

Structural Framework and Tectonostratigraphic Controls on the Evolution of the Turbón and Serrado Anticlines, South-Central Pyrenees, Spain

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Abstract

There is a growing industry interest in contractionally rejuvenated salt structures in fold-and-thrust belts such as in the Campeche deep water fold belt or the mature fields in the Northern Calcareous Alps beneath the Vienna Basin. The highly variable geometries that result from the deformation of pre- and syn-contractional salt structures and minibasins require three-dimensional analysis. This analysis can only be accomplished by understanding the pre-contractional salt systems, the influence of salt on deformation, and modern salt tectonic concepts. By integrating field work and subsurface data (seismic and wells), we introduce the Turbón and Serrado anticlines from the Spanish Pyrenees as excellent outcrops to understand the geometries and kinematics of contractionally rejuvenated salt structures. The Turbón and Serrado anticlines are detached on Triassic salt, involve thin Mesozoic stratigraphic series, and developed during uppermost Cretaceous times as shown by overlapping turbidites. These anticlines run N-S, perpendicular to the structural trend of the South-Central Pyrenees and display shorter wavelengths than the nearby salt-controlled Cotiella and Las Aras Cretaceous depocenters. Structural restorations were constructed to understand the geometry and kinematics of the salt structures and show the temporal migration of the Cretaceous depocenters. The deposition of synfolding turbidites facilitated the development of the Turbón lift-off anticline. The Serrado anticline involves thicker stratigraphic series and shows a fault-propagation fold

geometry. Branch line maps were generated to understand the geometry of the underlying thrust system and illustrate the relationship between structurally higher salt-detached structures and lower, younger basement-involved thrusts; this thrust stack is responsible for the observed structurally higher position of the Turbón anticline and Las Aras depocenter. The Turbón and Serrado anticlines likely developed in a major relay zone characterized by thin stratigraphy on inflated Triassic salt on the southern margin of the Pyrenean Rift System, adjacent to major salt-controlled depocentres. Understanding the evolution and kinematics of these structures is important as they can be used as analogues for deep water fold-and-thrust belts (such as Campeche) and de-risk new leads in mature fields such as the Northern Calcareous Alps plays beneath the Vienna Basin.