whether the dykes are related to Maat Mons.

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] Mouginis-Mark P.J. (2016) *Icarus*, 277, 433-441. [2] Brossier J.F. et al. (2020) Icarus, 343, 113693. [3] Shalygin E.V. et al. (2015) *GRL*, 42 (12), 4762-4769. [4] Christensen, P. R. et al. (2009) *AGU Fall Meeting*, Abstract #IN22A-06. [5] MacLellan L.M. et al. (2021) *Earth-Sci. Reviews* (in review). [6] Gudmundsson M.T. et al. (2016) *Science*, 353, 6296.

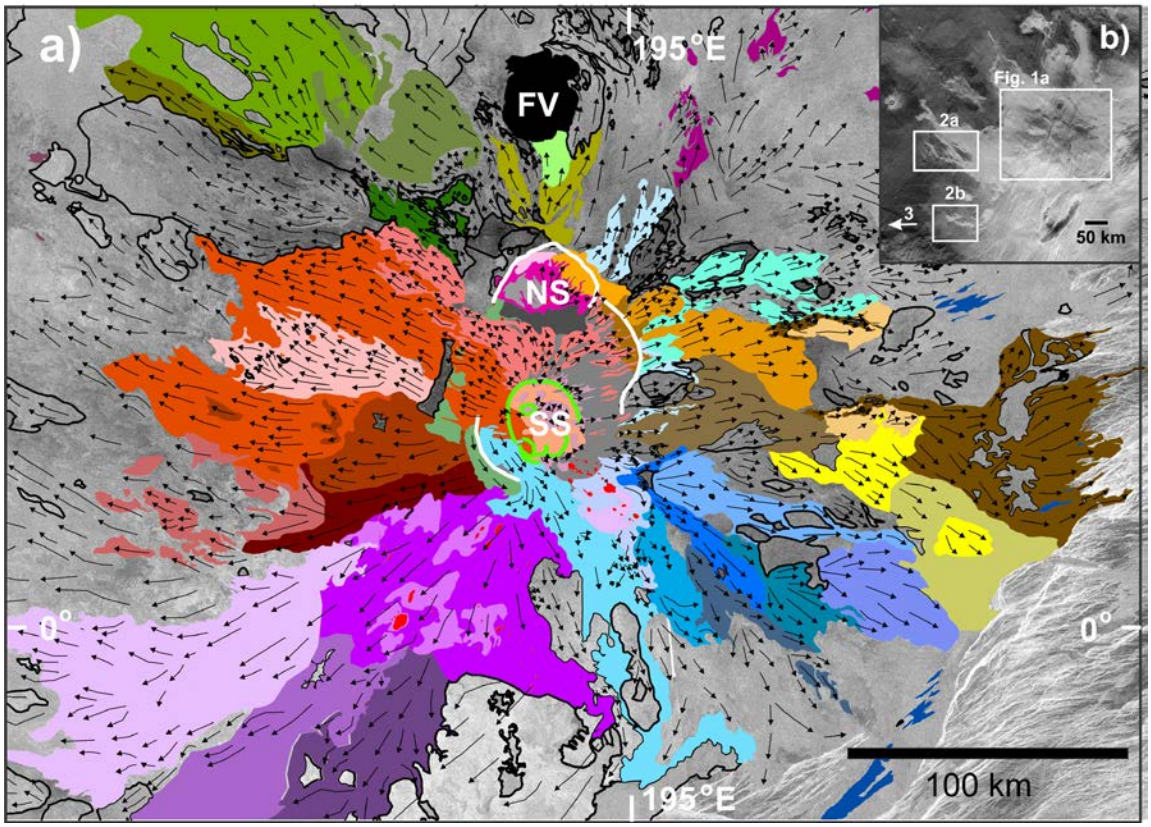

Fig. 1. Preliminary map of Maat Mons. a) Colours indicate flow units. Black arrows show flow directions. SS = southern summit; NS = northern summit; FV = flank volcano. Arcuate green lines locate the rims of the nested caldera complex of SS. Arcuate white lines indicate a possible larger caldera rim. Background is a Magellan SAR image. b) Inset shows Magellan SAR image showing location of Figures 1a, 2 and 3.

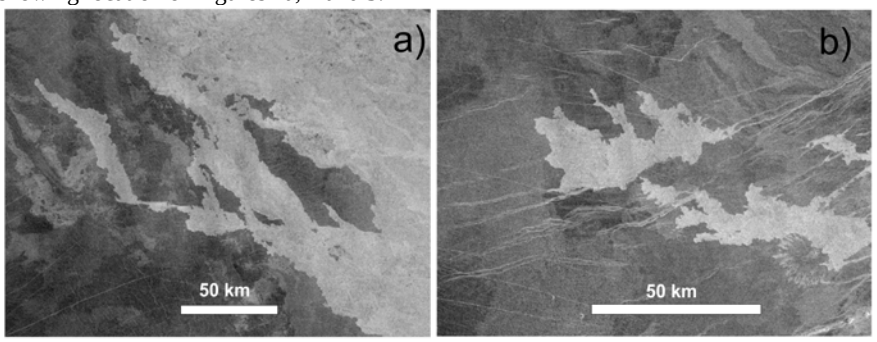

Fig. 2. Radar bright flows fed from grabens (dykes). a) Flows fed from WNW-trending dyke. Image centre: 190ºE, 0ºS. b) Flows fed from ENE-trending dykes. See Figure 1b for locations. Image centre: 191ºE, 2ºS

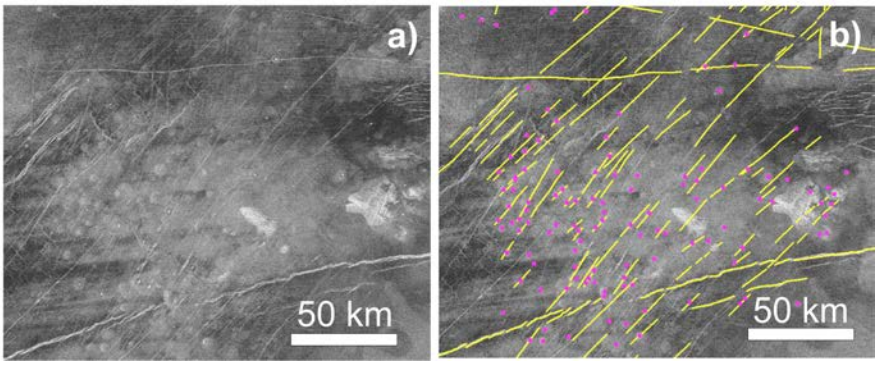

Fig. 3. Shield field and associated dykes. a) Magellan SAR image. b) Shield volcanoes (summits labelled with pink dots) and graben underlain by dykes (yellow lines). Many of the volcanoes are aligned along the NE-trending swarm. The shield field is located immediately west of Fig. 1b. Centre of image: 187.5ºE, 3ºS.