Geological evolution, salt tectonics and petroleum potential of the Atlantic passive margins of Morocco and Mauritania

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The Atlantic margins of Morocco and Mauritania are among the oldest passive margins on Earth. They host the two major salt basins of the NW African margin, the Moroccan and the Mauritanian salt basins for which the east-American conjugate counterparts are the Nova Scotia salt margin and the Carolina Trough, respectively. The Moroccan and Mauritanian margins show a similarity in their stratigraphy, with Triassic red bed rift infill, followed by Early Jurassic salt, Jurassic to Early Cretaceous carbonate platforms, and a marine clastic infill in the Cretaceous and Tertiary. They also show a remarkable broad homogeneity in their geodynamic evolution that can be subdivided into two main phases: a rifting phase that started in Late Triassic to Early Jurassic times, followed by a drifting phase which initiated around 180-170 Ma.

The Essaouira-Agadir segment of the Moroccan Atlantic margin is characterized by the incursion of the salt basin into the onshore and by the interception of the passive margin by the High Atlas Alpine Fold belt. Therefore, from Upper Cretaceous onwards, this segment underwent a NNE-SSW compression resulting from the Atlasic orogeny and leading to: (i) the inversion of Triassic faults, (ii) the formation of salt anticlines in the onshore basins and (iii) to the formation of a flexural basin in the offshore. This flexural basin is characterized by a thick northward wedging Cretaceous series and NE-SW striking décollement folds. These folds which correspond to the Cap Tafelney fold belt constitute a system of lateral ramps which terminate the Atlas system at its intersection with the Atlantic margin and marks the transition from a thick-skin deformation style in onshore to a thin-skin deformation style in the offshore. Triassic-Liassic salt played an important role in the genesis of these structures. It was injected upward into the anticlines along strike from a basal décollement and eventually encounters the slop and initiates basinward raft sliding systems. Large allochthonous salt bodies thus developed and terminate westward by a toe thrust zone.

Salt was deposited on Moroccan and Mauritanian segments of the NW African margin in Upper Triassic to Liassic Times. In Morocco, the CAMP basalts can be found in the salt, in many cases interpreted as sills. The Moroccan salt basin has an along-strike length of about 1000 km and an average of 100 km wide dip-oriented segments, locally extending even onshore. In contrast, the Mauritanian basin is only about 300 km long and has only an average of 50 km width in a dip direction. The effects of the post-sedimentary mobility of salt on sedimentation and on structural styles are analyzed in both basins and linked to the main stages of their geodynamic evolution. Salt was deposited during the syn-rift, or more specifically, the syn-stretching stage of continental rifting between the African and North American plates, therefore it has a patchy, discontinuous original distribution in fault-controlled extensional troughs. A great variety of salt structures were identified including gentle salt-cored folds and pillows, compressional diapirs, salt withdrawal synclines and completely allochthonous pluri-kilometric salt sheets and canopies which are bounded to the west by toe thrust salt structures that overly the oceanic crust in the deep offshore basin. Salt played an important role in the genesis of most of the structures presently encountered in this area. In the Cap Tafelney High Atlas, salt-provided regional décollement levels for Cenozoic thrust-folds during the inversion of the Moroccan margin due to the Atlas mountain building. Therefore the overall pattern of salt tectonics is more complex in Morocco than in Mauritania. A great variety of favourable settings for possible hydrocarbon traps are offered by this particular tectono-sedimentary framework.

In this presentation we propose to review the main stratigraphic and structural features that characterize the Moroccan and Mauritanian Atlantic margins with a description of their salt tectonics and a review of the role the Triassic salt played in the structural evolution of the onshore/offshore Essaouira Basin and the Western Atlas. The description is essentially based on regional seismic transects and borehole data. This is the best way to directly compare the basin-scale geometry of different segments of the Margin.

References

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