Frøya High: An integrated reservoir study of the Late Jurassic sands

Authors: John Ford, Peter Wellsbury, Gary Mullins, Kay Hawkins, Graeme Petrie, Dean Rigby, Katharina Wien, Eduardo Carrillo Perera, David O'Connor, Gareth Williams and Kamala Sen.

Recent discoveries in the Pil and Bue prospects, targeting Melke and Rogn Formation sandstones on the footwall of the Vingleia Fault complex, have rejuvenated interest in exploration around the Frøya High region. The wildcat well, 6406/12-3 S (Pil 1), with estimated resources of 8.8-21.1 MMSCM[1], has focused current attention on combined structural-stratigraphic traps associated with proximal rift sedimentation, restricted to the eastern margins of the Southwest Basin, Halten Terrace.

An integrated reservoir quality assessment of the Late Jurassic Viking Group in the Frøya High region has been undertaken to aid in the understanding of sand distribution and reservoir quality variation in this area. In-house biostratigraphic review of key wells within the study area has produced a constrained temporal framework. This framework has been key to understanding the complex interplay of structural re-organisation and differing depositional settings across the Frøya High region, by tying sedimentation between the Froan Basin and the eastern margins of the Haltern Terrace. Where possible, this newly reviewed data has been tied to seismic and used to constrain a regional analysis of public domain 2D seismic lines. This analysis has delineated large 'troughs' running subparallel to the Vingleia Fault complex. These troughs were created during Callovian rifting with a lateral strike-slip component between two normal fault segments generating local transtension and greater subsidence. Towards the north of the Frøya High such troughs contain thick, mud dominated sediment piles comprising Callovian to Oxfordian aged, variably restricted shelfal facies. In Block 6406/12, sediments of similar age comprise stacked successions of thin turbidites to thick debris flow facies characterising proximally sourced, rift-initiated, fan sediment packages. These facies, identified through detailed core description work, have been up-scaled into the log domain and used to constrain the propagation of petrophysically defined 'electrolog facies' into the uncored intervals. This results in a more holistic understanding of the depositional systems, allowing for more accurate mapping of these complex fan and shelfal systems. The differing ages of sediments between wells suggest a complex series of discrete fans, which appear to 'young' towards the southwest. Broad, coeval sedimentation is only observed within the late Kimmeridgian to Tithonian section, where rates of sediment progradation appear greatest and such discrete fans appear to 'connect' updip to a broad linear to deltaic shoreline. Primary and secondary controls on reservoir quality have been established using CCA and in-house petrophysical data, coupled with integrated semi-quantitative and automated mineralogical analysis on c. 400 core and ditch cuttings samples. Across the study area, depositional textures (i.e. primary controls) are observed as a key reservoir quality controlling factor, and are of particular significance within the texturally immature rift-initiated fan sandstones in Block 6406/12.

[1] http://www.npd.no/en/news/exploration-drilling-results/2014/640612-3-b-and-640612-3-a/