GEOLOGICAL HISTORY OF THE SOUTH-EASTERN REGION OF POLIK-MANA MONS, VENUS. V. E. Rozhin[1], R. E. Ernst[1,2], H. El Bilali[1,2], E. G. Antropova[1], C. H. G. Braga[1], [1]Faculty of Geology and Geography, Tomsk State University, Tomsk, Russia (vadimroz@mail.ru) [2]Department of Earth Sciences, Carleton University, Ottawa, Canada.

Introduction: The Polik-mana Mons volcano (24.8°N, 264°E) is located in the Asteria Rego lowlands along Latona Chasma which is part of the 7000 km long Hecate Chasmata rift zone and 1500 km west of Beta Regio (Fig. 1).

Polik-mana Mons is a large volcano with a diameter of 600 km. There are three main subdivisions of lava flows associated with this geological structure (Fig. 2). The first subdivision is located in the central summit depression of Polik-mana Mons (fPob). This subdivision overlaps the second one which consists of lava flows from the central and flanking vents of Polik-mana Mons (fPoa). The third subdivision is the lava flows from the eastern flank vents of Polik-mana Mons (fPoc).

We have selected this Asteria Regio region (Fig. 1) for the research because of the intense volcanism and the opportunity to characterize its volcanic history through detailed mapping (1:500,000 scale). Such Venus volcanism is analogous to Large Igneous Provinces (LIPs) on Earth [3, 4, 5] and provides a complementary view, given the absence of erosion on Venus at this time [6], when compared to the erosion that can deeply dissect terrestrial LIPs.

Our mapping of this region at 1:500,000 is 10x more detailed than previous mapping. The western part of our area is in Hecate Chasma V-28 quadrangle which was mapped at 1:5,000,000 [1]. The eastern part of this area is within Devana Chasma Quadrangle V-29, for which initial mapping of V-29 was reported [7].

The goals of this research of Asteria Regio are: 1) the detailed mapping of the lava flows and identification the specific sources for each of them; 2) detailed mapping of graben systems (interpreted to overlie dyke swarms) and linking them to specific magmatic centers; 3) determining the relative ages of dykes and flows and developing a geological history for the area; 4) determining the geodynamic relationship with the plume-related magmatism of Beta Regio, centered about 1,000 km to the east; and 5) considering implications for improved understanding of terrestrial LIPs

Grabens. In the study area, 10 main swarms of grabens were identified, which contain about 4000 grabens of different systems (Fig. 3). The largest swarm is the Radial swarm from Polik-mana, which forms a system of grabens trending radially in all directions. This swarm overlies the pA layer, which is the lava material of the Asterio Plain, consisting predominantly of areally extensive flow units dissected by numerous fissure complexes. But at the same time, the Radial swarm is almost completely covered by the fPoa lava flows. The second most widespread swarm is the Center U swarm, the source of which is the corona located in the western part near Kono Mons. This swarm has a parallel distribution and a main direction to the northeast. The Center U swarm dissects the pA layer, but it is dissected by the Radial Swarm from Polik-Man. The northern part of this swarm is partially overlapped by the fPoc lava flow.

A family of circumscribing grabens is also formed around Polik-mana Mons. It is divided into two parts. The first is the inner swarm of grabens, which has a complete ring structure; the second is the outer swarm of grabens, which is spread only to the north and south of Polik-mana. The outer type of grabens of this swarm cuts the fPoa lava flow and the radial family of grabens from Polik-mana. The inner type of the grabens of this swarm is partially covered by the fPob lava material. Lineaments of Hecate Chasma rift zone and its Latona Chasma cross Polik-mana Mons. Both sets of these rift lineaments have a northeastern direction and cut the Radial swarm from Polik-mana.

Lava flows. In our work we have distinguished three types of lava flows according to their brightness on the Magellan SAR images: dark, grey and light, reflecting the strength of radar reflection back to the spacecraft and corresponding to the orientation and roughness of the surface.

Within the fPob flow, light radar flows are dominant and occupy about 80% of the entire area. The main source of these flows is the central caldera of the Polik-mana Mons structure. The larger flow unit is fPoa, which is sourced from the central crater and flank vents of the Polik-mana Mons (Fig. 4).

Although the mapping of the southeastern region is still in progress, the approximate age relationship between lava flows and graben swarms can already be distinguished. The lava flows from Polik-mana Mons are largely overlain by the rift zone structures. The graben swarm around Polik-mana is covered by the fPoa lava flows; this is, especially evident in the southern outer swarm. The radial swarm of Polik-mana covers the lava flow of fPoa, this allows us to suggest that the formation of the fPoa flow was preceded by the

formation of a circular swarm of grabens around Polik-mana, and the radial swarm of grabens formed after.

