The observed size-frequency distribution of impact craters on Venus is consistent with a production surface that is approximately 0.5 to 1.0 Gy old [1]. However, widespread volcanism on the surface suggests that some regions may be significantly younger than this, and the question of whether the surface is in production or equilibrium remains open. Recent results from the Magellan mission to Venus show that only a small number of impact craters are modified by volcanism [2]. Furthermore, statistical analyses of the placement of impact craters on the surface of Venus suggest a completely spatially random distribution [1]. The existing distribution of impact craters on Venus may be explained by three possible equilibrium models:

1. Global scale resurfacing occurred at some time in the past, followed by much reduced volcanic activity [2]. Impact craters would have accumulated since this time, and the surface of Venus would be of a single production age.

2. Resurfacing occurs on a regional level, with a characteristic length scale that is less than the scale of randomness of the crater population [3].

3. Volcanic activity is responsible for a slow vertical accumulation of lava, resulting in the eventual removal of craters [1].

We have developed a three-dimensional model of venusian resurfacing that employs Monte Carlo simulations of both impact cratering and volcanism. The model simulates the production of craters on Venus by using the observed mass distributions of Earth- and Venus-crossing asteroids and comets [4]. Crater rim heights are calculated from a power law fit to observed depth/diameter ratios. The growth of a variety of volcanic features is simulated in the model. The areal extent of shield fields, large volcanos, and lava flows is determined in the simulations by sampling the appropriate distributions for the feature type from Magellan data. Since a greater number of modified craters is found in the Atla-Beta-Themis region, the spatial distribution of volcanic activity is skewed in the model to represent regions of greater or lesser volcanism. Lava flows are modeled by an energy minimization technique to simulate the effects of local topography on the shape and extent of flows. Some mixture of the three endmember models described may be necessary to adequately explain the observed paucity and distribution of partially embayed impact craters. The model is run under a wide range of assumptions regarding the scale and time evolution of volcanism on Venus. Regions of the parameter space that result in impact crater distributions and modifications that are currently observed will be explored to place limits on the possible volcanic resurfacing history of Venus.