SPATIAL DISTRIBUTION OF CIRCULAR FEATURES ON VENUS. *J. Plaut and R. Arvidson, McDonnell Center for the Space Sciences, Dept. of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130.*

With the return of radar images from the Venera 15 and 16 spacecraft, the nature, origin, and distribution of circular features on Venus have been clarified to some degree. One hundred and thirty-nine circular features have been identified as impact craters (1). Other circular features have been ascribed to volcanic origins, while approximately 500 features were put into an enigmatic category (2). In this study we report on a statistical treatment of the areal density of circular features, particularly those ascribed to volcanic origins, since the locations of these features provide first-order constraints on the volcano-tectonic history of Venus.

We apply criteria developed (3) for determining statistically significant clusters of data points on an equal-area net to delineate the areal distribution of circular features mapped by (2). The criterion is based on the binomial theorem and leads to a minimum size counting circle to properly sample a random distribution. Clusters are defined based on significant deviations from the expected values for random data. The area mapped by (2), a major portion of the northern hemisphere north of 30° latitude, is approximately 7 x 10^7 km^2, or about 15% of Venus' surface. With 377 circular volcanic features, the criteria imply that the smallest counting circle to use is 1.6x10^6 km^2, which is approximately the size of Lakshmi Planum. Using the criterion that clusters occur when the number of features within the counting circle exceeds the expected value by three standard deviations, significant clustering does occur in a plains region between roughly 30° and 50° N and 5° and 40° E. The region is bounded by the foothills of south-central Ishtar Terra on the north, by Bell Regio on the east, by Eisila Regio on the south, and by the lowlands of Sedna Planitia on the east.

Ring-like features and associated concentric and radial bands are seen in Venera images for the area with a significant clustering of circular volcanic features. They are described by (2) as "arachnoids" or "spiders and cobwebs." Pioneer Venus radar altimetry gives an elevation range for the area of -0.9 km to 1.7 km, assuming a mean planetary radius of 6051.5 km (4). PV radar reflectivity for the area has a typical plains low value of 0.12 (5), indicative of a combination of rock and soil components. The area appears quite smooth in PV meter-scale radar roughness, with a mean value of rms slope of 1.9°. Over 78% of the region, when sampled with the PV cell width of approximately 30 km, is smoother than the planetary mean value of 2.65° (6). The combination of low reflectivity and low radar roughness indicate that while the complex landforms seen in the Venera images retain a distinctive topographic signature, their radar characteristics at PV cell widths are similar to the more subdued, relatively featureless plains. Thus, the arachnoid terrain, if volcanic, is either old enough to have any distinctive roughness and reflectivity signatures removed, or the signatures produced during creation of this terrain were not different than signatures for surrounding areas. Magellan data, with an order of magnitude better spatial resolution, should help in choosing between these two alternatives.

Given the locations of the 139 impact craters defined by (2), a crater density contour diagram could be generated under the described criteria. However, the counting circle needed to obtain a good statistical sample encompasses an area of about 5 x 10^6 km^2, which exceeds the scale of the geologic provinces mapped by (2). Caution must therefore be exercised when attempting relative age dating of units based on crater density, due to limited number of craters.

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