SPACING DISTRIBUTIONS AND INTERSECTION ANGLES FOR KILOMETER SCALE LINEATIONS ON THE PLAINS OF VENUS; D. D. Bowman and C. G. Sammis, University of Southern California, W. Bruce Banerdt, Jet Propulsion Laboratory

Images from the Magellan space probe have revealed broad regions of intricate small scale, regularly spaced, radar-bright lineations on the volcanic plains of Venus. These lineations, which we interpret as tensile cooling fractures, have spacings ranging from 0.5 to 2.0 km. Extensive measurements of lineation spacing have been taken, primarily in the plains to the north of Ovda Regio. According to a shear lag model of fracture formation, the standard deviation of the spacing of the lineations should be 1/3 the mean spacing. To date, our analysis of the plains of Venus has revealed that the standard deviation is actually closer to 1/4 the mean. There are two possible explanations for this discrepancy. The shear lag model assumes homogeneous, isotropic cooling, which results in random nucleation. However, if a cooling front advances across the flow, the nucleation spacing may be more regular, resulting in a smaller standard deviation. A second possibility arises because the predicted relation between mean and standard deviation is derived from a one dimensional model of crack nucleation. Nucleation in two dimensions may allow fractures to grow into an otherwise "dead" zone of fracture formation in the 1-D model. In addition to measuring the mean spacing of fractures, we also measure the angle of intersection between two or more superimposed sets of lineations. The intersection angles typically fall between 30° and 45°.

Figure 1 shows a volcanic plains unit with fractures trending to the north and northeast. To facilitate the processing of fracture spacing data, the pixel intensity of the fractures is set to zero using the program "NIH Image". An intensity profile is then taken across the fracture pattern and processed to determine the mean and standard deviation of the lineation spacing. Several highlighted fractures and an example of a profile line can be seen on the right side of the image.

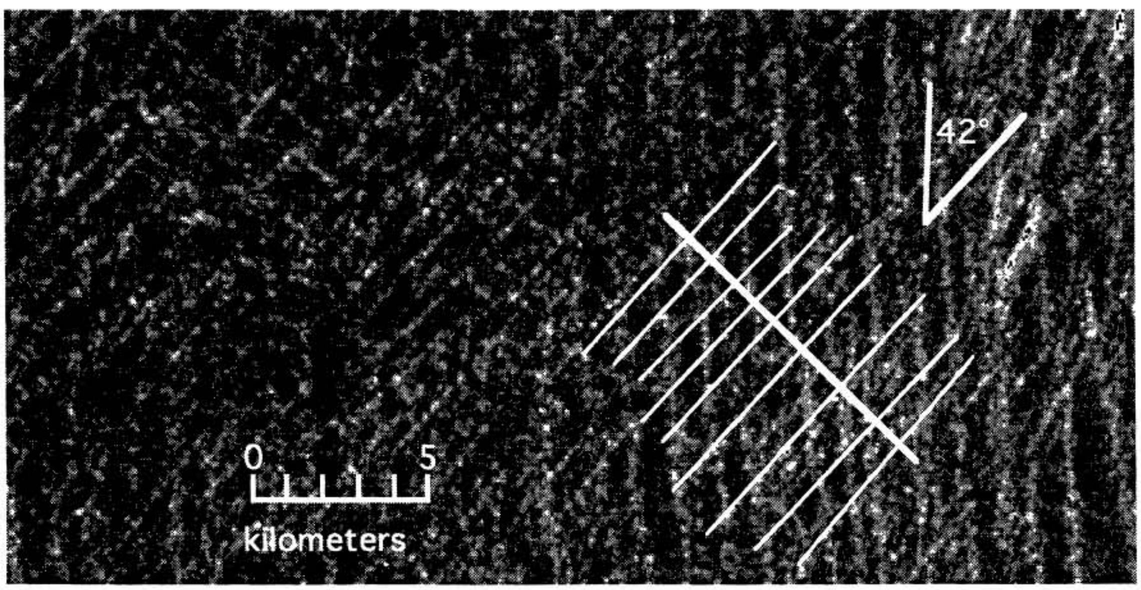

Figure 1. Two intersecting fracture patterns trending north and northeast. A portion of the northeast trending set has been highlighted, with an intensity proflie line drawn perpendicular to the fractures. Image taken from F-MIDR 05N076;1.

