

3D seismic interpretation of inverted salt-related structures of the Broad Fourteens Basin

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ABSTRACT

The Broad Fourteens Basin (BFB) located in the Southern North Sea is a NW-SE intracontinental rift basin formed during Mesozoic that was subsequently inverted during Late Cretaceous times. The BFB is characterized by a complex evolution which involved extension, inversion and salt tectonics. The diverse extensional pulses from Permian to Early Cretaceous lead to the development of the main geometry of horsts and grabens in the BFB. Following the extensional pulses the basin was affected by different contractional stress fields oblique to the pre-existing structural trend during Late Cretaceous and Early Tertiary, giving place to the inversion of the basin. The main evaporitic unit corresponds to Zechstein Permian salts which played an important role during both extension and inversion deformation. The inherited extensional structures can control the contractional deformation which can also be influenced by the presence of this evaporitic regional layer. This study is based on the detailed 3D seismic interpretation of blocks Q1-Q4 and focuses on the structural style resulting from the inversion of the basin. In this study 7 key seismic horizons have been interpreted to understand the basin evolution and the structural style of the BFB. The construction of depth maps and a 3D structural model were achievable based on the seismic interpretations of horizons and faults. The results of this interpretation exhibit how the Zechstein salt layer decoupled the sub-salt structural style from the supra-salt structural style. Sub-salt units are characterized by steeply-dipping normal faults whereas the supra-salt ones are affected by both extension and contractional deformation and characterized by the reactivation and formation of thrusts. The Zechstein unit strongly controlled the basin evolution and the hydrocarbon system. This salt detachment regional unit allows the decoupling of sub- and supra-salt structures where Zechstein is considerably thick, but in the areas where salt is thinner the deformation is propagated from the sub-salt to the supra-salt units.

Keywords: Broad Fourteens Basin, Oblique Inversion, Salt Tectonics, Southern North Sea, Zechstein