

Expression of the Atlas Inversion Tectonics in Deepwater Offshore Morocco: Influence of Syn-Rift Structures on Post-Rift Deformation

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Neogene to Recent inversion of the Atlas system, as the result of African-Eurasian plate convergence, is well documented onshore Morocco. However, recently acquired and vintage academic reflection seismic data in the offshore Essaouira segment of the Atlantic passive margin of Morocco show the presence of inverted structures of mid-Tertiary age in the deep-water area as well.

These unusual structures are best imaged outboard of the widespread salt basin of Late Triassic/Early Jurassic age, 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/WNW-ESE trend determined first by a regional-scale 2D seismic reflection data set, also confirmed by a subsequent 3D seismic survey. Compressively reactivated syn-rift normal faults are responsible for these inverted structures which clearly involved the pre-Mesozoic basement.

The areal extent of the inverted structures coincides with that of the deepwater Tafelney Plateau and show not only anticlines as the result of the overall N-S compressional stress field, but also a broad, neotectonic updoming of the Tafelney Plateau as the offshore continuation of the uplifting Atlas trend. This interpretation is supported by several observations: a) the unusual concave-upward bathymetric profile of the Tafelney Plateau, b) lack of a pronounced shelf-break; c) pronounced truncation of Tertiary and Cretaceous rocks at the seafloor; d) isopaching and flattening on several Tertiary seismic horizons and e) analogue, well-exposed E-W trending anticlines in the onshore Essaouira Basin.

The localization of late post-rift inversion and neotectonic arching within the Tafelney Plateau is the result of its syn-rift structural inheritance, as it acted as a high-relief accommodation zone during the opening of the Central Atlantic.