Geophysical Research Abstracts,
Vol. 11, EGU2009-10709, 2009
EGU General Assembly 2009

Evidence for contractional reactivation of a passive margin : the case study of the central Algerian margin

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There are few cases on Earth of ongoing passive margin inversion within a convergence of large continental plates. The northern limit of Algeria offers the opportunity to observe the initial steps of this process. A system of Plio-Quaternary folds and blind thrusts is observed from the Alpine belt of the Tell-Atlas to the foot of the continental slope offshore.

The formation of the northern Algerian margin started during the late Oligocene or early Miocene and occurred in a context of slow N-S trending convergence between Europe and Africa. The Algerian margin formed in a position of backarc relative to north-dipping Tethyan oceanic subduction, as a consequence of slab roll-back. The collision of the Kabylian blocks, which have moved from the European plate, occurred during the Burdigalian and was associated with the emplacement of the Tellian nappes on the Atlas foreland.

We focus here on the segmentation of the fold-and-fault system and on the amount of shortening that could be accounted for by the offshore part of the system. Our study is based on the interpretation of a bathymetry dataset at 50 m resolution and on the comparison of several seismic sections shot during the MARADJA 2003 and 2005 cruises (Déverchère et al., 2005; Domzig et al., 2006) with profiles from industry in different parts of the margin. We compare different segments of the margin that are associated to the collision of various Kabylian blocks.

From West of Algiers towards the Lesser Kabylies, we describe strong changes in the style of faulting, the distribution of deformation, the position of the thrusts compared to the Continent-Ocean boundary, and the timing of deformation (Yelles et al., in press, Kherroubi et al., in press). In particular, the position and number of young uplifted basins formed during the Plio-Quaternary contraction have different expressions along the margin; they appear to be at least in part controlled by previous basement highs of the deep transitional domain and by crustal heterogeneities inherited from the rifting and drifting stages. Salt tectonics due to the Messinian décollement is developing in the deep basin and interact in a complex way with crustal compressional structures.

On the basis of shortening estimates and time constraints based on the seismic images at various scale and on Messinian seismic markers, we obtained shortening rates on different segments of the margin. Although the styles and geometry of margin segments differ, shortening rates are of comparable magnitude and represent a significant part of the present-day Africa-Europe convergence.