

The Role and Value of an Integrated but Sedimentology-Led Approach to Creating New Value in Mature Basins – Lessons From a North Sea Discovery Around Basement Highs

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ABSTRACT

Exploration in mature basins requires an understanding of the key controls on prospectivity and lessons from analogues. One such, the Johan Sverdrup discovery in the mature Norwegian North Sea is estimated to hold between 1.7 to 3.3 Billion Barrel gross recoverable oil. A 2-day workshop organised by a Norwegian joint industry group provided an opportunity to view the cores from nine of the appraisal wells. This was accompanied by presentations from workers in the area. This workshop enabled an examination of key sedimentological data and the reservoir quality. Notes and sketches were integrated with regional geology knowledge and data sets which led to an improved understanding of the depositional model. Four major reservoir units were interpreted. Units A-C are made up of poorly sorted conglomeratic near source alluvial deposits, distal fluvial, floodplain and tidal-influenced deposits of the Vestland group. Unit-D is the better and thicker reservoir of the intra-Draupne formation (5-30 Darcy permeability and 24-32% porosity). Unit D is interpreted as partly gravity induced turbiditic flow mixed with continuing fan-delta deposition on a steep shelf. Transgressive lag over the Draupne formation suggests deposition within an overall transgressive system. Wells 16/3-2, 4 & 4a encountered weathered basement which constitutes part of the basal reservoir unit. The interpreted GDE model is that of an embayment with strong tidal influence in an overall transgressive system. Multiple sediment sources from fluvial systems reworked in estuaries accompanied by sediment gravity flows as the whole system is drowned. A sedimentology led integrated approach provides a “back to the basics” foundation for understanding the regional influences, integrating seismic and well-data and improving wellsite selection. This approach revealed where near source sand rich intervals were erroneously interpreted as shale on the Gamma ray log due to high potassium content. The need to improve stratigraphic definition of sand tops and regional sand distribution trends is also highlighted. Mass-flows do not necessary have to be accumulated downhill of highs, they may have been moved across the valley in different directions due to the prevailing depositional process – hence critical catchment and depositional analysis should be incorporated. It is expected that when executed properly, a sedimentology first approach is beneficial in unlocking remaining value in mature basins.