Paleozoic Frontier Plays Along the Western Flanks of the Northern North Sea Rift System (UKCS): The East Shetland Platform

Stefano Patruno[1] and William T. Reid[1]

[1]PGS, Weybridge, Surrey, United Kingdom.

ABSTRACT

Despite significant discoveries within predominantly Palaeogene-age reservoirs (e.g., Mariner Field) the East Shetland Platform (ESP) is underexplored, with only 10 wells per 1,000 km2. Mesozoic units are generally thin or absent whilst Paleozoic reflectors were often interpreted as acoustic basement on legacy seismic. Recent 3D towed dual-sensor broadband seismic surveys covering 17,500 km2 over the region straddling the edges of the ESP (parts of UKCS Quadrants 3, 8-9, 14-16) have allowed for clear imaging of the entire stratigraphic section. Following the 29th Frontier Licencing Round (2016), exploration efforts have shifted westwards on the ESP, and 7,701 line km of additional 2D regional dual-sensor broadband data were acquired, aimed at better defining the overall regional structures. Here, seismic interpretation and well analyses are combined to unravel the tectono-stratigraphic architecture and prospectivity of this large frontier region. Oil seeps in the centre of the ESP suggest a working source rock. Oil charge could be delivered by lateral migration from 'traditional' upper Jurassic kitchens to the east and south. Additional charge may be provided by vertical/lateral migration from Devonian source intervals (c.f., Beatrice Field). Previous geochemical analyses postulated Devonian contributions for major fields around this region (e.g., Clair, Claymore, Piper fields). Burial history modelling suggests late generation/expulsion from the Devonian over parts of the ESP. Pre-Tertiary horizons have been mapped in 3D and a history of repeated tectonic inversions is interpreted. This created four regional unconformities, which merge into fewer, composite erosional surfaces on persistent platform highs. Elsewhere on the ESP, predominantly subsiding Permo-Triassic depo-centres contain a nearly continuous Paleozoic-Mesozoic succession. The most prominent of these, to the south and west of the Beryl Embayment, is here named the 'Crawford-Skipper Basin'. All existing hydrocarbon discoveries on the ESP are located in the immediate vicinity (<7 km) of intra-platform Permo-Triassic basin margins. Exploration close to such basins is less risky due to multiple possible positive influences of deep-seated structures on the petroleum system. These include: (1) formation of Meso-Cenozoic closures; (2) maturation of the Devonian source and presence of simple fault-related migration pathways; (3) enhanced viability of sub-Cretaceous reservoir-trap-seal configurations.