

Structure and petroleum prospectivity of the Dutch Central Graben and neighbouring platform areas

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Structural interpretation and seismic mapping of the Dutch Central Graben and its neighbouring Cleaver Bank and Schill Grund platforms has provided evidence for a complex history of halokinesis, Jurassic rifting and Cretaceous/Danian inversion tectonics. The graben in this area is asymmetric: a well-defined fault terrace and lenses of Jurassic strata are present in the west, whereas to the east of the inversion axis the Jurassic is thinner and the faulting is more complex. The axial part of the graben is interpreted as an inverted hanging-wall basin, which formed over a westward-facing ramp of a ramp/flat listric-fault system. The inversion of the graben is thought to have resulted from a reversal of movement of the hanging wall with respect to the footwall. This inversion was accompanied by considerable lateral displacement of strata along planes of decollement formed primarily in Permian and Triassic salts.

The original distribution of Upper Jurassic sandstones (Lower and Upper Graben Sands and overlying Scruff Sands) was controlled by graben palaeogeography, particularly by the position of the controlling bounding faults. Structural and stratigraphic trapping of these potential reservoirs is determined by inversion tectonics. Away from the axis of the graben, the Lower Graben Sands are overstepped by the Middle Graben Shale, which in turn is overstepped by the Upper Graben Sands and Kimmeridgian succession. This relationship is accompanied by an erosional trend whereby the Upper Jurassic succession is increasingly truncated towards the axis of inversion. As a result, the graben margins are prospective primarily for the younger reservoirs (Scruff Sands) whereas the graben axis is prospective at stratigraphically deeper horizons (Graben Sands). During the Kimmeridgian and Volgian, high sea-level stands led to widespread flooding of the platforms and localised deposition of Scruff Sands well away from the graben.

The platform areas and the terraces of the graben are also prospective in the Permo-Triassic and Carboniferous. Within the Main Buntsandstein Formation, excellent reservoir sands are present throughout the area whilst a combined Lower Slochteren and Stephanian/Westphalian sandstone play is developed in the south of the area.