

Syn- and post-rift anomalous vertical movements in the eastern Central Atlantic passive margin: a transect across the Moroccan passive continental margin.

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Traditional models of passive margin evolution suggesting generalised regional subsidence with rates decreasing after the break-up have been questioned in the last decade by a number of detailed studies. The occurrence of episodic km-scale exhumation well within the post-rift stage, possibly associated with significant erosion, have been documented along the Atlantic continental margins. Despite the wide-spread and increasing body of evidence supporting post-rift exhumation, there is still limited understanding of the mechanism or scale of these phenomena. Most of these enigmatic vertical movements have been discovered using low-temperature geochronology and time-temperature modelling along strike of passive margins. As proposed in previous work, anomalous upward movements in the exhuming domain are coeval with higher-than-normal downward movements in the subsiding domain. These observations call for an integrated analysis of the entire source-to-sink system as a pre-requisite for a full understanding of the involved tectonics. We reconstruct the geological evolution of a 50km long transect across the Moroccan passive margin from the Western Anti-Atlas (Ifni area) to the offshore passive margin basin. Extending the presently available low-temperature geochronology database and using a new stratigraphic control of the Mesozoic sediments, we present a reconstruction of vertical movements in the area. Further, we integrate this with the analysis of an offshore seismic line and the pattern of vertical movements in the Anti-Atlas as documented in Gouiza et al. (2016).

The results based on sampled rocks indicate exhumation by circa 6km after the Variscan orogeny until the Middle Jurassic. During the Late Jurassic to Early Cretaceous the region was subsequently buried by 1-2km, and later exhumed by 1-2km from late Early/Late Cretaceous onwards. From the Permian to present day, the Ifni region is the link between the generally exhuming Anti Atlas and continually subsiding offshore basins. Along strike, the rifted margin exhibits significant variability in the architecture of the Mesozoic deposits onshore and present day offshore shelf. North of the High Atlas, the ca. 2km thick Mesozoic succession is characterized by continuous sedimentation. South of the High Atlas the thickness increases to 6km in the offshore Tarfaya basin, where the Jurassic succession may be separated by a regional unconformity. Further south, close to the border with Mauritania, the Triassic to Jurassic succession is missing and the Cretaceous attains less than a kilometre of strata.

In the Meseta and High Atlas, studies documented a similar kinematic Mesozoic evolution, whereas in the Anti-Atlas Gouiza et al. (2016) and this study document a different evolution. In addition, the kinematic evolution of the Reguibate domain to the south is also different from the other segments, showing post-Variscan exhumation with amplitudes lower than the ones observed in the Anti-Atlas. These observations highlight changes in the pattern of enigmatic movements along the same passive continental margin thereby showing that passive continental margins are more complex than expected only a few years ago.

Gouiza, M., Charton, R., Bertotti, G., Andriessen, P. and Storms, J.E.A., 2016. Post-Variscan evolution of the Anti-Atlas belt of Morocco constrained from low-temperature geochronology: International Journal of Earth Sciences.