remnants of deformation from earlier plume instability cycles that have so far escaped resurfacing since the most recent boundary layer instability events at these plumes. If so, this would essentially invert the sequence proposed by Herrick and Phillips [23], who suggested that Beta Regio represents an early stage of their blob model and that Thetis and Ovda represent later stages.

As an alternative to the mantle plume model, Bindschadler and colleagues [12,29] proposed that Ovda, Thetis, and Phoebe Regiones formed by crustal convergence over downwelling mantle "coldspots." As arguments against a plume model, coldspot advocates [12] point to the absence of evidence for early volcanism, prior to the formation of tessera, in these areas. This could be due to plumes rising beneath preexisting tessera, as suggested for Beta Regio by Senske et al. [28]. Alternatively, tessera formation may be an intrinsic part of the plume instability evolutionary sequence, but the tectonic disruption involved in forming the tessera may be sufficiently severe to destroy any evidence for earlier volcanism. A second argument that has been used against the plume model is the observation that the tessera is embayed by later flood volcanism, which is asserted [12] to be contrary to the plume model. This assertion is based on the detached blob model of a plume [23]. If a vertically continuous plume exists [15,18], then adiabatic decompression provides a continuing source of magma. In this case, volcanism and tectonic deformation can go on simultaneously, leading to possible complex superposition relationships.

Several observations have been asserted to favor the coldspot model, including the existence of steep topographic slopes on the margins of some highlands, margin-parallel compression at high elevations, and extensional deformation superimposed on compressional features [12]. However, a combination of dynamic uplift and crustal thickening by volcanism might be able to produce the observed marginal slopes. Margin-parallel compression might be the result of viscous flow of volcanically thickened crust down the topographic gradient. In such a model, one would expect extension on the topographic highs and compression on the lower flanks of the highland. However, as boundary layer instabilities move laterally through the upper thermal boundary layer, the margin of the highland can migrate laterally outward [21]. Thus, compressional features that originally formed at low elevations can be uplifted to high elevations. As these features are uplifted, they may be overprinted by extensional features. An additional argument that has been asserted to favor the coldspot model is the observation that the apparent compensation depths of Ovda, Thetis, and Phoebe are shallower than for Beta and Atla, and the correlation between gravity anomalies and topography is not as strong [12]. However, as noted above, a decrease in the apparent compensation depth is expected in the plume model because of the effect of the hot thermal anomaly on the mantle's viscosity. The increased volcanism associated with a rising thermal instability should lead to local crustal thickening, which will create topographic highs whose gravity anomalies will be small due to shallow compensation. This should decrease the overall correlation between gravity and topography. Thus, it appears that the time-dependent plume model is at least qualitatively consistent with observations of Ovda, Thetis, and Phoebe. Contrary to some assertions [12], qualitative geological and geophysical arguments cannot rule out the mantle plume model for these regions. Quantitative modeling of both the time-dependent plume model and the coldspot model are needed to assess their relevance to highlands on Venus.

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PIONEER VENUS POLARIMETRY AND HAZE OPTICAL THICKNESS. W. J. J. Knibbe[1], W. M. F. Wauben[1], L. D. Travis[2], and J. W. Hovenier[1], [1]Department of Physics and Astronomy, Free University, Amsterdam, The Netherlands, [2]Goddard Institute for Space Studies, New York NY, USA.

The Pioneer Venus mission provided us with high-resolution measurements at four wavelengths of the linear polarization of sunlight reflected by the Venus atmosphere. These measurements span the complete phase angle range and cover a period of more than a decade. A first analysis of these data by Kawabata et al. [1] confirmed earlier suggestions of a haze layer above and partially mixed with the cloud layer. They found that the haze exhibits large spatial and temporal variations. The haze optical thickness at a wavelength of 365 nm was about 0.06 at low latitudes, but approximately 0.8 at latitudes from 55° poleward. Differences between morning and evening terminator have also been reported by the same authors.

Using an existing cloud/haze model of Venus, we study the relationship between the haze optical thickness and the degree of linear polarization. Variations over the visible disk and phase angle dependence are investigated. For that purpose, exact multiple scattering computations are compared with Pioneer Venus measurements.

To get an impression of the variations over the visible disk, we have first studied scans of the polarization parallel to the intensity equator. After investigating a small subset of the available data we have the following results. Adopting the haze particle characteristics given by Kawabata et al. [1], we find a thickening of the haze at increasing latitudes. Further, we see a difference in haze optical thickness between the northern and southern hemispheres that is of the same order of magnitude as the longitudinal variation of haze thickness along a scan line. These effects are most pronounced at a wavelength of 935 nm.

We must emphasize the tentative nature of the results, because there is still an enormous amount of data to be analyzed. We intend to combine further polarimetric research of Venus with constraints on the haze parameters imposed by physical and chemical processes in the atmosphere.

Reference: [1] Kawabata K. et al. (1980) *JGR, 85*, 8129–8140.