Gomez, F., Allmendinger, R., Barazangi, M., Er-Raji, A., and Dahmani, M., *Crustal shortening and vertical strain partitioning in the Middle Atlas Mountains of Morocco*. Tectonics, 17, 520-533, 1998.

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Abstract:

The NE-SW trending Middle Atlas Mountains of Morocco are obliquely oriented within the late Cenozoic regional stress field, resulting in deformation that is partitioned into strike-slip faulting and thrust-related folding. In the central Middle Atlas, thrusting is confined to a 20 km wide fold belt between two relatively rigid crustal blocks that are obliquely converging. We suggest that in addition to strain partitioning observed in plan view, a partitioning of deformation between the upper and lower crust may be necessary to reconcile estimated crustal thickening and horizontal shortening within the fold belt. Cross-section balancing based on field observations demonstrates a relatively modest amount of Cenozoic horizontal shortening (~ 4.7 km) normal to the fold belt producing 800 m of structural relief. Yet, the geophysical data suggest this contraction has not produced a significant crustal root beneath the fold belt; that is, the belt does not appear to be isostatically compensated. Assuming all horizontal shortening was accommodated by crustal thickening beneath the fold belt implies much greater thickening than is suggested by constraints on the preshortened crustal thickness. It thus appears that thickening does not accommodate all of the contraction. We suggest one possible solution: The upper crust shortens by thickening (faulting and folding), whereas the lower crust deforms laterally.

Figure 10. Schematic diagram illustrating the Middle Atlas as a sinistral contractional shear zone. Although detailed structural information about the northern Middle Atlas is not available, the different implications for that region are illustrated. Vertical strain partitioning is illustrated in the southern and central region and may change to thick-skinned tectonics to the north as shown by the cut-away sections. If more horizontal shortening is occurring in the north, then perhaps a vertical-axis rotation of the Moroccan Meseta relative to the High Plateau may occur. The arrow labeled "s" denotes the magnitude of shortening orthogonal to the fold belt. Rotating blocks beneath the thin-skinned region are intended to illustrate the contractional shear zone and do not necessarily suggest the existence of regularly spaced domino blocks within the middle crust. Differential movement between the Moroccan Meseta and the High Plateau probably initiated during the Neogene, coinciding with the uplift in the Middle Atlas fold belt [Charriere, 1981].