Distribution of Small Volcanic Cones on the Surface of Venus by Size and Elevation: Implications for Differential Deposition of Volcanic Features; Sahuaro High School Astronomical Research Class[1], Tucson, AZ, J. F. Lockwood, teacher, Evergreen High School Research Class[2], Vancouver, WA, Mike Ellison, teacher, Advisors: J. Johnson, G. Kamatsu , (Lunar and Planetary Laboratory, University of Arizona, Tucson AZ 85721)

Introduction: It appears that volcanic features are not evenly distributed on the surface of Venus (3). Head et. al.(4,5) theorizes that the sparcity of volcanic features in the lowlands may be due to an altitude dependant inhibition of volatile exsolution and the resulting production of neutural buoyancy zones sufficient to form magma reservoirs and favoring flood lavas at lower elevation. The astronomy research classes of Evergreen and Sahuaro High Schools surveyed a cross- section of different elevation topography to investigate size and distribution of small volcanic cones by elevation.

Observations: Student researchers at Sahuaro High School in Tucson, Arizona and Evergreen High School in Vancouver, Washington, measured and located small volcanic cones (1 to 20 km) in sixteen FMIDRS taken from five Venus Magellian Mosiacked Image Data set. These FMIDRS are located in a strip from 60 degrees north to 10 degrees south latitude and 272 degrees to 295 degrees longitude.

The volcanic cones were located and measured by using the x and y coordinates found in the NIH Image 1.44 Program. The computer cursor was centered on the caldera of the cone and the x and y coordinates were recorded. The following formulas were utilized to convert the pixel values into degree values:

latitude= min. latitude+((max. latitude-min. latitude)/1024)* y coordinate

longitude= min. longitude+((max. longitude-min. longitude)/1024)* x coordinate

The minimum and maximum latitudes and longitudes are those of each of the fifty-six frames contained within an FMIDR. They were supplied by the labels for each frame.

The diameters were also measured in pixels along their x and y axes, averaged, and converted into kilometers by multiplying the pixel value by the resolution of the image (.075 kilometers per pixel).

In order to find the elevation of the cones, the latitude and longitude of each cone were converted back into x and y pixel values that corresponded to the GXDR Elevation and Altimetry Disk. To obtain the x coordinate, the minimum longitude for the elevation images were subtracted from the longitude of each cone, then multiplied by the longitude resolution of the elevation image. The longitude resolution of the image is acquired by dividing 1024 by the difference of the maximum and minimum longitudes. To obtain the y coordinate, the minimum latitude for the elevation image was subtracted from the latitude of each cone, then multipled by the latitude resolution, 1024 divided by the diference between the maximum and minimum latitudes of the elevation image.

Then the elevations were found, again using the NIH Image 1.44 Program, and were added to the minimum planetary radius, 6,040,000 m, and converted into kilometers.

The graphs of Cone Elevation vs. Cone Diameter, Cone Diameter Distribution, and Cone Elevation Distribution were then plotted.

Results: Figure One plots the diameter of the 6200 cones found in the sixteen FMIDRS against their elevation. Even though the data is too scattered to realistically fit a line to it, when a linear curve fit is applied to the data, a slightly increasing slope--about four percent--is evident, suggesting that as the elevation increases, the diameter of the cones increases slightly as well. The curved fit line centers close to the four kilometer diameter level.. The distribution of volcanic cone diameters is shown in Fig. 2. Forty-two percent of the 6200 cone sample fell in the two to four kilometer diameter bins. The graph peaks at the two kilometer bin with 690 cones and has a gaussian-like distribution down to the ten kilometer bin.

The sixteen FMIDR sample represents about one percent of the Venusian surface area between 65 N and 65 S latitudes. Given one data set is a rough approximation of the various topographic levels on Venus, we project that the number of small volcanic cones may range from 600,000 to one million in number if the polar regions are included.

Figure 3 shows the distribution by elevation produced by this sampling area. For lower elevations, the number of cones increases through the first four bins. But for middle to high elevation bins, the graph appears to contradict the result predicted by Head et.al. (4,5), in that small volcanic cones seem to occur more in plateau areas, as opposed to highland regions. We feel that the negative slope produced by this graph is due primarily to a significant lack of processed data above an elevation of 6052 km. . Although the

gaussian nature of the curve produced does provoke some interest, we cannot make any firm interpretations from this graph because of the paucity of data collected in highland regions where the theory put forth by Head et. al. 1992 predicts most of these small cones will be found. Future efforts will center on including many more FMIDRS, particularly those in regions above 6052 km in elevation. Many high school classes from different parts of the United States will process and collate this data

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[3] Saunders, S., et. al., 1992, *JGR*, vol. 97, no. E8, pp. 13067-13090.

[4] Head, J., et. al., 1992, *JGR*, vol. 97, no. E8, pp. 13153-13197.

[5] Head, J., Wilson, L., 1992, *JGR*, vol. 97, no E8, pp. 3877-3903.

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Fig. 1- Cone Elevation vs. Cone Diameter

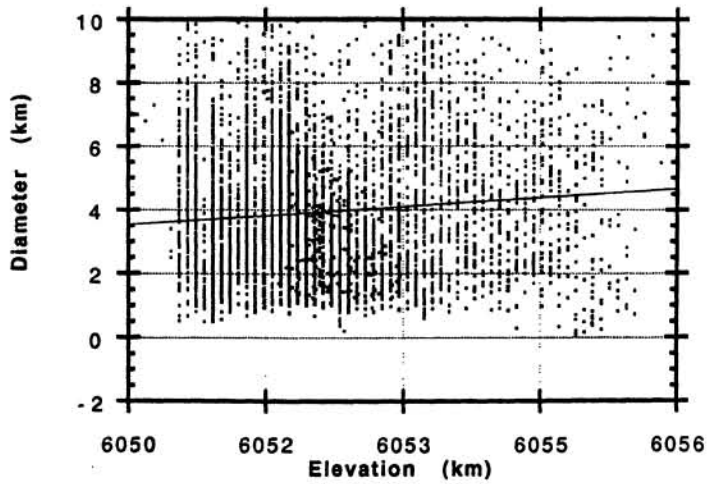

Fig. 2- Cone Distribution By Diameter

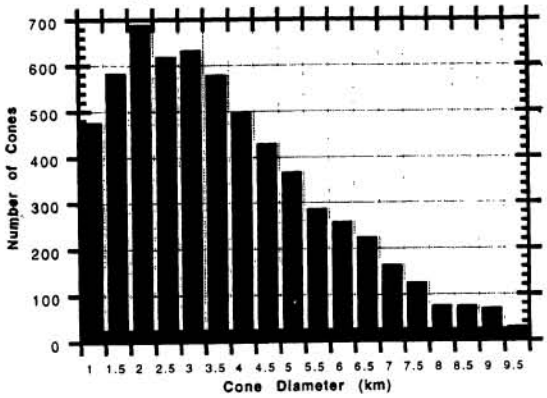

Fig. 3- Cone Distribution by Elevation