The standard deviation is plotted as a function of the mean spacing in figure 2. The one dimensional shear lag model predicts a slope of 1/3 [1]. However, the best fit line has a slope of only 1/4. This suggests that the fractures are more evenly spaced than would be expected if they were nucleated randomly.

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Figure 3 is a histogram of the observed angle between superimposed sets of lineations. The mean angle is 39°, suggesting that one of the sets may have been formed in shear.

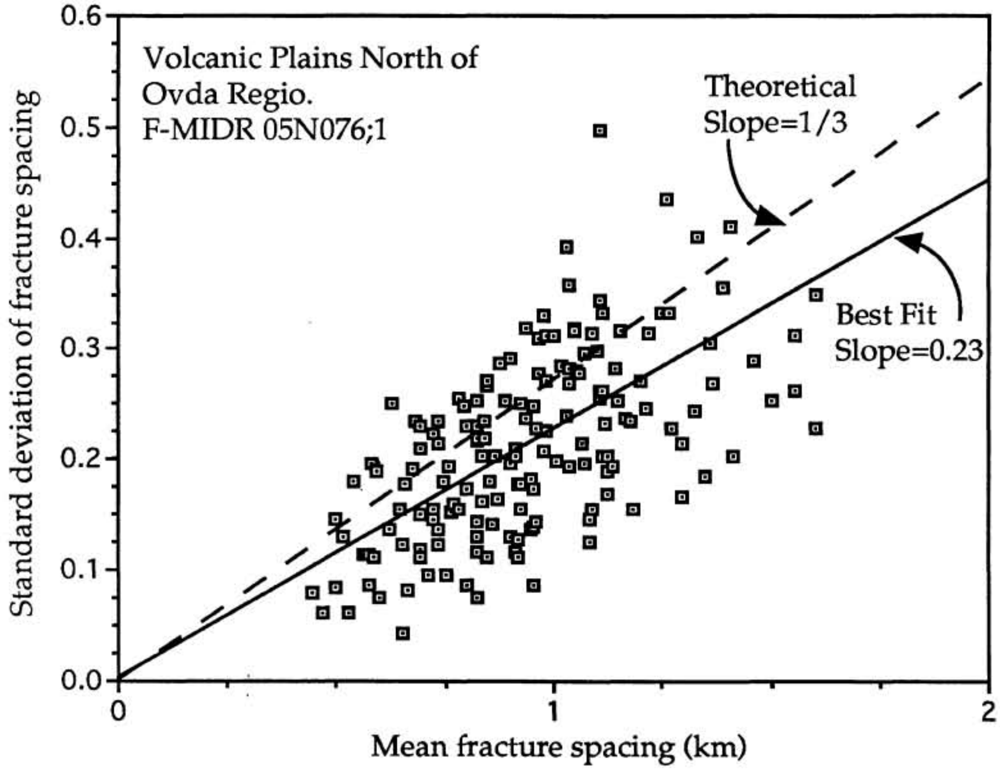

Figure 2. Standard deviation of fracture spacing as a function of mean fracture spacing. The dashed line is the theoretical slope [1], the solid line is a best fit slope

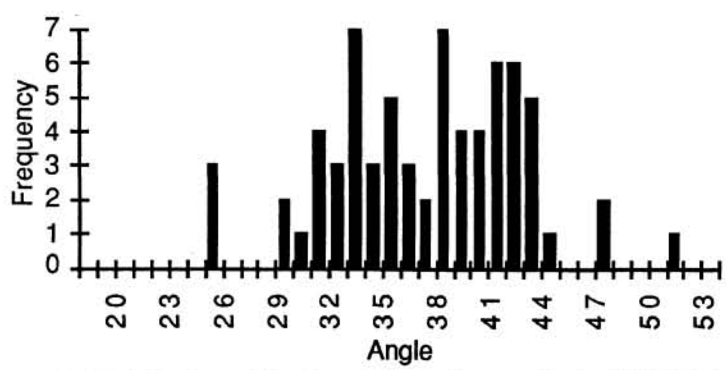

Figure 3. Distribution of fracture intersection angles in F-MIDR 05N076;1

References

[1] Banerdt W. B. and Sammis C. G. (1992) *JGR, 97,* 16149