Re-Evaluation of a Post-Rift Unconfirmed Play in the Norwegian North Sea for Undiscovered Stratigraphic Traps

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Abstract

The Norwegian Petroleum Directorate (NPD) has confirmed that "During the last ten years, ~35% of the targets in the Norwegian part of the North Sea have been related to stratigraphic traps while ~65% to structural traps". This supports the hypothesis that the Norwegian sector of the North Sea may match that of the UK sector of the North Sea where the largest proportion (33%) of the undiscovered resources are believed to be hosted within stratigraphically-trapped post-rift reservoirs, predominantly in Paleogene deep-water strata. The study area is called NPC-4 which is classified as an unconfirmed play in the northern Norwegian North Sea. The focus of this study is on the Sele and Lista formations within the Rogaland Group of the Paleocene age with deep marine depositional environments. The goal of the research is mapping potential reservoir-quality deep-water sandstones. The available data includes: 2D seismic lines, 3D seismic surveys, well logs data, well reports, images of core samples for four wells, and 3D pre - stack seismic data. The methodology includes: 1) interpreting the available seismic data and identifying sequence boundaries and existing faults; 2) Doing Seismic facies analyses for the selected seismic lines; 3) Correlation of key wells; 4) Creating a lithofacies framework 5) Mapping the deep - water sandstones in the study area; and 6) Identifying the type hydrocarbon accumulation in those deposits. Sequence and seismic facies analyses have been performed for selected seismic lines depending on the bounding relationships, reflection configuration, reflection amplitude, and reflection continuity. Six seismic facies have been determined. Maximum Flooding Surface (MFS) at the base of the

package has been used as a datum to correlate logs from key wells for selected sections. This helped with identifying the architecture of the sandstone deposits in the study area. Good resolution images for the core samples from four wells in the study area were used to identify the lithofacies in Sele and Lista formations. Eleven lithofacies were identified in those core sample images. The 3D pre - stack seismic data have been used to do the Amplitude Versus Offset (AVO) analysis to identify the types of the hydrocarbons in the identified sandstone deposits. Seismic sequence and facies analyses helped isolate packages with a higher probability of deep-water sand deposits. Log correlations show compensationally stacking lobes forming a sand-rich lobe complex. No evidence for channelization has been documented in the logs, cores, or seismic data. Sedimentary structures in the available core images such as normal grading, the massive sandstone, the ripples laminated sandstone and the planar lamination are interpreted at Bouma Ta and Tb divisions. The fine-grained and thinly-bedded lithofacies suggest that existing cored wells most likely intersected the Sele and Lista along a lobe fringe.