

Petroleum Systems and Risk Elements of the Offshore Eastern Canada

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Abstract

Source rock is a fundamental component of petroleum systems; coupled with reservoir distribution they are the two key risk elements in many basins offshore Eastern Canada. Significant issues in recent hydrocarbon exploration in the deepwater on this margin were the accurate definition of the main source rock intervals and detection of reservoir rock. Existing models of deepwater sedimentation have underestimated the links between shelf and slope sedimentation and the roles of sea level, salt tectonism, and canyon formation as sediment transport pathways. Mass failure and along-slope sediment transport are also significant processes in passive continental margin development. The consequence of these sedimentary processes is the inherent complexities of shelf to slope sedimentation patterns and movement of potential reservoir rock to greater depths than previously anticipated.

Hydrocarbon exploration offshore Nova Scotia began in 1959; nonetheless, the Scotian Basin remains virtually unexplored given low number of exploration wells (127 out of 207) and their concentration in the central Sable Subbasin. Testing focused on the successful rollover anticlinal plays (gas), yet the source and timing of hydrocarbon generation and migration pathways are not fully understood. On the other hand, over 1.3 billion barrels have been produced to date from the Newfoundland offshore margin. Here, the petroleum systems are better understood, but rely on one major source rock interval, the Kimmeridgian Egret Member, of the Rankin Formation. The single source interval in the Jeanne d'Arc Basin increases the risks associated with maturation and hydrocarbon migration. A proven petroleum system exists in the Hopedale Basin (Labrador margin), and expectations are high for further gas discoveries.

Research in the Basin and Reservoir Lab of the Dalhousie University focus on petroleum system and risk elements analysis on the Nova Scotia, Newfoundland, and Labrador shelves and deepwater offshore. Research includes the observation and geochemical study of selected cores to improve source rock understanding, reservoir outcrop analogs, overpressure and integration of these data with time-equivalent sedimentary series in eastern Canada and associated conjugate margins (Morocco, Portugal, Spain and Ireland). The extensive source rocks and reservoir analogs cropping out on the Western European and African conjugate margins suggest that exploration for hydrocarbons can test alternative (and new) play concepts, improving chances of success.