Morphology, Diameter, and Elevation Distribution of Small Volcanic Edifices on Venus between Phoebe and Ulfrun Regio

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Introduction: Recent research shows that volcanic features are not evenly distributed on the surface of Venus.² Head et al. ³,⁴ theorize that scarcity 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 lavas at lower elevations. The astronomy research class of Sahuarro High School surveyed a rectangular area consisting of seven FMIDRS, located between Phoebe Regio and Ulfrun Regio, centered at 240° longitude and 0° to 30° South latitude. This data was used to investigate the frequency of volcanic edifice type, the frequency distribution of edifice diameters, and the frequency distribution of edifices by elevation.

Observations: Student researchers located and measured small volcanic edifices (1 to 20 km) in 7 FMIDRS taken from Venus Magellan Mosiacked Image Data sets. Students used the four classifications (shield-shaped, dome-shaped, flat-top, and cone-shaped) described in Aubele, 1993.⁵ Using the NIH 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 CD-ROM. To find the elevation, the latitude and longitude of the edifices were located on the topographic image and the elevation was recorded directly from the results box in Image 1.49.2.

Results: The percentage of volcanic edifice types is illustrated in Fig. 1. Shield-shaped edifices were the most dominant type, accounting for 52% of total edifices; while cones accounted for 30%, domes for 15%, and flat-tops 4%. Our percentage of volcanic edifices characterized as shields is similar to data produced by last years Sahuarro Astronomical Research Class who found that 58% of all edifices in their longitudinal section were shields. From the results of both research studies, a sample of over 3,000 cones, the percentage of shields was 55%. This conclusion is significantly different from a study conducted by Head and Aubele who reported 85% of small volcanic edifices to be shield-shaped.⁵

Corresponding to research done by Head et al., we found the majority of volcanic edifices are found in the plateau region. With the peak at 6051.3 km, our results indicated an even distribution between 6051.2 and 6052.0 km, just above the MPR (6051 km), and a paucity of cones at lower elevations. Contrary to the research results of the prior year, which found approximately 130 edifices above 6053.4 km, we did not encounter any above this elevation since the topographical area selected for study did not contain any highland areas.

The distribution of small volcanic edifice diameters is shown in Fig. 2. Fifty-seven percent of the 767 cones surveyed were in the 2-4 km range. The great majority of volcanic edifices fall between two and four km in diameter (57%). These data correspond with the results from the 1994 class who determined that 58% of volcanic edifices in their sample were in the 2-4 km range.⁶

Fig. 3 shows the combined results from elevation data collected by three Sahuarro High School Research classes, beginning in 1993. The combined results, comprised of a large sample of approximately 9290 edifices, peaks at 6052 km and descends hyperbolically. Sixty-five percent of the total combined edifices is concentrated in elevations between 6051 km to 6052.6 km, the plateau region of Venus. This represents a sample of 2.5% of the planet's surface.

Conclusion: Volcanic edifices are not uniformly distributed on the surface of Venus. The distribution of volcanic edifices by elevation according to the neutral buoyancy theory put forth by Head et al., 1992⁴ is supported by the data we have gathered. Furthermore, the research...
done in the past two years by our group on the classification of edifices yields percentages of shields and domes which differ with the study done by Head and Aubele.  


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