

Tectonic history of Hoop Fault Complex – Implications on fault transmissibility, Barents Sea/Norway

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The Barents Sea consists of several tectonic elements, which were formed at different plate tectonic collisional and rifting stages. This work focuses on the Early Mesozoic to recent events of the central Barents Sea, the eastern edge of the Bjarmaland platform. We have analysed the clastic deposits of Mid-Triassic to Upper Jurassic to reconstruct the tectonic history of the Hoop Fault Complex, Barents Sea/Norway. The obtained results served as input for a fault seal analysis (FSA). Apatite fission track and (U-Th)/He thermochronology were used to determine the maximum burial depths and exhumation history. According to the combined evaluation of results from shale ductility analysis (BIB-SEM), fault kinematic analysis and structural modelling (section balancing based on a 125 km long 2D seismic section line) the following tectonic evolution can be drawn: deflation of late Palaeozoic salt deposits was initiated by the tectonic activity on the early structures of the Hoop Fault zone. The orthogonal faults of the Hoop Fault Complex developed at the early stage, during Late Triassic to Early Jurassic times at relatively shallow depth, below 1,000 m. Ongoing subsidence related to the extension caused by the opening of the Atlantic Ocean created accommodation space for Upper Jurassic to Cenozoic deposits with maximum burial depth of 2,000 m for the analysed Mid-Jurassic rocks. The exhumation of the Hoop Fault complex started around 10 Ma and remained constant until Quaternary times (140 m/Myr). The purpose of this study was to use the quantified results as input to model and determine the sealing capacities of faults compartmentalizing a hydrocarbon accumulation. The fault rock calibration workflow requests a depth at time of faulting and maximum burial depth in order to perform a shale to permeability transform. Well-constrained values are crucial to limit the range of uncertainty with respect to fault transmissibility. Our study shows the importance of thorough reconstruction of the tectonic history and the impact of the expected results.