

A Middle to Upper Ordovician Carbonate Shelf from Offshore Labrador, Canada, and its Contribution to the Hydrocarbon Potential of the Margin

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Abstract

Hydrocarbon exploration along the Labrador margin has been intermittent since the 1960's, with no economically viable quantities of hydrocarbons discovered. A gas show (Bjarni O-82), an oil show (North Leif I-05), as well as five Significant Discovery Licenses (SDLs) for gas along the margin has helped to maintain exploration activities in the offshore in the absence of a major discovery. Two of these SDLs are associated with Ordovician dolostones: Hopedale E-33 (SDL-203) and Gudrid H-55 (SDL-184). Despite the proven reservoir potential of the Lower Paleozoic rocks, little is known about the relationship between these deposits, the paleoenvironments that existed during their deposition, and their full hydrocarbon potential. Middle to Upper Ordovician strata are restricted to the Hopedale Basin (offshore Labrador) where they occur as isolated, laterally discontinuous packages associated with Cretaceous syn-rift structures. The Lower Paleozoic succession is encountered in seven wells and is dominated by carbonate rocks (limestones and dolostones) with some fine-grained siliciclastic strata in the Freydis B-87 well. Macro and micro (palynomorphs) fossil assemblages typical of shallow to intermediate carbonate marine environments, are here used to correlate the northernmost (Hopedale E-33) and southernmost (Indian Harbour M-52 and Freydis B-87) wells and suggest that an extensive Ordovician shelf once occupied the southern Labrador margin with the current distribution representing erosional remnants. The Lower Paleozoic of the Labrador margin has been

previously identified as a potential hydrocarbon play with proven dolostone reservoirs in Hopedale E-33 and Gudrid H-55, which contain Cretaceous gas condensates that migrated updip. The Ordovician limestones and clastic rocks may also have good reservoir potential locally depending on the degree of fracturing and diagenesis. Additional Paleozoic deposits, including potential source rocks, may also exist beneath untested Bjarni depocenters. Thermal alteration data from Middle to Upper Ordovician palynomorphs on the Labrador margin demonstrate that the Lower Paleozoic has the potential for the generation of early dry gas (~5+ to 6+). Furthermore, the presence of an unknown hydrocarbon in the Lower Paleozoic dolostones at Roberval K-92 (observed filling fractures and pores) suggests that we still don't fully understand the hydrocarbon potential of the margin and that there are still questions to be answered.