topographic reconstruction (Figure 11*d*) suggests that Maxwell Montes did not experience any large-scale changes in relative relief during strike-slip faulting. However, if the movement of Maxwell within the converging shear zones was up to 1000 km, then significant amounts of crust must be removed beneath Maxwell. Mechanisms of ductile crustal thickening at depth may be capable of preserving the topographic signature of proto-Maxwell Montes during this second stage of deformation. It is therefore suggested that some large-scale uplift may have accompanied the movement of Maxwell Montes within the bounding shear zones. The importance of this mechanism of crustal uplift depends on the relative amounts of lateral transport and large-scale rotation of the mountain range during the strike-slip phase of deformation. With the present data it is unclear how these two processes are related. If Maxwell underwent more rotation, then less lateral transport is required. This, in turn, requires less material to be removed at depth, as well as less concomitant uplift, and implies that proto-Maxwell Montes originated as an 11-km-high mountain range that was oriented along a more north-south trend. High-resolution images and gravity data obtained by the Magellan spacecraft should help clarify the mechanisms of crustal compensation and the relative importance of large-scale lateral movement and large-scale crustal block rotation in the Maxwell Montes area.

## INTERPRETATION OF GEOLOGICAL HISTORY

The evolution of Maxwell Montes interpreted from this analysis may be described as a two-stage process. In the first stage, a linear mountain belt formed through processes of compression and crustal convergence. Ridges, valleys, and high topography resulted from processes of crustal thickening including folding, thrusting, and stacking. Additional deformation occurred along the steep boundaries of the orogenic belt through interaction with shear zones and gravitational effects. In the second stage, this linear mountain belt was disrupted by strike-slip faulting to produce the presently observed morphology. Several models describing this second stage have been presented above (Figure 13). The first two suggest that Maxwell Montes underwent large-scale strike-slip motion while situated at its present location, either with or without large-scale rotation of the CSDs. A third model involves lateral transport of the entire mountain range within two converging shear zones. A combination of this last model with some rotation of the mountain belt during transport can account for the majority of features observed including the morphology, topography, and sense of shear along both the CSDs and the shear zones. Based on our study of Maxwell Montes and the three models, it is possible to determine the relative ages of a number of structures and features in and around Maxwell Montes, so that a more detailed deformational history may be recognized. Figure 14 shows a summary of this multistage evolution.

*Formation of proto-Maxwell Montes.* The first stage (Figure 14*a*) involves the formation of the Akna Montes-like proto-Maxwell Montes as a linear mountain belt. Compressional stress oriented at N70°E formed an orogenic belt that was 300 km wide and 1200 km long. By direct analogy with Akna Montes we suggest that the banded units and dissected terrain of Maxwell Montes may have formed synchronously as compressional ridges and troughs, with a continuous, linear boundary between the two units. The continuous ridges of the banded units would represent the deformational front of the mountain range, with the less continuous ridges of the dissected terrain representing slightly more complex hinterland deformation. In this scenario, the deformation in the dissected terrain may be similar to that behind the Himalayan front in the Tibetan Plateau, which is characterized by compressional ridges and troughs often disrupted by later stage extensional graben [*Molnar and Tapponier*, 1978]. Alternatively, the more disrupted nature of the dissected terrain could be the result of continued imbrication and suturing of crustal blocks beyond the banded units, as *Head* [1990] has interpreted the ridged and domed unit in Freyja Montes. However, this suture model seems less likely at Maxwell because the dissected terrain does not contain any obvious linear troughs that could represent the location of crustal underthrusting. Regardless of the specific style of orogeny, the creation of proto-Maxwell Montes as a long, linear mountain belt is the initial stage in its evolution.

*Cleopatra and associated deposits.* Following the creation of proto-Maxwell Montes, our reconstruction suggests that the dissected terrain was a single, contiguous unit running north-south across the entire eastern slope of proto-Maxwell Montes, before being overlain by the bright terrain associated with Cleopatra Patera (Figure 14*b*). *Peterfreund et al.* [1984] have suggested that Cleopatra formed before the ridges. They based this argument on the observed disruption of the rim of this structure and what they described as the deflection of large ridges around Cleopatra. This interpretation was made without the benefit of the Venera data sets, however, which were unavailable at that time. Although it is true that the rim of Cleopatra is somewhat disrupted (Figure 2), if Cleopatra were present before the initial stage of N70°E compression, then it would be elongated in a NW-SE direction consistent with the shortening associated with the formation of the ridges. Such an elongation is not observed. Disruption of the rim of Cleopatra could instead be due to structural control by the preexisting ridge pattern. In addition, we attribute the superficial deflection of large ridges about Cleopatra to the arcuate nature of the mountain range (Figure 11). Finally, the Venera image (Figure 2*b*) reveals that small ridges to the immediate south of Cleopatra in the dissected terrain are not deflected at all. It is unreasonable to suggest that ridges over 100 km away could be deflected while others within 50 km were not. Therefore we believe that the weight of the evidence supports the interpretation that the Cleopatra structure was created after ridge formation, but prior to strike-slip faulting. Since creation of the dissected terrain occurs synchronously with ridge formation, then Cleopatra must have been superposed on the dissected terrain unit. This superposition relationship suggests that formation of Cleopatra Patera followed the creation of the dissected terrain. Whether Cleopatra originated as an impact crater [*Basilevsky et al.*, 1986] or as a volcanic caldera [*Schaber et al.*, 1987*a*] cannot be determined from our present study, but high-resolution images to be obtained by the Magellan spacecraft should help resolve this issue.

*Strike-slip faulting and lateral transport.* The next phase in the development of Maxwell Montes was the creation of strike-slip faults (CSDs) and offset along these faults (Figure 14*c*). The exact reason for the change in style of deformation is uncertain, but could be attributed to any of the three models discussed above and illustrated in Figure 13: (1) regional NNW-SSE compression of the mountain belt resulting in the formation of the CSDs and strike-slip faulting along them but