

Labrador Prospectivity 2025

Andrew K Hartwig, Henri Houlevigüe, Kyle Reuber, Susana Tierrablanca
TGS

Summary

A robust offshore 2D seismic database, complemented by two modern 3D seismic datasets, provides a unique perspective of subsurface prospectivity in the 2025 Southern Labrador Call for Bids. The combination of datasets reveals reliable regional maps of major geologic boundaries and cross sections exposing crustal architecture and depositional systems associated with the development of a proven, yet untested petroleum system on the slope and deep water. Heat flow measurements and coring samples have identified potential source rocks ranging from the Early Cretaceous Snorri Formation to the Paleocene Cartwright Formation (Enachescu et al., 2007), with evidence of potential reservoirs in Upper Cretaceous and Cenozoic clastic systems. Observations from extensive seismic interpretation provide insight into hydrocarbon exploration inside the Call for Bids territory by identifying potential AVO (amplitude versus offset) leads in new play types. The identification of leads and the presence of oil and gas shows on the shelf invites explorers to venture into the next frontier of the Northwestern Atlantic.

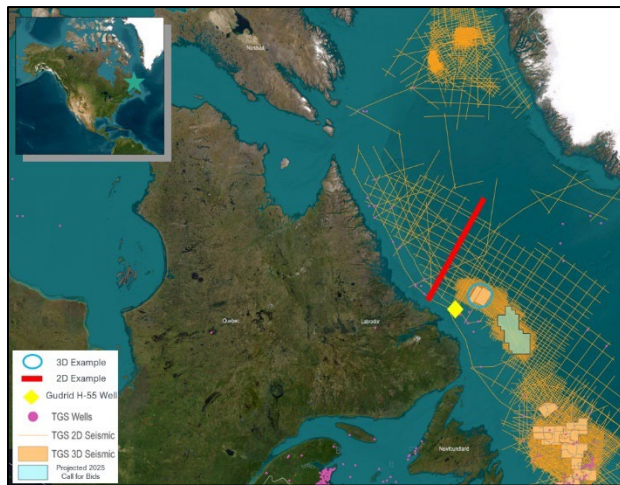


Figure 1. Map of study area, data library, Projected 2025 Call for Bids, and data examples.

Purpose

At the time of writing, the public announcement for the projected 2025 Call for Bids is roughly 20,000 km², squarely overlying Labrador's Hawke sub-basin, however past Call for Bids have not been limited to the published polygon. For example, the 2024 Orphan Basin Call for Bids Polygon was ~22,000 km² but the released area was ~102,000 km² thus requiring a regional approach to the evaluation of the available opportunities.

Methodology and Data

Over the past decade, more than 60,000 km of 2D seismic and ~6,200 km² of 3D seismic have been acquired and interpreted to develop a thorough understanding of Labrador Basin (Figure 1). 3D seismic and velocity models in time and depth domains, as well as a variety of dense 2D data, complemented with angle-stacks and attribute volumes, are utilized to visualize structural traps, stratigraphic pinch-outs, and amplitude-related hydrocarbon indicators. Arbitrary seismic lines and well data through the latest Call for Bids, highlight similarities and differences in exploration targets while also importantly differentiating the area from recent unsuccessful results in the Orphan Basin.

The Long offset 2D seismic builds our understanding of basin evolution by visualizing crustal features to over 30 km depth. Subsequent tying of the regional 2D observations into detailed 3D seismic attributes and well data enhances our understanding of the basin’s petroleum system and accompanying seismic responses.

Approximately 35 wells have been drilled in the last 50 years throughout Labrador Basin. Evaluation of the sparse well data from offshore Canada can be complemented by wells from its conjugate West Greenland Basin where comparisons show lithological similarities from potential source rocks in the Upper Cretaceous - Paleocene Markland Formation of Labrador, and the Itilli Formation of Western Greenland (Bojesen-Koefoed et al., 2004).

Observations

Seismic interpretation, facies mapping, and well analysis confirms regional observations of South-to-North oriented Cretaceous continental rifting and brief seafloor spreading between Labrador and Greenland. Horst and graben geometries, familiar throughout the rifted margins, display similar seismic character to petroleum systems currently being explored throughout the Atlantic realm. Interpretation on the regional 2D seismic lines within the 2025 Call for Bids area of interest highlights the angular, horst and graben basement framework displaying accommodation space for up to 3 km of syn-rift Lower Cretaceous Snorri Formation source rocks on the shelf and deep water of Southern Labrador (Figure 2). Where favorably juxtaposed in onlapping geometries against volcanic basement, clastic reservoirs of the Bjarni Formation with average porosity of 15%, can be charged (Carey et al., 2019), with alternative targets in overlying Tertiary toe-thrusts. Cretaceous units thicken in localized troughs and thin or bypass paleo-structural highs, setting up more widespread depocenters for Paleocene lacustrine or marine shale source rock to be deposited, subside into the oil window (Figure 2; Christiansen et al., 2020), and charge sandy deposits of the Paleocene Cartwright-Gudrid Member and Eocene Kenamu-Leif Member, evidenced by increase of amplitude with offset in 3D seismic (Figure 3).

