Conclusions: On the basis of our initial analysis, we conclude that the observed pattern of volcanic features may be correlated with the distribution pattern of global physiographic and geologic characteristics. The distribution of volcanic centers and regional tectonic patterns suggests that volcanic features are generally excluded from lowlands and regions of tectonic shortening, and occur predominantly in upland regions characterized by geologic evidence for extension. Three hypotheses that may account for the observed distribution and geologic association may be categorized as (1) environment/elevation-related, (2) mantle dynamics-related, and (3) age-related. It is likely that all three influences occur, but on the basis of the global association of areas of high volcanic center abundance with tectonic characteristics of extension and the probable association of many individual volcanic centers with local mantle upwelling and plumes, we believe that the regional concentrations of volcanic centers may be primarily associated with regions of broad mantle upwelling phenomena. Although the broad-scale characteristics and association of the distribution of volcanic centers may be accounted for by the first hypothesis, details of the distribution and local associations may be strongly influenced by altitude and age-dependent effects.

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THE SPIN VECTOR OF VENUS DETERMINED FROM MAGELLAN DATA.

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A control network of the north polar region of Venus has been established by selecting and measuring control points on full-resolution radar strips. The measurements were incorporated into a least-squares adjustment program that improved initial estimates of the coordinates of the control points, pole direction, and rotation rate of Venus. The current dataset contains 4206 measurements of 606 points on 619 radar strips. The accuracy of the determination is driven by spacecraft ephemeris errors. One method used to remove ephemeris errors is to adjust the averaged orbital inclination and argument of periapsis for each orbit. A more accurate method that has been used with selected blocks of orbits incorporates optimally fitting measurements of additional points at all latitudes of the radar strips together with Earth-based spacecraft radiometric tracking measurements to compute new spacecraft ephemerides. The root-mean-space (RMS) of the point measurement residuals in these improved ephemeris solutions is typically about 20 m in slant range, and 40 m in the along-track direction. Both the control network computations and the improved ephemeris solutions incorporate radii at the measured points derived from the Magellan altimetry dataset [1]. The radii of points north of 85° are computed in the least-squares adjustments.

An accurate estimate of the rotation period of Venus was obtained by applying the ephemeris improvement technique to the second cycle closure orbits 2166–2171 that overlaid the first cycle initial orbits 376–384. Sixty-four common points were measured on both orbit groups and improved ephemeris solutions computed over both blocks simultaneously, along with the rotation rate. A similar analysis was made using orbits 874–878 from cycle 1 and 4456–4458 from cycle 3. Fifty-two common points were measured on both orbit groups and the rotation period of 243.0185 ± 0.0001 was computed. This latter solution confirmed the initial solution, and was an improvement over the first closure solution because of the longer period between overlapping orbits.

The geodetic control network uses measurements of points on overlapping radar strips that cover the north polar region; these are only the even-numbered orbits. These strips were taken in the first cycle and encircle the pole except for three gaps due to the superior conjunction data loss, the reduced data due to occultation, and the area of ongoing work. Improved ephemeris solutions for 40 orbits (376–384, 520–528, 588–592, 658–668, 1002–1010, 1408–1412, 1746–1764, and 2166–2170) are included and fixed in the geodetic control computations, thus tying the network to the J2000 coordinate system. The argument of periapsis and orbital inclination of all remaining orbits were allowed to vary as part of the least-squares adjustment. The RMS of the point measurements is typically on the order of 75 m in both along-track and cross-track. The rotation period was fixed at 243.0185 days. The coordinates of the 606 measured points were determined and the solution for the direction of the north pole was $\alpha = 272.76° \pm 0.02°$, $\delta = 67.16° \pm 0.01°$ (J2000).

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MONTE CARLO COMPUTER SIMULATIONS OF VENUS EQUILIBRIUM AND GLOBAL RESURFACING MODELS.

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Two models have been proposed for the resurfacing history of Venus: (1) equilibrium resurfacing and (2) global resurfacing. The equilibrium model [1] consists of two cases: In case 1 areas ≤0.03% of the planet are spatially randomly resurfaced at intervals of ≤150,000 yr to produce the observed spatially random distribution of impact craters and average surface age of about 500 m.y., and in case 2 areas ≥10% of the planet are resurfaced at intervals of ≥50 m.y. The global resurfacing model [2] proposes that the entire planet was resurfaced about 500 m.y. ago, destroying the preexisting crater population and followed by significantly reduced volcanism and tectonism. The present crater population has accumulated since then, with only 4% of the observed craters having been embayed by more recent lavas.

To test the equilibrium resurfacing model we have run several Monte Carlo computer simulations for the two proposed cases. For case 1 we used a constant resurfacing area of 0.03% of the planet with a constant thickness and a constant 150,000-yr time interval