

Post-Variscan thermal histories in Morocco: Implications for Mesozoic source-to-sink systems

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The post-Variscan history of Morocco is characterised by six major geological events. Four long known events were recognised from the rock records: the Variscan Peneplain prior to the Mesozoic, the break-up of Pangaea in Triassic to Jurassic times, the African and European plate convergence starting in the Late Cretaceous, and the Atlas rift system inversion. Two, however, were recently evidenced by low temperature geochronology and time-temperature (t-T) modelling studies: a post-Triassic rift and pre-Atlas orogenesis km-scale exhumation and subsidence. The exhumation is responsible for the settlement of major source-to-sink systems throughout the Mesozoic Morocco, which varied in terms of timing from north to south, along the Atlantic margin. These sedimentary systems are yet to be spatially constrained.

Our work comprises new Apatite Fission tracks, (U-Th)/He dating, t-T modelling (HeFTy and PECUBE), and thorough analyses of sedimentary data and geometries from field work analyses, published outcrops and well logs, and remote-sensing observation.

In the Meseta and the Western High Atlas, which is called Western Moroccan Arch during the Mesozoic (WMA), t-T modelling showed that the presently outcropping basement rocks underwent Jurassic to Lower Cretaceous exhumation. The Anti-Atlas thermal history, suggested by our modelling results, is characterised by an Upper Triassic to Dogger exhumation. Previous works show different results, as they do not consider a combination of fission tracks and (U-Th)/He dating for t-T modelling; neither the petrographic evidence from the Central Atlantic Magmatic Province related dykes, which suggesting that the outcropping rocks were at ca. 8 km in depth at 200 Ma. In the south, the Reguibat Shield post-Triassic rift exhumation starts in the Late Triassic and ends in the Early Cretaceous. After these exhumation phases, the above-mentioned areas are characterised by a mild subsidence.

The differences of exhumation timing directly influenced the location of source areas east of the Atlantic basins. Indeed, during the Early Jurassic, the Reguibat Shield and the Anti-Atlas were sourcing sediments to the W and to the N, as the WMA underwent subsidence. During the Early Cretaceous, however, the Anti-Atlas had stopped going up, while the WMA was being exhumed. Source areas were then the WMA and the Reguibat Shield, suggesting that the Anti-Atlas was completely to partially covered by Lower Cretaceous sediments.