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3D geological structure of Le Danois basin (North Iberian Margin) between 3º and 5º W

Patricia Cadenas, Gabriela Fernández-Viejo, and Jorge Gallastegui
Departamento de Geología, Universidad de Oviedo, Oviedo, Spain (pcadenas@geol.uniovi.es)

This study shows a 3D geological interpretation of Le Danois Basin from the analysis of a dense set of high quality seismic reflection profiles together with boreholes, well logs and previous studies. The available data were acquired for oil exploration purposes in the North Iberian Margin, an extensional margin, separated from the Armorican counterpart during the opening of the Bay of Biscay in the Mesozoic. This margin was moderately inverted during the Alpine orogeny, when the Cantabrian-Pyrenean realm was formed in the North of the Iberian Peninsula and the Bay of Biscay was partially closed.
Well data compilation and correlation led to the recognition of different stratigraphic units. The average velocity was deduced from sonic log tests, allowing the correlation with the seismic horizons, in order to obtain a 3D geological model of the studied area.

The results show a deep trench filled with a thick mesozoic sequence uncorfomably covered by the cenozoic materials. The stratigraphic sequences, distinguished by their reflectivity patterns, geometrical relationships and structural features, show evidence of the three main tectonic events: 1) the extensional regional period from Permian to Upper Cretaceous, whose main recognizable structures are normal faults and asymmetric basins, filled by the Upper Jurassic to Lower Cretaceous synrift deposits which uncorfomably overlays the Lower to Middle Jurassic prerift materials; 2) the Upper Cretaceous passive margin stage, depicted by the formation of constant thickness deposits; 3) the Alpine compressional period, when reverse faults and related folds were formed by the inversion and reactivation of the previous extensional ones, at the same time that the Oligocene to Middle Eocene synorogenic material were deposited in minor basins, and diapirs were squeezed.
From the structural patterns and spatial distribution of the stratigraphic sequences, three main domains, limited by four major normal faults, can be differentiated: 1) the southernmost area, where a minor trench is formed in relationship with a major inverted normal fault. It is filled by a thick sequence of cenozoic synorogenic deposits which uncorfomably overlays the thin extensional one; 2) the Asturian basin, a deep and wide trench filled by a thick sequence of synrift deposits, with a maximum thickness of about 5000 meters at the depocenter, which gradually decreases up to 1000 meters towards the edges, covered by the synorogenic materials, with a maximum thickness of 500 meters in the syncline structures which gradually decrease towards the anticlines, formed as a result of the fault inversion and diapir squeezing; 3) Le Danois Basin, a minor graben located in the northernmost edge, limited by a major horst structure and Le Danois High. The extensional basins geometry and the thrust emplacement cause a gradual uplift of the basement and the sedimentary sequence towards Le Danois High, where local erosional truncations, onlap geometries and unconformable surfaces are developed within the cenozoic syntectonic deposit.