THE GEOLOGICAL HISTORY OF ALEKSOTA MONS, VENUS. C. C. Malliband[1]*, P. Martin[1], K. J. W. McCaffrey[1], C. G. Macpherson[1] and E. R. Stofan[2]. [1] Department of Earth Sciences, Durham University, South Road, Durham, DH1 UK. [2] Department of Earth and Planetary Sciences, UCL, WC1E 6BT. *Now at: School of Physical Sciences, Open University, Walton Hall, Milton Keynes, MK6 1AA, UK. (chris.malliband@open.ac.uk)

Overview: Aleksota Mons is an area of extensive small scale volcanic activity centred at 308.5ºE, 9ºS, and of radius 250km in the Navka Planitia region of Venus. It is located approximately 520 km ESE of the centre of the Venera 13 landing ellipse. While the area may be characterised as a shield field, with many small (<5 km), broadly conical shields, it has also been identified by [1] as the location of a type 2 corona.

We propose that the majority of volcanic vents in the Aleksota Mons shield field are aligned with local faulting in Perunitsa Fossae. Therefore, it is likely that both formed within the same stress field.

Regional Geology: The area around Aleksota Mons (Fig 1) shows complex tectonism, with extensive rifting in both the adjacent Perunitsa Fossae and the more distant Khosedem Fossae. The Perunitsa and Khosedem Fossae systems appear to meet and terminate at Vostrukha Mons in the northwest. They also appear to join south of Panina Patera and then continue south as a single system until terminating to the south at Iweridd Corona. Between Vostruka Mons and Aleksota Mons, Perunitsa Fossae runs approximately NW-SE. South of Aleksota Mons, Perunitsa Fossae runs approximately N-S.

There is evidence for volcanism throughout the area studied. In Perunitsa Fossae this mainly takes the form of isolated small scale shield vents that do not appear to show any clear preferential alignment on local scales. In contrast, in Khosedem Fossae there are large flows in the style of ridge volcanism identified by [2] and numerous pit chains.

Methods: A history of the area was determined using geological mapping of tectonic and volcanic features, and examining geological relationships. We used stratigraphic relationships and a novel statistical technique to determine age relationships.

2-point Azimuth Method: Two-point azimuth methods are used to determine and quantify preferred orientations in clusters of point features. The initial method was developed by [3], and a modified method was presented by [4]. Work by [5] created a MATLAB script compiled with a GUI (Graphical User Interface) to facilitate use of both methods on point data from Venus, Earth, Mars, and a unit sphere. The software corrects for box shape by normalising the data using a specified number of Monte Carlo models. It also incorporates a Student's t distribution to find the 95th percentile critical threshold, to determine a significance.

In this work, we have used the Lutz method [3] which calculates azimuths between each point and every other point identified. This means for N points, there are N(N-1)/2 orientations. We have normalised for box shape using 200 Monte Carlo models.

Styles of volcanism: The mapping of vents in the study area used 3 classes, which could then be further examined. These were: a) central pit with flows or ejecta, b) pit only and c) flow/ejecta centre. These classes were chosen to provide the best representation of the styles of volcanism, following a preliminary study of the area.

Results: The orientations for the amalgamated dataset determined from the Lutz 2-point azimuth analysis are shown in Fig 2A. This shows a significant preferential orientation of vent alignments sub-parallel with the direction of NW-SE faulting of the northern Perunitsa Fossae (Fig 2B). The trend is stronger when the 'central pit with flows or ejecta' class is analysed separately (Fig 2C). These orientation relationships suggest that the majority of vents at Aleksota Mons and the faulting in northern Perunitsa Faulting developed under the same NW-SE trending stress field. Therefore, we infer that most of this volcanism at Aleksota Mons was broadly contemporaneous with the northern Perunitsa

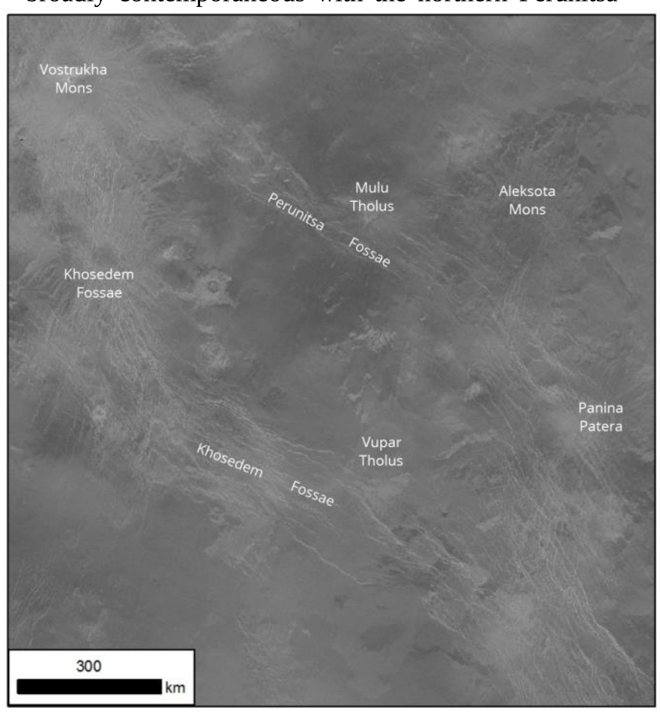

Fig 1: Map of area with named volcanic and tectonic features labelled. North directly up. Image: NASA/JPL.

Fossae faulting. This is supported by our observations of superposition relationships.

In contrast to the overall trend, vents mapped as 'pit only' show a preferential N-S alignment (Fig 2D). Thus, pits without visible flows formed under the influence of a N-S stress field. Many of these 'pit only' vents appear to overlie traceable lava flows associated with Aleksota Mons, and are therefore interpreted to be younger than those flows.

