GIANT SPIDERS OF VENUS – REDEFINITION, REVISED POPULATION, AND IMPLICATIONS OF FORMATIONAL PROCESSES OF ARACHNOIDS. V. -P. Kostama[1] and T. Törmänen[1], [1]Department of Physical Sciences, PO BOX 3000, FIN-90014, University of Oulu, Finland <petri.kostama@oulu.fi>.

Introduction: Since Venera 15 and 16, and in more detail after Magellan mission, it has been recognized that Venus has a collection of different volcano-tectonic features on its surface (i.e. coronae, novae and arachnoids). The features share some similarities, but they all have unique characteristics. Such characteristics as radial lineaments, annulus, central region, presence of volcanism, diameter, location, geologic contexts, topography, and complexity have been used in studying and classifying these structures [e.g. 1-13].

Similarly to the well studied and established coronae, the arachnoids have generally a circular or ovoidal central structure. The structure is surrounded by a radial system of ridges [1], fractures or a combination of both [7,11]. The definition of the arachnoids is based on the morphological description proposed first by [13] of a central circular structure adjoined with associated radial features. We propose the use of additional constraints in order to eliminate some of the interpretational problems:

1) Arachnoids are quasi-circular volcano-tectonic structures with a structural annulus and/or topographic rim, sometimes associated volcanism, with a system of radial ridges and/or fractures that originate at or are connected to the annulus or rim of the structure.

2) Features where radial fractures, fissures or ridges are not influenced by the annulus or rim are not arachnoids but coronae.

3) Structures with a central dense radial swarm of fractures are not considered arachnoids (they are coronae with a nova-like fracture swarm).

Despite the similarity of the central structures, the arachnoids do show differences to the coronae. They are generally much smaller in size than coronae, their mean diameter is 129 km while the coronae have a mean diameter of 207 km (the calculations do not include the two largest coronae). There also seems to be differences in their formation process. The observations show that the concentric structures of arachnoids are formed probably due to depression rather than by uplift and formation of a plateau-like expression as in the proposed corona-model [14]. The arachnoid lineaments are also in many cases different to the proposed radial fractures formed in the coronae formation, although with arachnoids there seem to be several processes that form the lineaments. One other important difference between coronae and arachnoids is also the fact that novae, which in many cases exist within coronae [9], are not associated structurally in that manner with arachnoids.

Differences in associated volcanism are also observed; coronae are usually associated with large amounts of extrusive volcanic activity and volcanic features which is not common to the arachnoids [i.e. 1]. Coronae annuli are also more complex and prominent compared to the arachnoid rim features. The central regions of coronae are detail–rich while the arachnoid central region is usually quite featureless. Besides the morphological separation, the apparent topography also differs: Coronae topography may be very complex, while the arachnoids do resemble more calderas by being more commonly simple depressions.

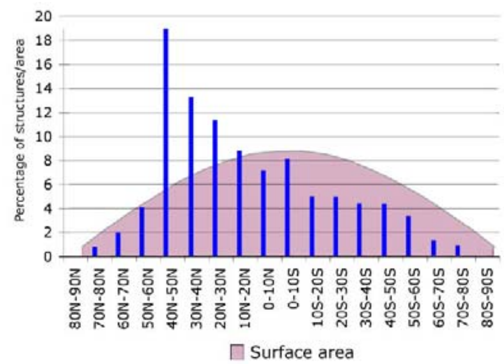

Figure 1. The latitudinal distribution of arachnoids.

Distribution of the arachnoids: The identification process of the arachnoid population is still a work in progress. The introduction of the Type 2 features [15,16] increases the arachnoid population. The arachnoids have a higher distribution on the northern hemisphere as 68 % (94 features) of the features are located north from the Venusian equator, while only 32 % (45 features) is located in the southern hemisphere. In addition to this concentration, 52 % (72 features) of the arachnoids are located between the latitudes 45°N and 10°N (Fig. 1). This is mostly due to the large arachnoid groups in Bereghinya and Ganiki Planitiae. Notable in the latitudinal distribution is the difference to the coronae distribution, which follows the distribution of the surface area.

