GLOBAL CHARACTERISTICS OF "ARACHNOIDS" ON VENUS; V. E. Hamilton, *Department of Geology, Arizona State University, Tempe, AZ 85287-1404* and E. R. Stofan, *Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109.*

Abstract. The term "arachnoid" has been used colloquially (*e.g.* [1,2]) to describe circular to elliptical structures having a set of radiating lineaments distinctly resembling the legs of a spider. However, little is known about the origin of these features and whether or not they are genetically related to each other or to other circular structures on Venus (*e.g.*, coronae, volcanoes, and calderas). We have conducted a global survey of these features in order to more clearly define their characteristics and determine if they are in fact a separate type of feature. In contrast to previous counts [2], we find a rather small global population of only 36 features that we feel we can confidently call "arachnoids". A detailed examination of these features reveals that they do not display a common set of volcanic or tectonic characteristics indicative of a single process of formation. We also find that these features do not appear to universally represent a particular stage of corona, volcano, or caldera development.

Characteristics. Most arachnoids are circular or elliptical in shape; only three of the features we examined have irregular planforms. The features examined range from 40 to 240 km in diameter, with an average of about 125 km. Morphologically, arachnoids are similar to coronae in that they typically have concentric and radial fractures, but differ in that the radial fractures of arachnoids extend a significant distance (up to several radii) beyond the circumferential fractures, while at the majority of coronae, radial fractures are generally found in the interior or extending only a limited distance from the annulus. Arachnoids also differ from coronae as they do not usually have a topographic moat or annulus associated with the concentric fractures.

Arachnoids are non-randomly distributed around the planet (Figure 1). Binned by equal area latitude, arachnoids occur almost exclusively in northern latitudes, and that 18 features (50%) lie between 37°N and 53°N, only 10% of the planet's surface (Figure 2). Only four features occur in southern latitudes. Twenty-two of the 36 features are found in four geographic groups; the largest group, containing 12 features, is the Bereghinya Planitia group, first observed by the Soviet Venera 15/16 spacecraft [1].

The topography associated with arachnoids is variable, but the majority of features (24 of 36) are depressions. The remaining features are rises (4 of 36) or have irregular topography (7 of 36), and only one lacks any significant topography at Magellan resolution. Topography generally correlates well with the position of observed concentric fractures, suggesting that little deformation subsequent to formation has occurred in most cases.

Twenty-five features (70%) are characterized by volcanism that apparently preceded formation of concentric and radial fractures. Volcanism is most commonly manifested as small interior cones and shields or as digitate flows. Because our reconnaissance has been primarily at the C1-MIDR scale, smaller features and flows that may postdate fracture formation may have been overlooked. However, extrusive volcanism appears to be a minor characteristic of arachnoids, suggesting that they are not large volcanoes.

The circumferential and radial fractures at an individual arachnoid may be compressional, extensional, or a combination of both, and no consistent pattern can be established linking the dominant circumferential fracture type and the dominant radial fracture type. For example, approximately half of the features examined have only extensional concentric fractures and roughly half of the features have only radial compressional fractures, but these two types of fractures do not occur together in half the arachnoids; in fact, just six features have extensional concentric fractures (only) with compressional radial fractures (only).

Formation. We have attempted to find correlations among arachnoid characteristics in order to identify common processes of origin among these features. However, there do not appear to be any general links between the dominant characteristics, which include: diameter, degree of circularity, topography, associated volcanism, radial and concentric fracture types, and location. The volcanism, topography, and fracture patterns of arachnoids are suggestive of caldera collapse or diapric upwelling and relaxation. However, the formation of the extensive radial lineaments, as these types of features are not predicted by models of upwelling or downwelling. Additionally, these radial lineaments commonly have a single dominant orientation, and although no model for arachnoid formation has been proposed, several authors have attributed the arachnoids' radial lineaments to dike emplacement in a regional stress field [3,4]. However, we have found that many of the radial lineaments are compressional in origin, implying that while some radial fractures may represent dikes, others are formed by a different process. *Cyr and Melosh* [5] have shown that in the presence of a pre-existing compressional stress field, compressional faults can be expected to form perpendicular to the maximum principle (compressional) stress in the region beyond an imposed load or upwarp. Thus, dike emplacement is not the only way to produce the radial lineaments. The origin of arachnoid radial lineaments is complicated further when looking at arachnoids in groups, such as the Bereghinya Planitia group. The radial lineaments connecting these features are typically compressional and form the outline of a hexagon in plan view. We assume that the features were formed at approximately the same time since there are no clear superposition relationships; therefore, a unidirectional regional stress during formation is unlikely. As a result, we still cannot say for certain what process is responsible for the majority of these features.

