Identification of Agat Formation Sand Fairways on the Måløy Slope, Norwegian North Sea

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Abstract

The Early Cretaceous Agat Formation sands on the Måløy Slope, Norwegian North Sea, constitute a reservoir for oil and gas accumulations, such as in the Duva Field and Hamlet and Ofelia discoveries.

The Måløy Slope is the transition from the source area of the western Norway mainland to the deep sinks of the Northern Viking and Sogn grabens. Due to heavy sediment loading in the sink, the Måløy Slope was faulted into a set of basement-rooted, north-south-trending fault blocks, which dominate the structural setting. The basement is metamorphic and overlain by Jurassic and younger strata, both intersected by a system of west-east-trending canyons. These canyons have repeatedly acted as sediment feeders into the northern North Sea basin throughout Mesozoic and Cenozoic times where the Agat Formation sands are deposited as submarine channels and fans, derived from the Norwegian mainland.

Wireline log signatures have been used to identify sand bodies and sand quality which was then correlated to the analysis of seismic attributes across the study area. This provides a robust assessment of the lateral and vertical heterogeneities and reservoir complexity.
The high–quality seismic dataset used for this study facilitated a good interpretation of the top and base of the Agat Formation and allowed mapping of different intra-Agat sand intervals. The result of the interpretation has revealed thickness and lateral amplitude variations across the study area. The different sand intervals tend to pinch out towards the structural highs as sediments accumulate on the terraces before the channels bypass and the main depocenter moves to the next terrace downdip. This process results in a pronounced lateral facies variability. Correlation with the well data shows stronger amplitudes where deposits are thicker indicating potential sand-rich depositional features such as channels and lobes.

The variations in thickness, and facies are well-captured by a series of attribute maps, such as the root-mean- square, sweetness, and spectral decomposition, computed at different intra-Agat levels. Observations from the attribute extractions show many feeding systems into the basin from multiple directions, and several sand fairways are identified. These sand fairways exhibit elongated and linear geometries, enabling lateral differentiation of different sand qualities. Better-quality sands give brighter amplitudes than the background, as correlated with the wells drilled in the area. The amplitudes are dimming along the top of the pre-existing structural highs, where the sands appear thinner, as seen in Ofelia and Hamlet discoveries.

By mapping several intervals within the Agat Formation on the seismic and integrating the observations with amplitude maps and well data, we identify several sand fairways within the Agat Formation, and by analysing the facies variations derived from these results we can delineate better quality sands for hydrocarbon exploration on the Måløy Slope.