References: [1] Stofan E. R. et al. (2012) *USGS Scientific Investigations*, Map 3163. [2] Basilevsky A. (2008) *USGS Scientific Investigations*, Map 3023. [3] Head J. W. and Coffin M.F. (1997) *AGU Geophys. Monograph*, 100, 411-438. [4] Ernst et al. (2007) *In: Superplumes: Beyond Plate Tectonics*. Springer. 537-562. [5] Buchan K. L. and Ernst R. E. (2021) *Gondwana Research*, in press. [6] Khawja S. et al. (2020) *Nature Communications*, 11, 5789. [7] Tandberg E. R. and Bleamaster L.F. (2010) *XLI LPS*, Abstract #1402. [8] Magee K. P. and Head J. W. (2001) *In: Mantle Plumes: Their Identification Through Time: GSA Special Paper*, 352, 81-101. [9] Christensen P. R. et al. (2009) *AGU Fall Meeting*, Abstract #IN22A-06.

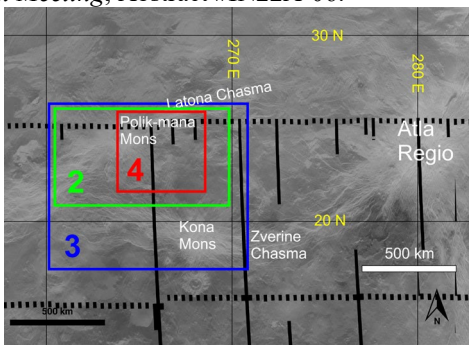

Figure 1: *Magellan SAR image of the Asteria Regio region with main features labelled. The boxes give the locations of Figure 2 (green box), Figure 3 (blue box) and Figure 4 (red box).*

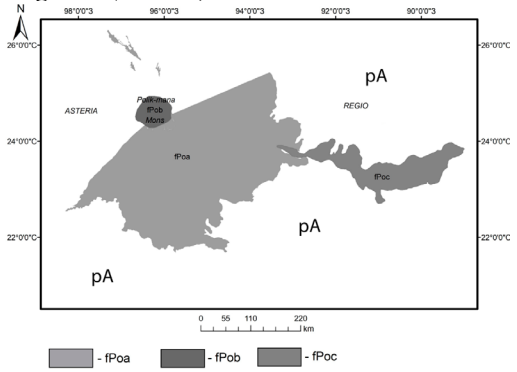

Figure 2: *Distribution of three main flow units of Polik-mana Mons (in the southern and eastern sectors).*

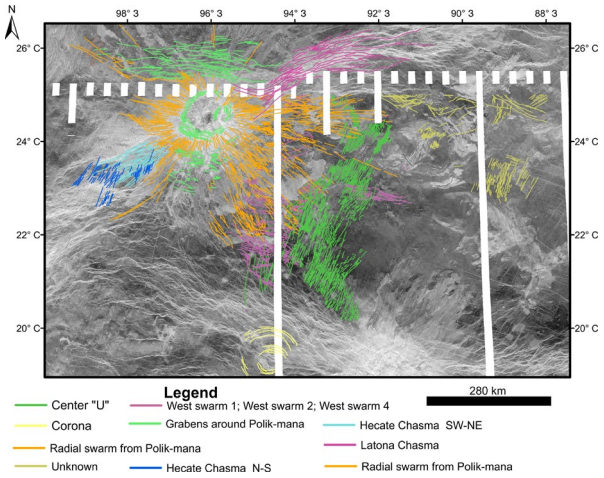

Figure 3*: Extensional lineaments (grabens) of Polik-mana region. For location of study area see box in Fig. 1. The grabens are grouped into sets (distinguished by colour as per the legend) based on trend and whether their distribution is radiating, circumferential or linear colour.*

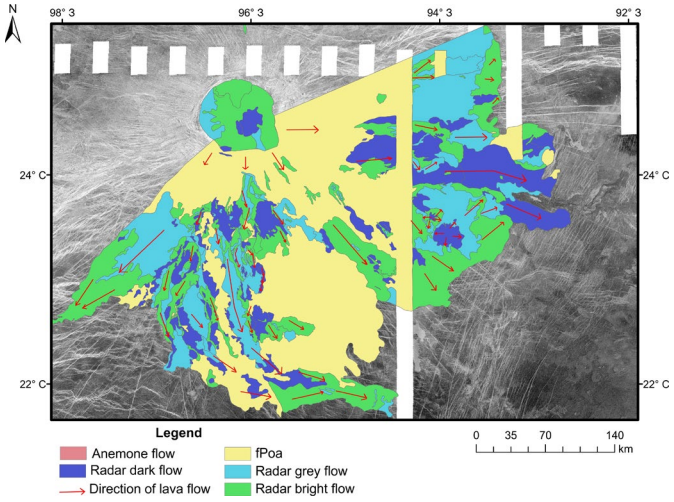

Figure 4: *Mapping of lava flows of southern and eastern sectors of Polik-mana Mons (for location see Fig. 1).*