Insights into post-rift vertical movements of a mountain range in a passive margin setting: the thermal history of the Anti-Atlas across a WSW/ENE transect (Morocco)

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Recent low-temperature geochronology studies carried out in Morocco documented a post-Triassic rift and pre-Alpine orogenesis exhumation along the western passive margin. While its N-S extent seems to be continuous along the actual shoreline, studies focus neither on the landward width of the exhumation, nor its wavelength.

The Anti-Atlas is oriented WSW-ENE approximately perpendicular to the Eastern Central Atlantic margin. There, the rifting started in the Triassic leading to the development of the conjugate passive margins of western Morocco and eastern North America in the Jurassic and onward.

In this Variscan belt, the Late Jurassic-Early Cretaceous exhumation is assumed and modeled for the Western (e.g. Ruiz *et al.*, 2011) and Central Anti-Atlas (Oukassou *et al.,* 2013), and not implemented in thermal history models in the Eastern Anti-Atlas (Malusá *et al.,* 2007).

New apatite fission track and (U-Th)/He data were combined with existing radiometric data to reconstruct the thermal history of a WSW/ENE transect across the Anti-Atlas (inverse modelling with the HeFTy software solution), to estimate rates and amplitudes of vertical movement from the end of the Palaeozoic to the Present-day, and to constrain the width and wavelength of the exhuming area.

The results are in agreement with the previous geochronology works conducted in the Western and Central Anti-Atlas. Whereas they reveal that the Eastern Anti-Atlas was undergoing the Late Jurassic-Early Cretaceous exhumation as well during the drift phase. The Precambrian to Palaeozoic rocks in the entire Anti-Atlas, presently exposed at the surface, underwent km-scale exhumation from the end of the Palaeozoic to the Early Cretaceous, with a major pulse occurring during the Atlantic post-rift time (Middle Jurassic-Early Cretaceous). The width of the exhumation is therefore, at least, as long as the belt itself, i.e. ≥700km. These rocks were then deeply buried (up to 90°C) from the Late Cretaceous to the Palaeogene.

The Lower Cretaceous siliciclastic sediments from the adjacent Tarfaya basin are likely to be sourced from the Precambrian and Palaeozoic rocks of part of the Anti-Atlas, which, according to our results, were brought at/close to the surface and eroded during the Early Cretaceous. These sediments potentially form an important petroleum reservoir, as they are the main targets for on-going exploration in the Early Cretaceous plays offshore Morocco.

Malusà, M. G., R. Polino, A. C. Feroni, A. Ellero, G. Ottria, L. Baidder, and G. Musumeci, 2007, Post-Variscan tectonics in eastern Anti-Atlas (Morocco): Terra Nova, v. 19, no. 6, p. 481–489, doi:10.1111/j.1365-3121.2007.00775.x.

Oukassou, M., O. Saddiqi, J. Barbarand, S. Sebti, L. Baidder, and A. Michard, 2013, Post-Variscan exhumation of the Central Anti-Atlas (Morocco) constrained by zircon and apatite fission-track thermochronology: Terra Nova, v. 25, no. 2, p. 151–159, doi:10.1111/ter.12019.

Ruiz, G. M. H., S. Sebti, F. Negro, O. Saddiqi, D. Frizon de Lamotte, D. Stockli, J. Foeken, F. Stuart, J. Barbarand, and J. P. Schaer, 2011, From central Atlantic continental rift to Neogene uplift - western Anti-Atlas (Morocco): Terra Nova, v. 23, no. 1, p. 35–41, doi:10.1111/j.1365-3121.2010.00980.x.