

# OFFSHORE OPPORTUNITY - 2019 Call for Bids



## JEANNE D'ARC BASIN - NEWFOUNDLAND AND LABRADOR

### EXECUTIVE SUMMARY

On April 3, 2019, the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) announced a Call for Bids for the Jeanne d'Arc land tenure region. As part of the land tenure process, this area follows a 1-year cycle (mature region). A Call for Nominations for Parcels was announced in August 2018 and closed in January 2019. The Call for Bids was announced April 3, 2019 and will close November 6, 2019 at 12:00 p.m. NST.

The Jeanne d'Arc Basin is considered highly prospective for hydrocarbons and represents part of the North Atlantic Mesozoic rift network. This network includes the Flemish Pass, East Orphan, and Jeanne d'Arc basins where intense exploration and production activity has been ongoing for the past decade. There is excellent seismic coverage and the Call for Bids provides an opportunity to enter a highly productive, shallow water basin (Figure 1).

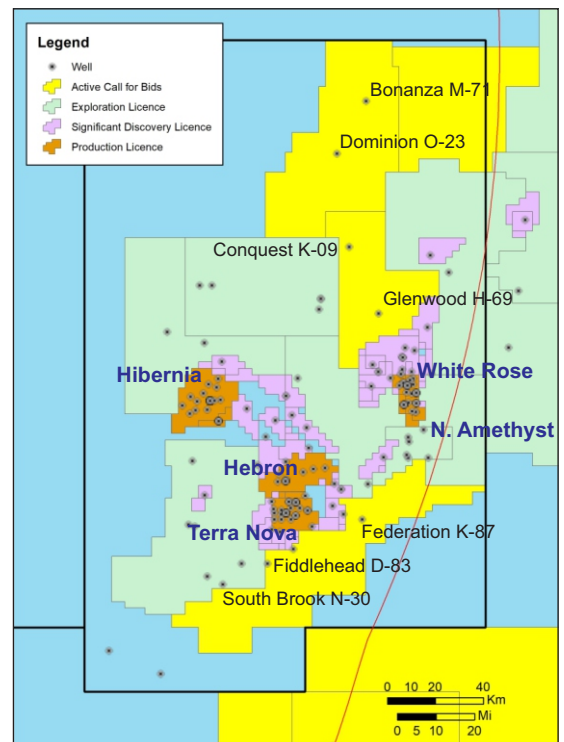
### OVERVIEW

Located on the east coast of Canada, the province of Newfoundland and Labrador is the country's only offshore oil producing region. Since 1996, the province's five producing fields – Hibernia (1997), Terra Nova (2002), White Rose (2005), North Amethyst (2010), and Hebron (2017) – have produced in excess of 1.8 billion barrels of light oil (32 - 35° API). The Newfoundland offshore area now produces over 225,000 bopd and output is estimated to increase to approximately 400,000 bopd when the Hebron field reaches peak production. Recently, the Province reached a framework agreement with Equinor Canada (formerly Statoil) to develop the Bay du Nord oil discovery in the Flemish Pass Basin. The project is expected to deliver first oil by 2025.

With substantial undiscovered oil and gas resource estimates and 1.8 million km<sup>2</sup> of prospective acreage with less than 7% having been held under licence, the NL offshore holds great potential. This potential will be further realized in the 2019 Call for Bids (Figure 1).

### KEY ATTRIBUTES

- The Call for Bids area consists of 4 parcels and totals 464,877 hectares (4,649 km<sup>2</sup>).
- Water depths range from 60 to 250 m.
- Modern seismic coverage including ties to representative wells.
- Public data available in recently launched exploration data room.
- Competitive fiscal regime with very low political risk.
- Proximity to both North American and European markets.
- The Call for Bids closes at 12 p.m. NST on November 6, 2019.
- The successful bid is based solely on work commitment.
- For more information, visit [www.cnlopb.ca](http://www.cnlopb.ca)



