Small Volcanic Edifices on Venus: Morphology, Diameter, and Elevation Distribution 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. Komatsu, (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 dependent inhibition of volatile exsolution, and the resulting production of neutral buoyancy zones sufficient to form magma reservoirs and favoring flood lava's at lower elevations. The astronomy research classes of Evergreen and Sahuaro High Schools surveyed a slice of Venus Magellan data to investigate the frequency of edifice type, the frequency distribution of edifice diameters, and the frequency distribution of edifices by elevation.

Observations: Student researchers from the two high schools located and measured small volcanic edifices (1 to 20 km) in 15 FMIDRS taken from five Venus Magellan Mosiacked Image Data sets. These FMIDRS are located in a strip from 70^0 N to 60^0 S latitude and centered at 0^0 longitude.

Students used the four classifications (shield-shaped, dome-shaped, flat-top, and cone-shaped) described in Aubele, 1993.[6]

Using a 1.49 PDS program, the volcanic edifices were located by centering the cursor on calderas and recording the latitude and longitude. The diameters were measured in kilometers by averaging the distance across the x and y axes.

The elevation was recorded by using the GXDR Elevation and Altimetry Disk. To find the elevation, the latitude and longitude of the edifices were located on the topographic image and the elevation was recorded directly form the results box in Image 1.49.2.

Results: The total number of volcanic edifices per class and the percentage in each class was plotted in Figure 1. Shield-shaped volcanoes appear to be the most dominant with over 50% of the total number of edifices measured. Cone-shaped and dome-shaped edifices were both 20% and flat-tops were only 2%. This compares to a similar study by Head and Aubele who reported 85% of the small volcanic edifices measured to be shield-shaped.[7] They did not report, however, on the percentages of the other classes.

The distribution of volcanic cone diameters is shown in Fig. 2. Of the 2221 cones sampled, 41% fell in the 2-3.5 km size range. The graph peaks at the 2.5 km bin with 320 cones. A 200 cone sample of terrestrial submarine cones by R.C Searle (Fig. 3) shows a distinct peak (30% of sample) between edifices with diameters of two to three kilometers.[8] Both graphs show similar and gaussian-like distribution to about ten kilometers (Fig. 2 and 3).

The 15 FMIDR sample represents about 1% of the Venusian surface area. Given that 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 400,000 to 600,000 if the polar regions are included.

Our sampling area's distribution by elevation (Fig. 4) shows very few cones in the lowland areas, a result similar to Head et. al.,1992[4], and it implies that cones are most densely populated in the plateau regions. The graph shows an even distribution from the Mean Planetary Radius (6051.4 km) to 6052.2 km However, there is no single peak in contrast to a previous distribution by elevation produced by last year's Sahuaro Astronomical Research class, which peaked at 6051.8 km. Our findings also showed a larger percentage of cones at higher elevation than last year's study. Figure 4 makes a dramatic downward turn at elevation 6052.4 km. We found very few cones located above elevation 6053.8 km. These findings could be a result of the number and type of F-MIDR's we chose for our sample.

The configuration of Figure 4 is strikingly similar to the results of Keddie et. al., 1993.[9] Their results show that the majority of large cones in his sample fall between 6051.5 km and 6052.5 km. There was also a paucity of edifices in both the lowlands and highlands, and an abundance of edifices in the mid-altitude regions. These results, which agree with our own, may be due to the fact that 70% of the Venusian surface is classified as rolling uplands or plateau.

Conclusion - Volcanic edifices are not uniformly distributed on the surface of Venus. This study shows that the distribution by elevation follows the neutral buoyancy theory of Head, et. al., 1992.[4] The percentage of edifice in each of the four classes may vary across different topographic regions while the distribution of small edifice diameters appears to be very uniform, peaking between 2 and 3 km. This distribution is very similar to the size of small cones on Earth. A more comprehensive sample is necessary to fix the percentages of small volcanic edifices on the surface of Venus as well as total number of these constructs.

SMALL VOLCANIC EDIFICES: Sahuaro High School Research Class

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a = principal investigator

Fig. 1- Total Edifices by Class

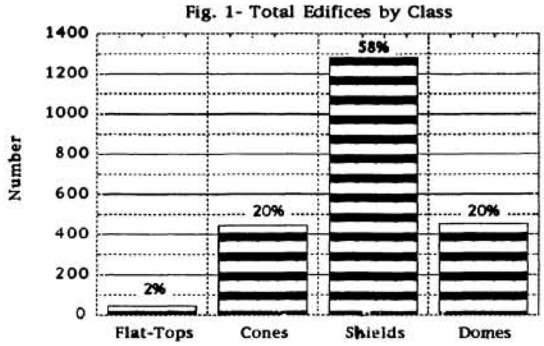
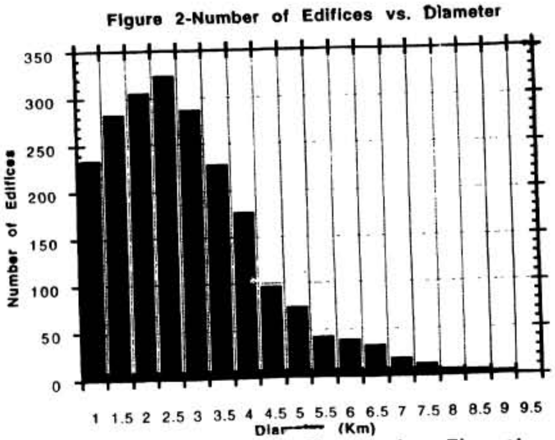


Figure 2-Number of Edifices vs. Diameter



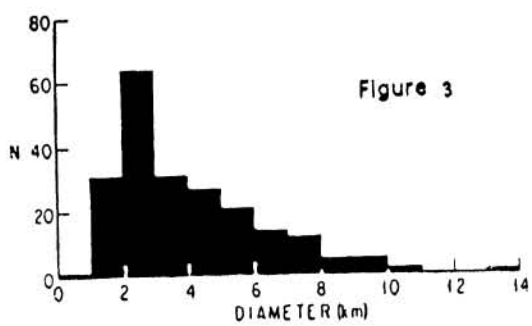


Figure 4 - Elevation vs. Number of Edifices