

OTC 19053

Exploration Potential of the Deepwater Petroleum Systems of Newfoundland and Labrador Margins

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This paper was prepared for presentation at the 2007 Offshore Technology Conference held in Houston, Texas, U.S.A., 30 April–3 May 2007.

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Abstract

The deep and ultra-deep water petroleum potential of the Newfoundland and Labrador (NL) is poorly documented in the literature. Only nine wells were drilled in water deeper than 500 m and only one well has been drilled as an ultra-deep, >2000 m, test. However, the available seismic data shows that numerous large structural and stratigraphic traps are located on the slope and rise of the network of interconnected Mesozoic-aged rift basins, situated on the passive margin surrounding the NL continental shelf.

Introduction

Deepwater exploration plays in Atlantic Canada extend from the Georges Bank's slope in southern Nova Scotia, through the Scotian and Grand Banks slopes, through the Flemish Pass and into Orphan and Hopedale basins in the north (Figure 1). All these basins are situated in a divergent margin setting, similar to the Brazilian or Angolan basin margins.

Until recently, the *Laurentian Basin* found between the Canadian provinces of Nova Scotia and Newfoundland and the French Territory of St. Pierre and Miquelon remained unexplored due to a long jurisdictional moratorium. The basin contains an impressive thickness of Jurassic to Tertiary-aged sediments, including source and reservoir rocks and remains undrilled in the Canadian jurisdiction.

Two deep water basins located north-east of the Grand Banks of Newfoundland in an intra-continental setting are the *Flemish Pass* and *East Orphan* basins. A 2003 well in the *Flemish Pass Basin* - Mizzen L-11 - has proven the existence of rich Kimmeridgian-aged source rocks and had a 5 m of net oil pay in Late Jurassic sandstone ("Baccalieu" sandstone) reservoirs equivalent to the Jeanne d'Arc Formation in the Jeanne d'Arc Basin.

The *East Orphan Basin* contains an impressive number of large undrilled structures, has seismic sequences that correlate to the Kimmeridgian source rocks in the adjacent basins and is in a midst of an exploration effort by Chevron Canada and its partners. A first well in the basin, the Great Barasway F-66 was drilled during the 2006 fall/winter and was rig released on winter 2007 with a total depth drilled of 7404m but its results remain confidential. The *West Orphan Basin* has seen drilling only on bold or thinly covered basement blocks and may have Cretaceous mature source rocks within deeper grabens.



Figure 1. Location of deepwater basins offshore NL and of the representative deepwater wells Great Barasway F-66, Mizzen L-11 and ODP Leg 210 holes.

Additional deepwater petroleum potential exists in the *Hopedale Basin*, of Labrador Sea where recent 2D seismic data shows that deep synrift depocenters and thick sedimentary cover continue into the deepwater, where structural and stratigraphic traps are abundant and an oil play may be present.