Reservoir quality controls in synrift facies of North Atlantic margin basins, offshore Newfoundland, Canada, and southwestern Ireland

SIMON F. GREENFIELD AND ANNE MCAFEE

Core Laboratories Integrated Reservoir Solutions, Redhill, Surrey RH1 2LW, United Kingdom

The varied success of exploration campaigns targeting Late Jurassic–Early Cretaceous sandstones in North Atlantic Margin basins prompts fundamental questions regarding the key controls on reservoir development and reservoir quality in this complex tectonic domain. Our approach to reservoir evaluation is to perform systematic rock-based sedimentology and detailed petrography of the full drilled succession in representative wells from all drilled basins. Our rock database for these North Atlantic basins includes 91 offshore wells from which we generated >2200 m of new core description and >700 new core and cuttings thin section analyses. The main conclusion of our studies in this region is that the structural architecture exerted strong influence on both facies composition and cementation trends throughout the Oxfordian to Albian evolution of the margin.

In the Porcupine Basin, delta top channel and shoreline sandstones are preserved in the highly faulted Connemara Field area, where grain size, sorting, and clay volumes are the main controls on reservoir quality. Farther east in the Spanish Point Field, fluvial and fan delta feeder systems discharged directly into a fault-bounded topographic low, leading to the preservation of thick massive/fluidized coarse-grained delta front turbidite deposits. Here, the sandstones are both compositionally and texturally immature and show strong compaction and relatively strong cementation by carbonate minerals.

The Late Jurassic succession in the Flemish Pass Basin is characterized by sharp-based, fluvial-dominated sand packages encased within mid to outer shelf mudstones. These Tithonian sandstones show variable cementation and hydrocarbon charge in adjacent wells, thought to be due to the circulation of fluids around venting faults. The Lower Cretaceous succession in the Jeanne d'Arc Basin is dominated by lower delta plain and shoreline facies, including thick packages of burrowed, fossiliferous shoreface sandstones (e.g., Ben Nevis Field). In these sediments, the main controls on reservoir quality are grain size, bioturbation type and intensity, burial depth and volume of carbonate cement.

Several genetically related late diagenetic features occur in both Upper Jurassic and Lower Cretaceous reservoir units. These features include fracture-associated sulfide mineralization and secondary porosity development, possibly related to Albian magmatic activity.

Atlantic Geology, 2018, Volume 54
Conjugate Margins Conference 2018, August 19-22, 2018
doi: 10.4138/atlgeol.2018.014