The Role of Large Volcanic Rises on Venus

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Large volcanic highlands, or hotspots, play a key role in the study of the evolution of Venus both because several lines of evidence indicate that they may be relatively young features and because they provide a window into the lithosphere and mantle. Large volcanic rises also represent an intersection between venusian and terrestrial tectonic processes, since several rises are very similar to terrestrial hotspots, while other large volcanic rises arc dominated by corona, which are tectonic features unique to Venus. The age of venusian hotspots is not easily constrained since there is no appreciable plate motion to generate a hotspot track. However, cratering statistics [Namiki and Solomon, 1994], radar properties [Robinson and Wood, 1993], and a bottom-loading signature in some rises interpreted as a thermal anomaly [Smrekar, 1994], suggest that the rises maybe relatively young (as compared to the average resurfacing age of 300-600 m. y.), possibly even still active. Present day activity at these rises would be consistent with some resurfacing models since the area covered by volcanism associated with the rises is small as compared to intercrater distances. Numerical models of upwelling plumes can be used to predict topography, gravity, and volumes of pressure-release melting as a function of time, plume and mantle properties, and lithospheric thickness. Each of these variables can produce significant variations in gravity, topography, and melt volume. However, the observations are most consistent with a lithospheric thickness of -100-150 km, given Earth-1ike mantle properties [Smrekar and Parmentier, 1995]. Estimates of the elastic thickness at rises based on gravity and topography data arc 20-50 km [Phillips, 1994; Smrekar, 1994]. However, there is some uncertainty in these estimates due to the low resolution of the data and the difficulty of removing a convective signature. A tectonic synthesis of observations of venusian volcanic rises indicates that major differences in the geologic signature between hotspots is likely to bc a result of differences in the mantle or lithosphere properties [Stofan et al., 1995]. A goal of future studies of upwelling conditions unique to Venus is to determine whether these differences arc spatial or temporal.

1. 1995 Fall Meeting

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