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Cenozoic tectonic evolution of the High Atlas of Morocco: oblique compression, reactivation and strain partitioning.

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The High Atlas of Morocco is a double-vergent mountain belt developed during the Cenozoic compression by inversion of a Triassic-Jurassic rift. The reconstruction of its Cenozoic kinematic and structural evolution is a fundamental key to unravel the processes that controlled its topographic growth and shape through time. However, this reconstruction is complicated by the scarce Cenozoic geologic markers and by the long residence of the High Atlas rocks at shallow crustal levels where they recorded deformation at least since the Paleozoic. To constraint its Cenozoic large-scale evolution, we combine detailed structural analysis with six geological cross sections distributed from west to east along the Moroccan High Atlas.

We find that the large-scale physiographic differences between the Western and Central-Eastern regions of the Moroccan High Atlas reflects partly differences in their structural evolution. The western sector is a narrow mountain belt with basement rocks at its core, where shortening is largely accommodated along inherited structures acting as steep, reactivated, dextral transpressive faults, and with Mesozoic sediments along its borders, where deformation occurs by shallow folding and thrusting. The Central-Eastern High Atlas is, instead, a wide mountain belt that exposes a thick Mesozoic sedimentary cover deformed mainly by thrusts and folds. The complex distribution of deformation and its kinematic variations are related to the obliquity between the compression that caused the rift inversion and the inherited structures and to strain partitioning. Large heterogeneities in the occurrence of Mesozoic décollement layers and in the thickness of the Mesozoic sedimentary covers also play a major role by emphasizing the effects of strain partitioning. Moreover, in the western sector, the intensity of the deformation decreases northwards involving progressively younger strata that are as young as 6 Ma at the front and the main deformation event occurred during the Middle Miocene-to-Pliocene, at the same time with the activity of the Siroua volcanic field. The emplacement of this volcanic field, which lies between the High Atlas and the Anti-Atlas, is controlled by faults suggesting a possible bearing with the two orogenic systems during the Late Cenozoic shortening.