Deformation History of the Norwegian South East Barents Sea: Results From Regional 2-D Seismic Interpretation and Sequential Restoration

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ABSTRACT

After 40 years of dispute over maritime borders in the Barents Sea between Norway and Russia, an international agreement was reached in 2010, and the area became available for hydrocarbon (HC) exploration. We present an interpretation and sequential restoration of a regional 2D seismic line, NPD-BA-11-203. It runs parallel to the Russian border and is key to understanding several Jurassic HC plays in the SE Barents Sea. The goals of the restoration were to understand the timing of trap formation, and the impact of diapirism on the continuity of reservoir and seal rock deposition. Seismic interpretation reveals that the location of structural traps in the Jurassic HC plays is controlled by the facies of underlying Permocarboniferous sediments: Prospective dome structures form by inversion of Permocarboniferous basins and lagoons, especially where they contain mobile salt. Permocarboniferous platform and reef carbonates, on the other hand, resist later folding due to their stiffness, and no structural traps form above them. Based on the sequential restoration, the tectonic history of the SE Norwegian Barents Sea can be summarized as follows: During the Permocarboniferous, the basin was structured into carbonate platforms, reefs and lagoons, with WNW-ESE striking grabens and half-grabens. During the earliest Triassic, high sedimentation rates lead to the deposition of the Havert Fm. At the same time, subsidence of the NE-SW striking Nordkapp Basin started and salt flow was initiated under this extensional tectonic regime. In Middle Triassic to Jurassic times, the Kobbe Fm and Kapp Toscana Group sediments were deposited, with decreasing sedimetation rates, in a time of relative tectonic quiescence. A very slight regional tilt is visible, probably related to the uplift of the Fedinsky High. During the Late Jurassic, the Fuglen and Hekkingen regional seals were deposited without tectonic disturbance. The Base Cretaceous (“BCU”) is conformable and non-erosive in the area. Early Cretaceous (Barremian) sediments are downlapping onto the BCU. During the ?Oligocene to Miocene, a mild, roughly N-S directed compression lead to buckling and inversion, creating the prospective traps. Numerous extensional faults dissect the domes and must be of Pliocene to Pleistocene age. During the Pleistocene, there was a strong pulse of uplift, and about 1000-1500 m of Cretaceous to Tertiary strata were eroded. The present day seafloor is an angular unconformity.