Conclusions. There are few ubiquitous traits among arachnoids in terms of their volcanism, fracture types, or topography. While these features occur dominantly in northern latitudes, there is no evidence to suggest why this is the case. We find that the wide variety of structural characteristics observed suggests that not all arachnoids have a common mode of origin. It is possible that arachnoids are calderas and/or coronae in various stages of development, and we are currently examining the features' regional topographic and tectonic settings for other potential correlations and evidence supporting this idea. While the term "arachnoid" may be useful for referring to features broadly similar in appearance, we feel that based on our observations, it must not be used to imply a specific genetic relationship, and is probably best discarded in favor of more feature-specific descriptive terms.

References. [1] Barsukov, V.L. *et al.*, JGR, **91**, 378-398, 1986. [2] Head, J. W. *et al.*, JGR, **97**, 13,153-13,197, 1992. [3] McKenzie, D. *et al.*, JGR, **97**, 15,977-15,990, 1992. [4] Grofils, E. and J. W. Head, Earth, Moon, and Planets, **66**, 153-171,1994. [5] Cyr, K. E. and H. J. Melosh, Icarus, **102**, 175-184, 1993.

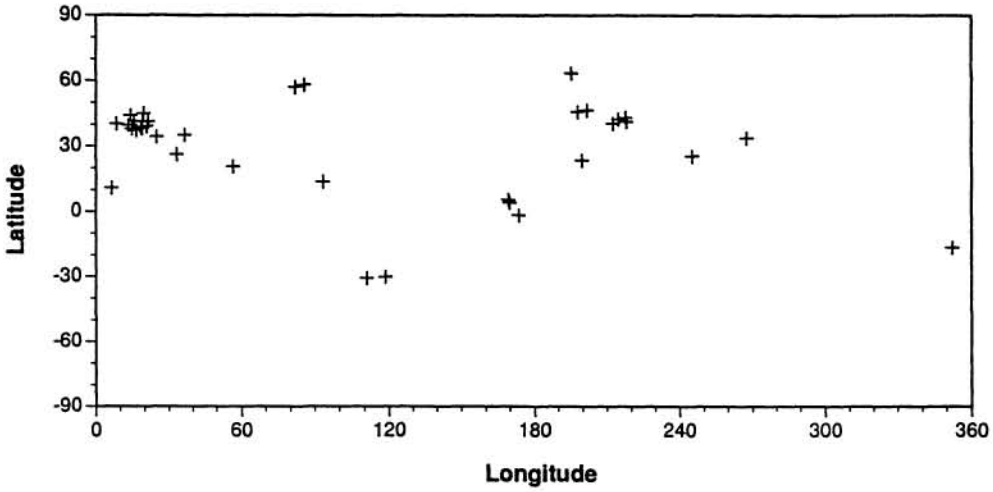

Figure 1. The global distribution of arachnoids.

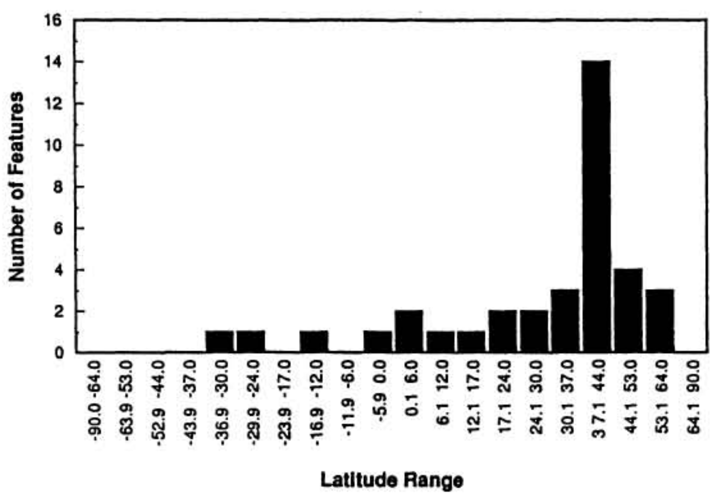

Figure 2. The distribution of arachnoids by equal area latitude.