

A New Permo-Triassic Tectono-sedimentary Model for Northern Africa: Challenging the Prevailing Models

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Abstract

In Morocco, Algeria, Tunisia and Libya, Permian and Triassic reservoirs host significant hydrocarbon resources, but many areas remain both poorly explored and poorly understood, and their potential untapped. This is partly because the focus of exploration has been largely on the established Lower Paleozoic plays, partly because the sedimentary record of the Carboniferous to Permian is often incomplete or because the interval is poorly dated, comprising mostly non-marine sediments. The interval is characterized by stacked angular unconformities recorded at the end Carboniferous to Permian. Because these successive erosional events are typically difficult to date, they are often ‘grouped’ under the generic term “Hercynian”, but this has hindered understanding of the tectonic evolution and relationship of the Upper Paleozoic to the overlying Mesozoic sediments. To address these many uncertainties, we present observations from an integrated dataset from Morocco to Libya, and propose some new ideas that challenge the “established tectono-stratigraphic model” for the Permo-Triassic of North Africa, with significant implications for hydrocarbon exploration. The generally accepted tectonic / stratigraphic model for this part of North Africa has the climax of the Hercynian Orogeny taking place during the Late Carboniferous. This is followed by a long-lasting rifting phase occurring in Morocco, Algeria, Tunisia & Libya from the Late Permian to the Late Jurassic (~100 Ma) thought to relate to the opening of the Neo-Tethys Ocean. Analysis of an extensive subsurface and outcrop dataset offers a mega-regional overview of the structure and stratigraphic relationships during the Permo-Triassic in Northern Africa, that demonstrates the absence of significant major rifting / extensional tectonic deformation in the Permian and early Triassic of eastern Morocco, Algeria, Tunisia & Western Libya. Accommodation is largely characterized by broad sag type basins, with minor faulting, or re-activation of older basin boundary faults. Subsurface & outcrop data from Morocco & Tunisia show that the Permian, Triassic & Early Jurassic sequences record common evidence of coeval compressive deformation, in form of large scale and low amplitude folded undulations, repeat stratigraphic sections in wells and reverse faults/thrusting observed at outcrop and on seismic. We present new alternative tectonic and sedimentary models for the Permo-Triassic of North Africa, which potentially has significant implications for understanding the evolution of northern Gondwana during the Hercynian collision with Laurasia and applied implications when address potential reservoir distribution and trapping for hydrocarbons.