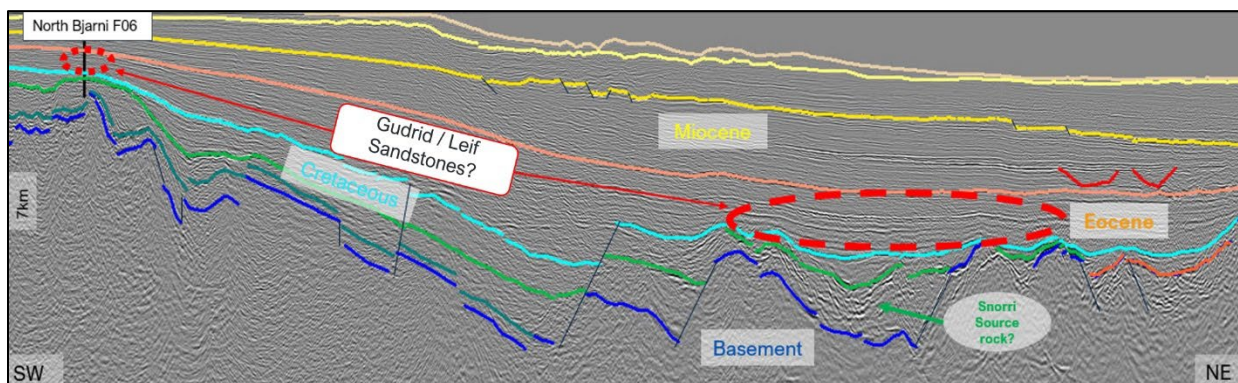
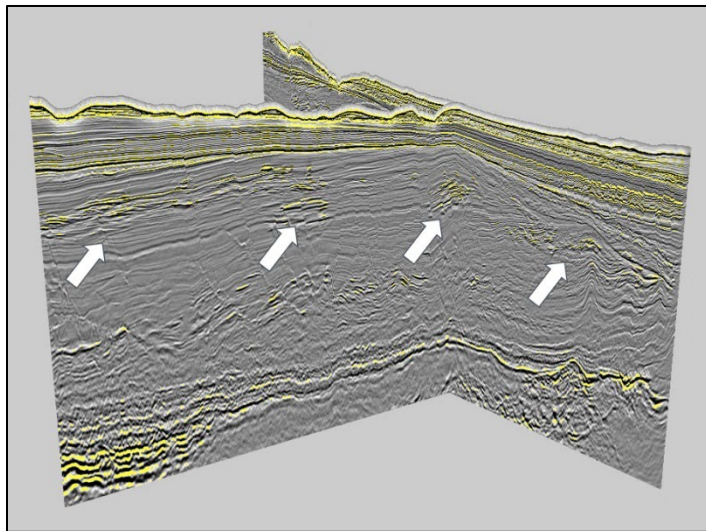


Figure 2. Regional 2D depth seismic cross-section displaying well-tied interpretation. The seismic section located in Figure 1 shows an expanded, down-dip depositional fairway and clastic reservoir potential with faulted migration pathways from the Cretaceous Snorri Formation into the Gudrid and Leif members.

Prospectivity Conclusion

The untested Eocene through Pliocene amplitude play shows promise. During the post-drift stage of basin development, subsidence and basinward tilting led to updip extension and downdip compression along a shale detachment. The Gudrid Member, within the Cartwright Formation, identified in the Gudrid H-55 well as a ~280 m thick sandstone, may expand its thickness to 800 m (Figure 2) with additional potential in the Mokami and Kenamu Formations (Figure 3; Enachescu et al., 2007). This section displays clear prospectivity on 2D seismic lines and corroborated in 3D domain, shows fault bounded amplitude anomalies in water depths from 700 m to 2,800 m.



Acknowledgements

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Figure 3.
3D seismic Inline/ crossline view of
Eocene – Pliocene amplitude
anomalies in far angle stack display.

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