Some pits outcrop as N-S trending pit chains. Current work [6] considers pit chains are most likely surface expressions of lateral dyke propagation. If this interpretation is correct, the pits and pit chains observed in this study may show dyke propagation in a N-S stress field. Given stratigraphy, this would be during the waning stages of magmatism in Aleksota Mons. Similarly to these pit chains, faulting in northern Khosedem Fossae (near Vostrukha Mons) trends broadly N-S. Our preliminary analysis of stratigraphic relationships near Vostrukha Mons indicate that faulting associated with Khosedem Fossae formed later than faulting associated with Perunitsa Fossae in this area. We therefore infer that both the pit chains and the faulting in northern Khosedem Fossae formed under the same N-S trending stress field.

Discussion: Aleksota Mons is isolated from the abundant N-S pit chains in Khosedem Fossae. It is possible that N-S pit forming processes, potentially dyke emplacement, were occurring simultaneously in both Khosedem Fossae and Aleksota Mons. This could mean that volcanic processes were long lived and were active through changing stress fields, and/or that there were two distinct stages of magmatism at Aleksota Mons: small shield emplacement within a NW-SE trending stress field, followed by later pit formation in a N-S trending stress field.

Conclusion: Stratigraphic and orientation relationships indicate that volcanic vents at Aleksota Mons were principally emplaced concurrently with faulting in northern Perunitsa Fossae, under a NW-SE trending stress field. This demonstrates volcanism and tectonics occurred concurrently. There is evidence for a later stage of pit formation, perhaps from lateral propagation of dykes that occurred concurrently with the formation of Khosedem Fossae faulting (trending N-S).

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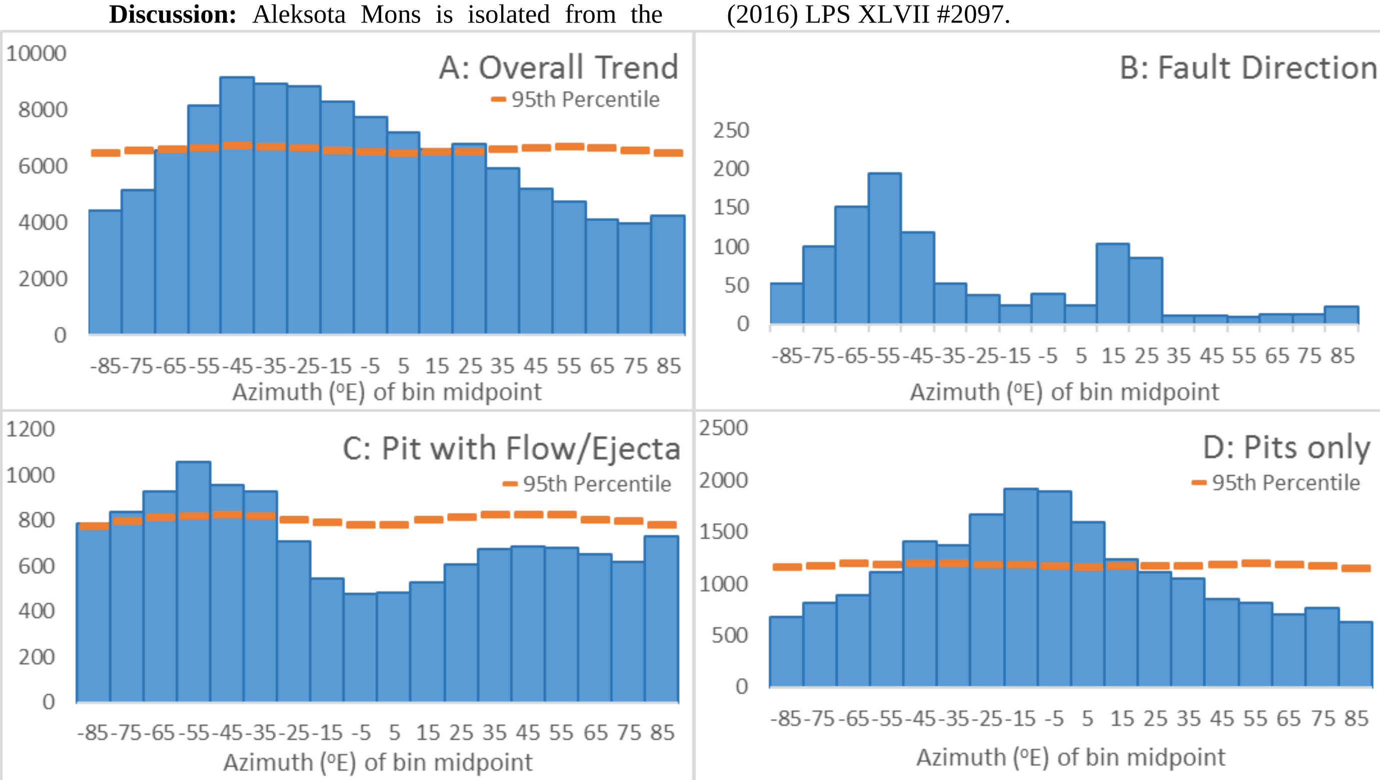

Fig 2: (A), Histograms of preferential orientation of vents in the overall dataset. (B), is a histogram of orientations of fault segments in the study area. Histograms of preferential orientation for: (C), Pits with clearly associated flows or ejecta; (D), pits without any attributable flow or ejecta. This suggests magmatic processes occurred under two different stress regimes. Orientations and stratigraphic relationships indicate that the formation of the majority of vents associated with Aleksota Mons is contemporaneous with the formation of NW-SE trending Perunitsa Fossae faulting, followed by later-stage pit forming process occurring under a N-S trending stress field.