Predictive modelling of sandstone reservoirs in the central Scotian Basin, Canada

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The Nova Scotia offshore has been the site of several major hydrocarbon discoveries and continues to be an area of interest for oil and gas exploration, in particular the Early Cretaceous sandstones of the Missisauga and Logan Canyon formations, in which several oil and gas reservoirs have been discovered. Determining the distribution and quality of other potential sandstone reservoirs in Early Cretaceous units elsewhere in the basin is essential in de-risking exploration, particularly in the deep basin. This project uses *DionisosFlow*™, a forward stratigraphic modelling software, to produce a predictive stratigraphic model of the central Scotian Basin and reduce the risks associated with reservoir distribution and quality.

DionisosFlow™ uses a sediment diffusion equation that simulates sediment transport with regards to water discharge, sediment load, and slope for particles with differing grain properties (e.g., grain size and density), which are tracked during the evolution of the basin. This study proposes an integrated multi-disciplinary approach to forward stratigraphic modelling, which implements data from several fields of sedimentary research (e.g., detrital geochronology, geochemical fingerprinting of minerals, and petrological studies) to generate realistic model inputs based on major sources and their catchment areas. This approach accounts for variations in source input, activation, and composition based on geological evidence. Model results are calibrated against well logs, facies, and seismic interpretations of the study area to produce a predictive stratigraphic model. The predicted distribution of sediment classes is used to de-risk reservoir quality by tracking feldspar content throughout the basin to determine its influence on reservoir quality.

During the Early Cretaceous, the central Scotian Basin received sediments from three distinct river systems: the major Banquereau and Sable rivers, and the minor rivers of the Meguma terrane. At this time, salt withdrawal generated major listric faulting, allowing for the deposition of thick clastic successions on the shelf, with sediment transport to the slope and basin floor by a combination of canyon incision, and turbidity current flows. Model results indicate that potential sandstone units are trapped as the result of three main mechanisms: (1) shelf deposition as the result of listric faulting; (2) in mini basins formed by salt withdrawal along the slope; and (3) sediment draping in the deep basin. By combining these results with future interpretations of the influence of feldspar on reservoir quality in the Scotian Basin, this predictive model will be an effective method of de-risking exploration in the central Scotian Basin.

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