**GLOBAL ORGANIZATION OF TECTONIC DEFORMATION ON VENUS**: Frank Bilotti, Chris Connors, and John Suppe; Department of Geological and Geophysical Sciences, Princeton University, Princeton, NJ 08544

The geographic organization of surface deformation on Venus as on Earth is a key to understanding the global tectonic system. To date we have mapped the distribution of three unambiguous tectonic land forms on Venus: 1) Linear foldbelts analogous to those at plate margins of the Earth, 2) Linear rift zones, analogous to continental rifts on the Earth, and 3) Distributed plains deformation in the form of wrinkle ridges and extensional faults and fractures. The linear foldbelts are the dominant structural style in the northern hemisphere; Ninety percent of the planet's foldbelts lie above the equator [1]. In contrast, compressive deformation in the southern hemisphere is dominated by two large, sweeping patterns of wrinkle ridges. The two hemispheres are divided by an equatorial region that is largely covered by rift zones and several large tessera blocks. A tectonic model of generally poleward convergence of the northern hemisphere explains the distribution of foldbelts and rift zones (figure 1). In our model (figure 2), a northern hemispherical plate (or system of plates) moves poleward and deforms along discrete, predominately longitudinal bands.

We recognize four types of foldbelts based on their relationships to other large-scale tectonic features on Venus. There are foldbelts that lie within the low plains, foldbelts associated with coronae, novae and chasmata, foldbelts that lie at the margins of poly-deformed tessera plateaus, and the folded mountain belts around Lakshmi Planum [2]. Figure 1 shows the area distribution of these foldbelts as a function of latitude. We see a geometric increase in the area of foldbelts when normalized to percent area at a given latitude. This increase is consistent with our model of poleward convergence. Also, the orientations of most foldbelts are either approximately north-south or parallel to lines of latitude in the northern hemisphere. This observation is also consistent with the model in that the longitudinal bands are the result of the decreasing area of the sphere as the plate moves poleward and the latitudinal belts are the direct result of poleward compression. Both result from only a few hundred kilometers of northward motion.

Rifts on Venus are unlike those of the Earth's ocean basins in that the amount of extension is much less. An analysis based on inference from structural evidence as well as a rifted crater in Devana Chasma [3] reveals that the range of extension for a typical Venusian rift is in the range of a few tens to a few hundreds of kilometers. Using a simplified area balance for the poleward convergence model, we find that the amount of north-south extension required to produce all the northern hemisphere foldbelts is in the range of 100-300 km. Figure 1 also shows the area distribution of rifts on Venus. While the area of rifts is not a direct measure of extension, we can conclude that the distribution of rifts is consistent with the poleward convergence model.

The trends of wrinkle ridges have been mapped over the planet (figure 3) and several large, sweeping patterns evidently reflect long-wavelength topography. Using wrinkle ridges as paleo-stress indicators, we have developed local and regional stress trajectory maps. These stress maps seem to indicate that the large-scale crustal stresses involved in formation of wrinkle ridges are derived from the regions of high topography near the equator [4]. The wrinkle ridge stressmaps are also very consistent with stress maps of Banerdt [5] who models stress distribution resulting from the support of long-wavelength loads. This suggests that the correlation of topography and gravity on Venus is vitally linked to the planets stresses and tectonics. We have yet to determined if the stresses associated with wrinkle ridge formation are contemporaneous with or related to the northward motion evidenced by the planet's foldbelts.

References: [1] Bilotti, F., Connors, C. and Suppe, J. (1992) Int'l Colloquium on Venus, 10 (abs). [2] Connors, C. and Suppe, J., (1992) Wkshp. on Mtn. Belts on Venus and Earth (abs). [3] Solomon, S.C., et al, (1992) JGR, 97, E8, 13,199. [4] Bilotti, F. and Suppe, J., (1992) GSA abstracts, v. 24, no. 7, A195 (abs). [5] Banerdt, W.B., (1986) JGR, 91, B1, 403.

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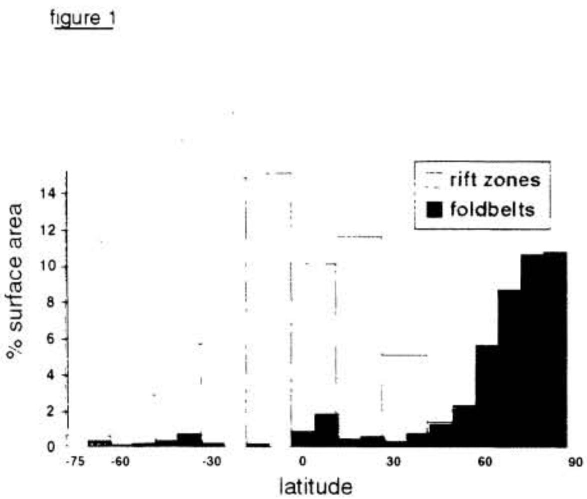


