CHARACTERISTICS OF ARACHNOIDS FROM MAGELLAN DATA C.B. Dawson and L.S. Crumpler, Department of Geological Sciences, Brown University, Providence, RI 02912

Introduction Current high resolution Magellan data enables more detailed geological study of arachnoids, first identified by Barsukov et al. (1) as features characterized by a combination of radar-bright, concentric rings and radiating lineations, named "arachnoids" on the basis of their spider and web-like appearance. Identification of arachnoids in Magellan data has been based on SAR images, in keeping with the original definition. However, there is some overlap by other workers in identification of arachnoids, corona (predominantly bright rings), and novae (predominantly radiating lineations), as all of these features share some common characteristics. Features used in this survey were chosen based on their classification as arachnoids in Head et al.'s (2) catalog and on SAR characteristics matching Barsukov et al.'s original definition. 259 arachnoids have been currently identified on Venus (3), all of which were considered in this study. Fifteen arachnoids from different regions, chosen for their "type" characteristics and lack of deformation by other regional processes, were studied in depth, using SAR and altimetric data to map and profile these arachnoids in an attempt to better determine their geologic and altimetric characteristics and possible formation sequences.

SAR Characteristics Figure 1a shows a "type" region of arachnoids originally identified in Venera 15/16 data. Based on this study, the outer ring diameter of arachnoids ranges from 50-175km, most commonly falling between 100-125km. (Fig. 2a) Arachnoids are commonly multi-ringed structures with two to four rings, frequently occurring as arcs rather than complete rings. The radiating lineations have an average width of 1km and may extend for more than 200km, often curving to merge with lineations of regional deformation belts. (Fig. 1a,b) As most lineations are below current resolution capabilities, it is difficult to determine if the relief of these lineations is negative or positive; where visible, however, radar shadows would suggest a combination of both ridges and, more commonly, graben.

Altimetric Characteristics Magellan altimetry data shows that arachnoids are typically depressions (maximum 1 km deep) with a very shallow slope (Fig. 2b). The center of the bright rings does not always coincide with the center of the depression. Bright rings or arcs do not always have corresponding altimetric changes visible in profiles. The outermost ring may represent the beginning of a depression, an annulus, or may have no apparent topographic correlation at current resolution capabilities. In one example the actual depression begins 75km west of the outermost bright ring (C1MIDRP.30S207, (-25,211)), while the bright rings do not correspond to any specific feature visible in the profile. Altimetric profiles show small scarps in some of the depressions, suggesting that small-scale faulting has occurred; these scarps often correspond to bright arcs on the SAR images. A few arachnoids have profiles similar to that previously identified as typical of coronae (4), although these arachnoids account for only a very small number of the overall arachnoid population.

Geologic Characteristics Arachnoids are typically found in clusters along deformation belts [(45,220), (-15,220), (45, 15)]. (Fig. 1) They are found in all latitudes, with no apparent relation between latitude and frequency. Small volcanic shields within arachnoids suggest related small-scale volcanism. Shields are typically <10km in diameter and occur both outside and, more frequently, inside the bright ring formation. Small volcanic flows are visible in some arachnoids, but appear to be related to the small shield fields. There is no apparent pattern to shield distribution within arachnoids, suggesting that they are not specifically correlated with any interior structure of the arachnoid. There is evidence of volcanism both predating and postdating subsidence: some flows show no correlation with current topography and are cut by rings and radiating lineations. In one case, the flow must have occurred before subsidence as it is unlikely that the flow would have moved upward out of the depression (FMIDRP.20S221); this would imply the occurrence of volcanic activity prior to final regional subsidence. Darkening and lack of lineations toward the center of some arachnoids suggests the occurrence of volcanism that postdates subsidence as well. Radiating lineations and bright rings seem to form concurrently, as lineations both cut and are cut by rings. Since some of the bright rings represent scarps and are thus related to subsidence, this would suggest that subsidence and formation of the radiating lineations occur simultaneously, with small-scale volcanism occurring throughout formation of the arachnoid.

Interpretations / Conclusions The high resolution Magellan data has allowed a much more detailed study of arachnoids than previous Venera data. Arachnoids show a complex history of formation of radar-bright concentric rings and radiating lineations during subsidence. The absence of arachnoids much greater than 200km in diameter or deeper than 1km suggests size restrictions in the formation of arachnoids. The shallow depression and lack of large-scale faulting seem to imply gradual rather than sudden subsidence, which may be a result of the gradual evacuation of an underlying magma chamber. The pattern of radiating lineations associated with arachnoids closely resembles that of terrestrial dike swarms. Calculations by McKenzie et al. (5) support that such lineations could be surface manifestations of Venusian dike swarms. Evacuation of the magma chamber through dikes would explain the lack of large-scale surface flows or volcanic edifices, and would be conducive to a gradual evacuation of the magma chamber.

References

(1) V.L. Barsukov et al. (1986) *JGR, 91*, 378. (2) J.W. Head et al. (1993) in print. (3) J.W.Head et al.(1992) *JGR, 97*, 13153. (4) E. Stofan and J.W. Head (1990) *Icarus, 83*, 216. (5) D. McKenzie et al. (1992) *JGR, 97*, 15977.

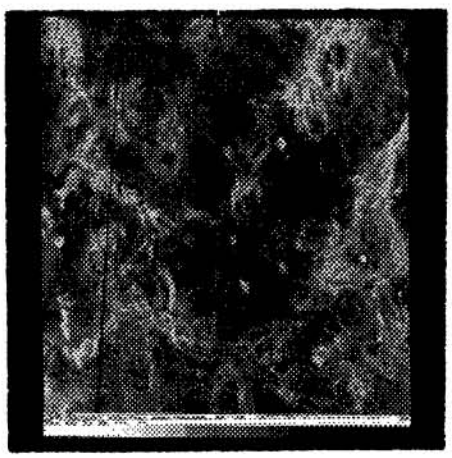

Figure 1a. Arachnoid "type" region identified by Venera 15/16. (C1MIDRP.45N011)

Figure 1b. Sketch map of radar-bright ring and lineation patterns in Fig. 1a.

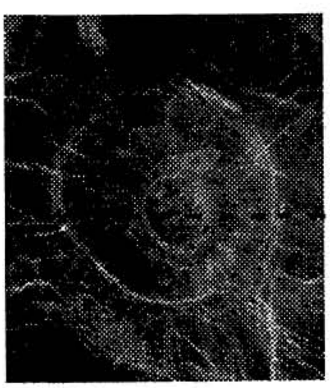

Figure 2a. Example of a "type" arachnoid, centered on (44, 14). (C1MIDRP.45N011)

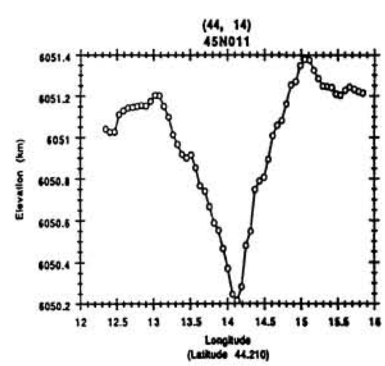

Figure 2b. Profile of arachnoid in Fig. 2a, along latitude 44.2 (shown by dotted line in Fig. 2a).