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Tectonic shortening, internal deformation and pre-compressional features constrained by paleo-magnetism and AMS in the Central High Atlas (Morocco)

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Twenty chain-scale cross-sections (between 50 and 100 km long) in the Central High Atlas (between Demnate and Rich, Morocco) considering potential field data and constrained by means of paleomagnetism (paleodips for cross-section reconstruction) and AMS (anisotropy of magnetic susceptibility as an indicator of internal deformation) reveal the internal geometry of this intra-plate mountain chain and the relative importance of the different processes involved in mountain building between the Triassic and the Miocene:
1. Basement faulting during the Triassic and the Jurassic is especially relevant in the westernmost studied sector (Demnate area), where NE-SW normal faults controlled sedimentation and thickness changes of the syn-rift sequence. Partial or total re-activation of these faults defined the compressional structure of the chain during the Cenozoic.
2. Particular basinal processes during the Middle-Late Jurassic, namely diapirism (mainly salt walls linked to basement normal faults and extension) and intrusion of magmatic bodies (mainly gabbros) defined the structure of the central part of the studied area (Imilchil sector), where a thick detachment level constituted by the Upper Triassic underlies the syn-rift, 5000 m-thick Jurassic cover. Gabbro bodies of different size appear at the core of diapirs or are the main responsible for the formation of anticlines.
3. Compressional structures, namely thrusts and compressional folds involving internal deformation (cleavage) are dominant in the central-eastern sector of the area studied (Toumfite area), where structures inherited from the Mesozoic stage (magmatic intrusions, diapirism and/or transpressive structures) are also present. Low angle thrusts showing plurikilometric displacements dominate especially in the southern margin of the Atlas mountains, and extend throughout the studied segment of the chain. Thrusts generally increase in dip towards the axis of the chain and show again shallower dips towards its northern margin.
4. Finally, a combination of processes without a general dominance can be interpreted for the easternmost studied sector (Rich area), where the elevation envelope of the chain is also lower. Early diapirism and transpression inferred from paleomagnetic features have been invoked as responsible for sharply changing vergences of structures and tightening of anticlinal ridges.
In our interpretation, the overall structure of the Central High Atlas can be explained by a low-angle (average 10-15º) basement thrust channelized through the Upper Triassic detachment in most part of the central sector, where the thickness of the detachment and the syn-rift sequence are higher. The structures defining the northern border are back-thrusts to the main structure and inner thrusts (generally with a northwards verging) and folds often result from tightening of diapirs inherited from the basinal stage. Many basement faults were also transported in the hangingwall of the main thrust, thus conforming a Mesozoic preserved structure in the hanging wall. These transects, together with paleomagnetic data, will conform the basis for a 3-D reconstruction of the structure of the High Atlas.