Formation process of the radial structures: One of the portrayed models of formation process is the presence of intrusive magmatism that forms the radial structures around the arachnoid. The lineaments of arachnoids would have been thus formed by a deformation caused by intrusion of magma into the surrounding crust [1,16-17]. In some cases, the tectonic deformation of arachnoid could also be tied to the proposed ascending diapirism. This may produce a dome-like rise and extensional fracturing [14,18-19] Still, in many cases, the lineaments of arachnoids do extend a significant distance, up to several radii of the arachnoid annulus and in these cases the lineaments cannot be formed only by the uplift, as has been shown by [20]. Instead, in cases where the far reaching radial fractures are observed, their origin is probably due to dike emplacement [c.f. 16,21-22].

Besides the dike emplacement or diapiric uprise, there are also other possibilities for the formation of the arachnoid radial or semi-radial structures. A modelling of tectonic patterns and regional stresses by [18] gives comparable analogs to some of the existing arachnoids. The Venusian wrinkle ridges may also be affected by regional stresses for example around topographical changes [23]. The relaxation of the surface and resulting shortening of the surface may also be the source of radial ridges. The survey of the arachnoid radial features [11] gave implications to different formational processes of the lineaments:

1) The lineaments radiating from the central structure are fractures and fissures resembling in cases the radial fracture centers. The two aspects of the structure (central structure and radial lineaments) are probably closely linked in these cases. The lineament formation could be due to **a)** topographical uprising (similarly as in proposed coronae evolution [14], **b)** dike emplacement processes [16], or more probably **c)** combination of both as was proposed by [16] for their studied radiating centers. The length of the lineaments is more similar to the dike formation, as in the doming of the structure the lineaments would be more constrained within the topographically deformed area.
2) In many cases, the lineaments are mostly just surface structures, which may be identified as wrinkle ridges. The ridges on the plains are affected by the arachnoid central structure (topography, magmachamber) resulting in identifiable arachnoid structure. This was proposed by [23] in his study of the Venusian wrinkle ridges.
3) The ridges of the arachnoid are "radiating" from the depressed central structure. In these cases, they may have been formed by the compressional effect of the formation of the topographical depression.

The survey showed that with 53 % (74 features) of arachnoids the lineaments are compressional (ridges), compared to the 30 % (41 features) of extensional cases (fractures or graben, AR(f)). As observed before, in some cases both extensional and compressional features are present (AR(rf)), in fact with 17 % (24 features) of arachnoids. Figure 2 shows the distribution of these three arachnoid subtypes. The discussed possible models of formation or origins for the lineaments as well as the observations of the structural composition enforce that similarly to the coronae, the arachnoid formational process is very complex, and generalizations for the whole population cannot be made.

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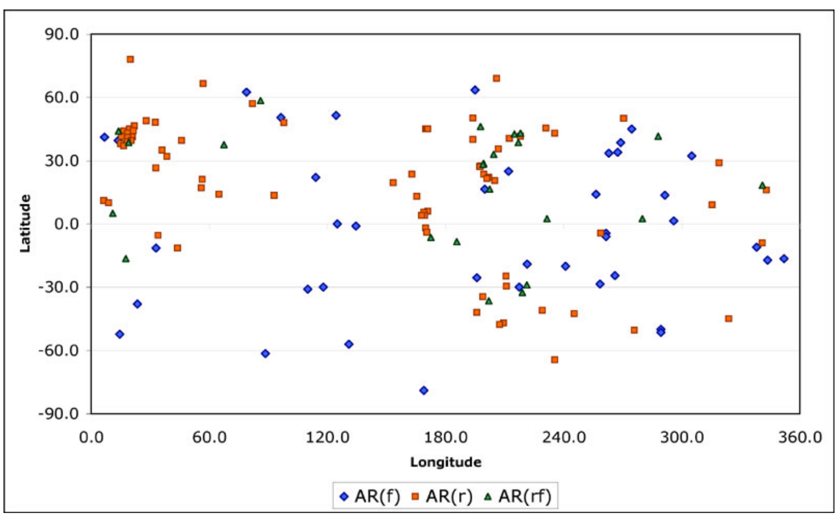

Figure 2. The global distribution of the three arachnoid subtypes. The subtypes are based on the characteristics of the arachnoid lineaments: AR(f) – radial fractures, fissures or graben, AR(d) – radial ridges, AR(rf) – combination of ridges and fractures.