ORIENTATION OF CORONAE AND RELATION TO CHASMATA ON VENUS. D. M. Jurdy[1] and P. R. Stoddard[2], [1]Dept of Geological Sciences, Northwestern University, Evanston, IL 60208, donna@earth.nwu.edu. [2]Dept of Geology and Environmental Geosciences, Northern Illinois Universe, DeKalb, IL 60115, prs@geol.niu.edu

Introduction: We examine the structural relations between coronae, chasmata, and the surrounding terrain for an assessment of global stratigraphy and temporal relations. Stratigraphic mapping [1] and detailed crater-count analyses [2,3] have suggested that different eras in Venus' recent history have been dominated by different processes. By specifically analyzing the eccentricity and tilt of coronae, we seek an independent determination of deformation and uplift history relative to the surrounding regions, as well as the interrelationship of coronae and chasmata.

Coronae: For our study we use two corona catalogs. The first is the set of 331 coronae classified by DeLaughter and Jurdy [4] from their analysis of 394 features from three sources [5,6, USGS Flagstaff]. Based on altimetry, these coronae were assigned to three distinct morphologic groups, although the actual shapes observed are gradational. Domal coronae (numbering 50) are distinguished by a central uplift with no surrounding moat and may have associated radial fracturing, often only visible in the SAR images. A flattened interior and an annular moat characterize the 93 Circular coronae. Portions of their interiors may be lower than the surrounding plains. Calderic coronae, with more than 50% of the interior lower than the surrounding plains, constitute the majority (188) of the classified coronae. They display raised rims and annular moats. The appeal of this scheme is that the three groups may represent evolutionary stages of corona development: Domal are incipient, active features; Circular are middle stage; and Calderic are the terminal stage of corona development.

The second catalog is the full set of coronae as defined in a global map [7]. It is composed of 669 distinct features, of which 105 can be matched to the morphologically classified coronae [4]: 16 Domal, 26 Circular, and 63 Calderic, with 518 remaining unclassified.

We analyze these coronae to assess whether this classification by stage yields systematic differences in size, shape, and tilt. Although there is considerable scatter among the coronae, some interesting patterns do emerge. Size strongly depends on the stage: ¾ of the Domal coronae are larger that ¾ of the Calderic ones, with Circular coronae intermediate in size. The ellipticity is also a function of stage: more than half the Circular and Calderic coronae have eccentricities less than 0.50 while more than half the Domal ones have eccentricities over 0.70. Furthermore, the tilt of coronae also seems related to the stage: ¾ of Domal tilt less than ¾ of Calderic, and Circular are intermediate. Thus, the coronae inferred to be the youngest (Domal) are larger, more eccentric, and tilt less than the presumably older set. These patterns support the morphologic classification of coronae [4] as an indication of stage or degree of maturity of individual features.

Surprisingly, there was no correlation between the long axis of individual coronae and their dip direction, as might be expected if corona ellipticity and uplift were both related to deformation.

Chasmata: Chasmata, linear to arcuate troughs with ridges extending thousands of kilometers, show the greatest relief on Venus, as much as 7 km over a horizontal distance of 30 km, and may be active rift zones. An early [8] definition of a series of rift zones on Venus, described them by four great circle arcs, using Pioneer-Venus radar data. Although updated by Magellan, the simplicity of the representation is convenient, and more importantly hints at an underlying global process. Following this approach, we represent the rift zone system by five great circle arcs, with a total length of about 55,000 km, 50% greater than the planet's circumference. Once corrected for the smaller radius of Venus, this length of extension is within 3% of the 59,200 km of active spreading ridges estimated for Earth [9]. We arbitrarily number these arcs with increasing longitude: The first arc, through Lada Terra, extends from (30ºS, 0º) to (30ºS, 130ºE), a distance of about 11,000 km. The longest of the rift zones, referred to as the Aphrodite-Beta zone, extends half-way around Venus roughly 22,000 km, which represent by the second and third arcs, from (10ºS, 70ºE) through (25ºS, 150ºE) to (25ºN, 280ºE). The fourth arc, from Atla to Themis, extends 15,000 km from (25ºN, 180º) to (40ºS, 320ºE). The fifth arc extends from Beta to Phoebe (40ºN, 285ºE to 20ºS, 285ºE), more than 6,000 km.

The chasmata themselves deviate from these arcs (right) by as much as 10º of angular distance; indeed 20º swaths about these arcs encompass fully 90% of the "rift zones." (The arcs are modified from an earlier representation [10] to better fit the full set of rifts.) In addition to the representation of the chasmata by five arcs, we use the full set of rifts as defined in a global map of Venus [7]. Using this full set of detailed rift zones provides a more accurate representation of the entire system.

Craters: We use the set of 940 craters as catalogued by Phillips and Izenberg [11]. Of these 940, 158 were classified as tectonized, 55 as embayed by lavas, with only 18 craters assessed as unambiguously both tectonized and embayed. Crater density is deficient along rift zones when compared to random distributions.

BAT Region: The Beta-Atla-Themis (BAT) region of Venus has long been known for its relatively high concentration of rifts and coronae (Figure 1). Three of the 5 major rift regions and almost 300 of the 669 coronae lie within the BAT region. In addition, 10 of the 18 unambiguously tectonized and embayed craters are found in this area, which comprises only 1/6 the surface area of the planet. The two major geoid highs are found in this region, over rift zone intersections. Interestingly, while craters seem to be underrepresented on and near rifts, roughly 1/3 of all craters that have been both tectonized and embayed are found at these rift zone intersections, and about 1/2 of the planetary total are on rifts in this region.

Our analysis reveals that coronae within the rifts tend to be aligned sub-parallel to the rift axis, but tilt generally away from their direction of elongation. Domal coronae within chasmata – as those elsewhere – tend to tilt less than the later stage ones, the Circular and Calderic. Given the uncertainties in the temporal and causal relationships between rifting and corona development, understanding the sequence of activity in the BAT region is particularly important.

Conclusions: We have found the following preliminary results:

- A morphologically based classification scheme for coronae also, to a first-order approximation, segregates coronae in terms of size, shape, and tilt.
- The BAT region, site of an unusually high degree of volcanism, is also an area of high chasmata concentration, crater modification, and the location of the planet's highest geoid.
- While most coronae, are apparently randomly oriented over much of the planet, those in chasmata align with the chasmata themselves.

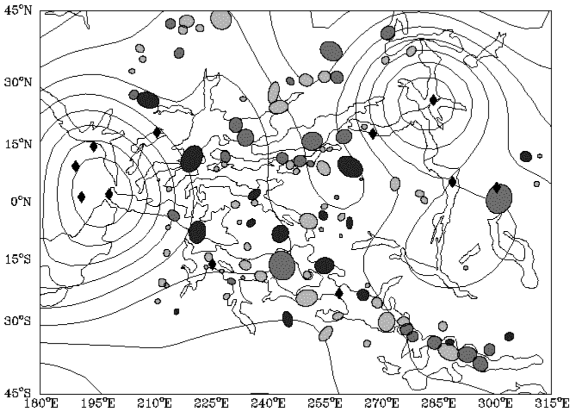

Figure 1: Features of the BAT Region of Venus. White regions are chasmata (rifts). Ellipses represent coronae classification [4]: Dark ellipses are calderic, intermediate are circular, and light ellipses are domal. Contours indicate geoid highs. Black diamonds represent craters that have been both tectonized and embayed.

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