

Architecture and Kinematics of the Talemzane Arch, North Africa

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Abstract

The Talemzane Arch (TZA) is a large structural feature, only recognised in the subsurface, that extends over 1000km from Algeria to Libya. It follows an approximate E-W trend, sub-parallel to the Saharan Platform northern boundary. Although relatively poorly understood, it appears to represent a complex of regional-scale Precambrian basement-cored anticlines involving deformation of the Palaeozoic and Mesozoic cover. The folded sedimentary section was truncated during several erosional events during the Carboniferous, Late Permian, Triassic, Jurassic and Early Cretaceous testifying to its importance as a large and long lived structure (e.g., Dixon et al., 2010). Carboniferous to Early Triassic sediments onlap the northern flank of the TZA, whilst its eroded crest (a composite erosional surface separating the Palaeozoic and Mesozoic successions) is covered by Triassic and (locally) Jurassic sediments. The precise timing of the arch formation is uncertain, though most authors suggested uplift in the Late Devonian and/or shortening related to the Variscan orogeny (e.g., Ben Ferjani et al., 1990; Frizon de Lamotte et al., 2013). Palaeozoic basins in the vicinity of the TZA (Ghadames, Oued Mya, Illizi, Timimoun, and Bechar Basins) have been the locus of many systematic investigations (e.g., Underdown and Redfern, 2008), whereas the arch itself has not been extensively studied and its detailed architecture and structural evolution remain elusive. Likewise, the nature of the connection between the arch and its counterparts in Algeria and Libya is not fully documented. In order to advance knowledge of the arch, we present a reconstruction of its architecture based on detailed mapping (subcrop, depth, and thickness maps), well-correlations, and interpreted seismic lines (compiled into the NARG GIS database), in the form of regional cross-sections and a 3D model. Subsequently, a kinematic restoration of the constructed model is performed with the aim of proposing an integrative structural reconstruction of the TZA evolution from the Ordovician to the Cretaceous. Our initial results suggest topographic growth in the Carboniferous, resulting in a regional topographic high that prevented Permian marine sediments from transgressing further south onto the Saharan Platform. Recognition of compressional structures in the Upper Triassic suggest an enigmatic shortening pulse that affected its northern flank, as well a more recent tilting of the Mesozoic series to the south.