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"Heading for Deeper Water"

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Central Conjugate Margin Petroleum Systems of the Scotian Shelf and Slope, Offshore Nova Scotia – Evaluation of the Future Oil versus Gas Prospects and its Significance to Nova Scotian Energy Strategy beyond 2014

The Scotian Basin which covers an area between Louisiana and the Texas Offshore in the Gulf of Mexico has been considered to be one of the major petroleum provinces in the Central Atlantic Conjugate Margin bearing a resemblance with the late Triassic-Recent sediments from Offshore Morocco (other side of the Atlantic Margin) in relation to geological framework, play types, and salt mobilization histories. Three subbasins the Abenaki, Sable, and Shelburne, and Laurentian have distinct variability in the geological framework, salt dynamics, source rock potential, and hydrocarbon migration pattern. Although In the Scotian Shelf, 23 significant hydrocarbon discoveries have been reported from Jurassic, Cretaceous, Tertiary reservoirs within the Scotian Shelf, our geochemistry and modeling data suggests that the future discoveries may exist within the Jurassic section of the shelf. In the Scotian Shelf, three petroleum systems and four hydrocarbon families (light oil, condensate, and gas) were genetically correlated with the early Jurassic lacustrine (Cohasset oil), late Jurassic mixed marine/terrestrial Verrill Canyon (Kimmeridgian-Tithonian) (Venture Gas), and the marine Cretaceous to Tertiary Banquereau Formation (Primrose oil).

Contrary to the Scotian Shelf, the Jurassic-Tertiary sediments within the Scotian Slope, only 25 m overpressure reservoir sand (early Cretaceous gas/condensate) was discovered. The lack of hydrocarbon discoveries in the slope is closely related to five critical parameters that have influenced the variability of each petroleum system with each basin: *(a) heat flow in relation to allochthonous and autochthonous salt mobilization and basement fractures*; *(b) direction of turbidite channel forming sand mobilization and the bypassing of sands in relation to salt mobilization*; (*c) deepwater source rock anoxicity and clastic dilution in relation to the organic facies and the kinetics of the hydrocarbon charge factor*; (*d) the timing of the hydrocarbon flow movement in relation to the timing of the hydrocarbon trap; and (e) the*

survival of hydrocarbons and seal rock stability in relation to the upper Tertiary sediment section and listric growth faults.

The Petroleum System Risk Assessment (PSRA) within the Deepwater Scotian Slope sediments of Eastern Canada has predicted the presence of four viable petroleum systems within the Mid-Jurassic to Tertiary sediments. Based on the variability of the heat flow regime and clastic dilution issues in various parts of the Scotian Margin, gas and condensate (40:60 to 60:40 proportion) in various Late Jurassic to Tertiary reservoirs could be the main hydrocarbon components within the Scotian slope. These hydrocarbons are genetically connected to two late Jurassic to early Cretaceous Verrill Canyon marine source rocks which could be the most effective hydrocarbons within the subsalt turbidite fans and salt-related reservoirs in various mini-basins. Late Triassic to Early Jurassic lacustrine source rock might be able to produce Cohasset type 40 to 55 API light oil within the Tertiary turbidite fan reservoirs of the eastern Shelburne Subbasin. However, my PSRA research in association with (IES Inc., Germany – Currently Schlumberger Inc.) clearly demonstrates that early Jurassic sourced lacustrine oil may not be volumetrically significant to total overall hydrocarbon volume of the Scotian Slope.