Late Jurassic-Early Cretaceous Tectonics and Exhumation Onshore Morocco: Implications for terrigenous Sand Reservoirs in the Offshore of NW-Africa

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Lower Cretaceous terrigenous sands are widespread in the NW Africa offshore. They form an exceptional sedimentary episode in the otherwise monotonous Mesozoic succession and are a potential reservoir. The tectonics driving continental exhumation and erosion are poorly known as they occurred following the appearance of oceanic crust in the Central Atlantic (passive margin stage) and prior to the onset of Atlas shortening. Using low-temperature geochronology we have recently documented 2-3km of exhumation and erosion in the Moroccan Meseta (Ghorbal et al., 2008) during the Late Jurassic to Early Cretaceous and have proposed that this event was responsible for the terrigenous sediments observed in the offshore. We present now i) new low-T geochronology absolute ages, ii) a reconstruction of the strain regime controlling exhumation and, iii) the results of numerical modelling work we performed to constrain the evolution of the lithosphere of the Moroccan margin during and following rifting.

Our new data document that Middle Jurassic to Early Cretaceous exhumation and erosion affected also the High Atlas, the anti-Atlas and, further to the S, the Reguibate shield. The area experiencing exhumation was elongated in N-S direction and partly coincided with the “West Moroccan Arch”. The area was separated from the more distal parts of the passive margin by a domain of continuous subsidence presently in the coastal and continental shelf domains.

Structural studies document an overall contractional regime during exhumation in contrast with the general lack of tectonic activity assumed for passive margins. In the coastal areas of Morocco, shortening triggered and interacted with the growth of salt diapirs. Most of these diapirs entered the diapiric phase long before the onset of Atlas orogeny. Rocks eroded from the exhuming area were routed by a fluvial system and shed into the subsiding margin forming of submarine deltas such as the Tan Tan delta.

Using kinematic and finite element numerical models we investigate the lithospheric evolution of the Moroccan lithosphere during and following rifting with the main goal of understanding the processes controlling the anomalous vertical movements observed. Modelling results suggest that the activation of secondary convection cells at asthenospheric/lithospheric is necessary to explain the observed vertical movements.