A CASE FOR A WEAK CRUST ON VENUS, H. Mizutani, Dept. of Earth Sciences, Univ. of Nagoya, Chikusa-ku, Nagoya, and H. Spetzler, CIRES and Dept. of Geological Sciences, University of Colorado/NOAA, Boulder, CO 80309

Since Venus and Earth are of similar size and bulk density, these planets are thought to have accreted with similar bulk compositions (1, 2), and to have similar internal structures (3). Recently, Anderson (4) showed that the slightly lower zero-pressure density of Venus can be explained by a deeper basaltic layer and that Venus has essentially the same bulk composition as Earth. CD and N2 abundances on Venus are about the same as on Earth (5, 6, 7). The composition of surface crustal rocks is also similar to that of terrestrial crustal rocks (8, 9).

Phillips et al. (10) and Kaula and Phillips (11) have analyzed Venusian topography and conclude that if plate tectonics exist on Venus the rate of generation of new plates is less than 25% of that on Earth. They further conclude that the major topographic features must be dynamically supported and that plate tectonics ceased when the entire surface was choked up by a thick (12) continental crust. The strength of this thick crust is due to its dryness which outweights the weakening effect of the high temperature in Venus.

We conclude from rock strength measurements and from a model (13, 14) in which we extrapolate the data to Venusian conditions, that the crust on Venus must be thin and that it is too weak (See Fig. 1) to support the stresses that are necessary for plate tectonics to exist. This holds, according to our model, even if the rocks are as dry as the atmosphere. The low A40 content in the atmosphere and the apparent cessation of plate tectonics are indicative of inefficient outgassing and the possibility of the rocks being much wetter than the atmosphere. The difference in tectonic style between Venus and Earth may alternately be due to the differences in mantle viscosities and might be visually grasped by performing two simple experiments. In the one case we mimic the low viscosity of the Venusian mantle with water overlain by a relatively stiff lithosphere of wax. For Earth we use a more viscous mantle of honey also overlain by a wax lithosphere. Upon application of heat along a linear source convection starts in both models. In Earth the up-welling is confined to a very narrow elongated zone. The crust thinned along a ridge and finally broke through, erupting honey. In Venus the convection was very diffuse and heat was transported evenly to the bottom of the crust causing uniform thinning. Although the above simple-minded experiments are not exact scale models of the convection in Venus and Earth, we believe the behavior observed in the wax on water experiment is analogous to Venus' tectonics, whereas the behavior in the wax on honey experiment is analogous to Earth's tectonics.

![Figure 1. Curves of equal strength for Ralston intrusive plotted in terms of partial pressure of water and temperature. Estimates of the partial pressure of water and temperature conditions for various bodies are indicated by the shaded regions.](image-url)
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