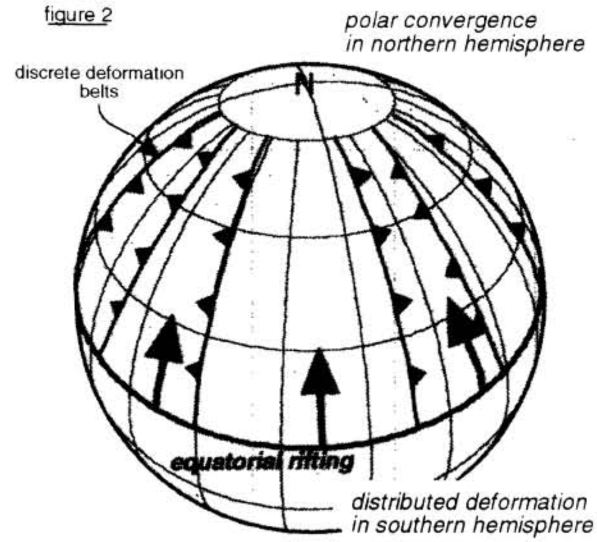


figure 1: Histograms of area of rift zones and foldbelts as a function of latitude. We find that the highest concentration of rifts occurs a few degrees below the equator whereas the area of foldbelts increases toward the north pole as prescribed by the model (fig. 2).

figure 2: Global model of deformation on Venus. Poleward convergence results in decrease in surface area of the crust which causes a poleward increase in compressive deformation. The observed poleward geometric increase in percent area of foldbelts (fig. 1) and the predominately longitudinal/latitudinal orientations of northern hemisphere foldbelts agree with the model prediction for a few hundred kilometers of northward motion.

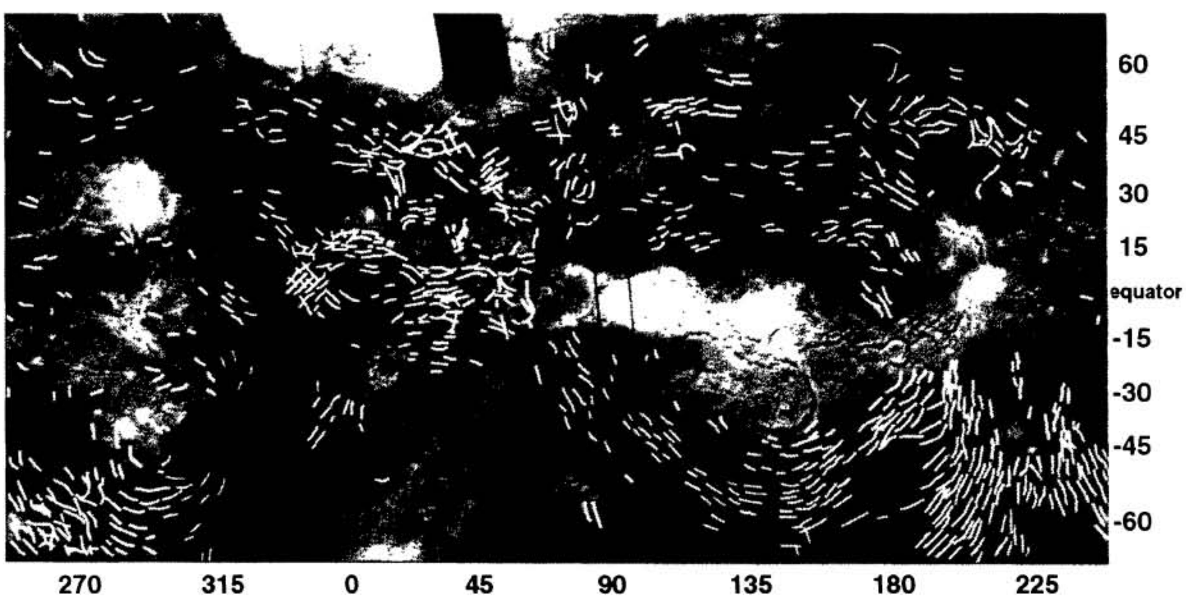


figure 3: Global distribution of wrinkle ridge trends (white lines) superimposed on Venus topography (low areas are black, high areas white). Wrinkle ridges do not occur above ≈6052 km. Note the high correlation of wrinkle ridges to long-wavelength topography in the southern hemisphere as well as the very coherent, large-scale patterns.