

Structural analogy between the inverted structures of the Moroccan Atlas system and the Syrian Arc structures of the Eastern Med

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Neotectonic inversion and uplift of the Atlas system, as the result of African-Eurasian plate convergence, is well documented in the Essaouira Basin and the western High Atlas, onshore Morocco. However, seismic reflection data acquired in the offshore Essaouira-Safi segment of the Atlantic margin of Morocco show the presence of similar compressional structures in the deepwater area as well.

These unusual structures are best imaged outboard of the salt basin, some 200 km to the west from the coastline in water depth of 2,000-4,000 m, but still over highly extended continental crust. The anticlines have a general NW-SE to WNW-ESE trend based on regional-scale 2D seismic reflection data sets. Based on the interpretation of 3D reflection seismic data, compressionaly reactivated syn-rift normal faults are responsible for these inverted structures which clearly involved the pre-Mesozoic basement.

Note that many of the prominent anticlines in the onshore Essaouira Basin have been interpreted in terms of salt detachment folding. Similarly, the Tafelney folded belt beneath the shelf of the offshore Essaouira Basin has also been interpreted as detached on the Triassic salt. However, the anticlines in the deepwater area are clearly controlled by basement involved faults. The age of these structures is mid-Tertiary, as they are truncated by an early Miocene unconformity. Moreover, in many cases these folds show fairly recent reactivation and have even bathymetric expression showing ongoing activity. Therefore the zone where the neotectonic shortening within the broader African-Eurasian plate-boundary is accommodated extends some 200 km offshore from the Atlas system onshore and it deforms the highly extended distal edge of the NW African continental crust.

Structurally analogous inverted features are very well documented along the northeastern African-northern Arabian margin (Syrian Arc), mostly onshore, including Egypt. These large-scale, northeast-trending asymmetric folds and associated contractional faults are well-dated and attributed to the "Santonian event" observed in many parts of the African plate. The traps within numerous Egyptian hydrocarbon fields are formed by the reactivation of these pre-existing inverted features. Also, Middle to Late Tertiary Syrian Arc style compressional features are present in the deepwater of the Eastern Mediterranean providing the traps for recent deepwater discoveries in the Levant. Therefore the pronounced similarity between the inverted structures of the Atlas system and those of the Syrian Arc in the broader Eastern Mediterranean has important implications for hydrocarbon exploration in Morocco.