Public Abstract

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Title:Recent faulting and active shortening of the Middle Atlas Mountains, Morocco, within the diffuse African-Eurasian plate boundary

The intracontinental Atlas Mountains of northwest Africa are prominent tectonic elements in the broader, diffuse plate boundary zone between the converging African and Eurasian plates in the western Mediterranean. Cenozoic geology, as well as present-day seismicity, document co-eval tectonism across a zone more than 500 kilometers in width. Hence, quantifying the rates of deformation in the Atlas Mountains is necessary in understanding the distribution of crustal deformation across the entire plate boundary zone. This study focuses on constraining the recent shortening rate across the NE-SW striking Middle Atlas Mountains, which are obliquely oriented to the NNW-SSE direction of Late Cenozoic plate convergence. Both strike-slip and contractional structures are exhibited with apparent slip partitioning: folding and thrusting is concentrated in the Folded Middle Atlas, whereas strike-slip dominates in the Tabular Middle Atlas. In the southwestern part of the Folded Middle Atlas, fault scarps of Quaternary alluvium, including a 4 meter composite scarp and a 1 meter single event scarp, attest to recent faulting along the mountain front. Detailed topographic mapping of the scarps provides a basis for geomorphic analysis and degradation modeling. Furthermore, the reconstruction of longitudinal stream terrace profiles helps constrain a long term deformation history. Radiocarbon dates provide age constraints on the faulted surfaces. To place these active tectonic observations in a larger context, the fault and fold geometry has been assessed by completing a 12.5 km structural transect across the frontal thrust, providing basis for the construction of a balanced cross-section. By combining the structural geometry with the uplift rate, a minimum estimate of the rate of horizontal shortening in the Middle Atlas is evaluated. Degradation modeling results suggest the Middle Atlas Mountains are shortening at a rate of 0.03 ± 0.05 mm/yr, which is lower than the geodetic estimates. This implies that shortening at a regional scale is being accommodated by an alternative mechanism such as strike-slip motion.