**Figure 1.** 2019 Calls for Bids in Jeanne d'Arc Basin, in yellow. Producing field names in blue.



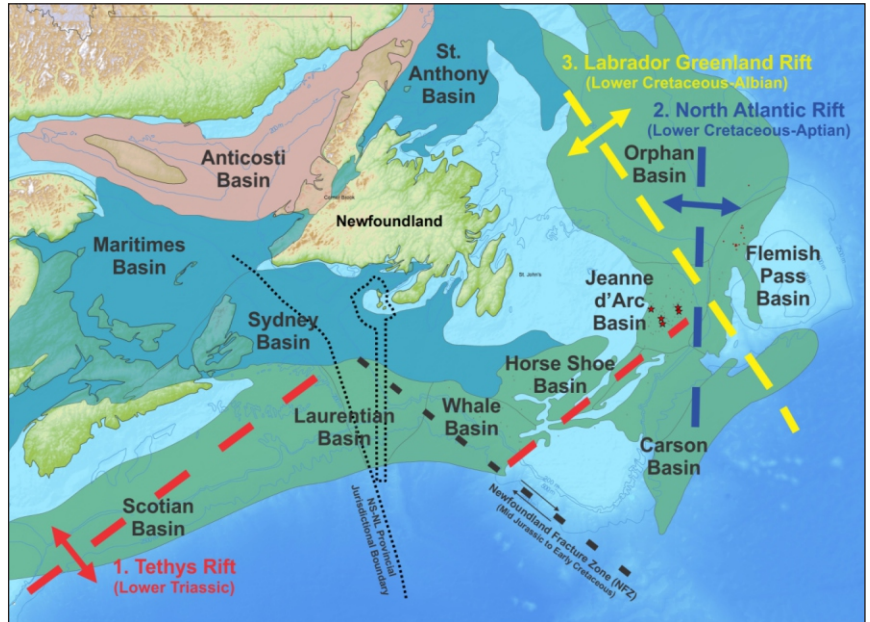
## REGIONAL GEOLOGY OF THE ATLANTIC MARGIN

The Late Triassic to Early Jurassic rifting of Pangea created a series of NE-SW oriented intra-cratonic basins extending from the Gulf of Mexico to the Barents Sea. In eastern Canada, the Mesozoic rift basin chain starts with the George's Bank Basin, offshore Nova Scotia, and stretches through the Scotian shelf and slope basins, including the Laurentian Basin, located between Cape Breton and Newfoundland (Figure 2). Further east along the southern Grand Banks are the shallow to deep water South Whale and shallow water Whale and Horseshoe basins. Around the Tail of the Bank sits the shallow to deepwater Carson Basin.

Northwards of the Carson Basin, the Mesozoic rift basin chain includes the shallow water Jeanne d'Arc Basin and the parallel, Central and Eastern Ridges, before sloping downwards into the deepwater Flemish Pass and Orphan Basins. Further to the northwest, seaward of Labrador, is the Hawke, Holton, Hopedale, Chidley, Saglek, and Henley extensional basins.

Most of the Newfoundland Mesozoic basins are confined, residing on continental crust within the Grand Banks and environs. Several other basins are unconfined, located at the continental margin, opposite their European conjugate basins in offshore Iberia and Ireland.

Other oblique and perpendicular rift branches, for instance the Bay of Fundy, Orpheus Graben, Aquitaine Basin, and Viking Graben also formed during the same series of extensional events.



**Figure 2.** Regional geology of the Canadian Atlantic Margin, showing main basins and phases of extension. Red stars are producing fields.

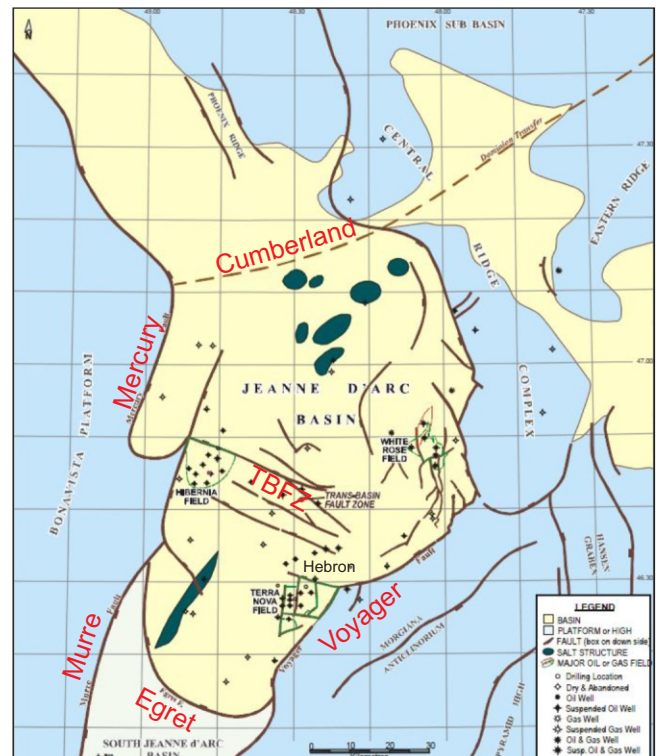
## JEANNE D'ARC GEOLOGY

The Jeanne d'Arc Basin is a large, funnel-shaped, intra-continental, half-graben that formed by extension on the Grand Banks and is part of a double-failed rift configuration. The basin is approximately 14,000 km<sup>2</sup> and is bounded to the west by the Murre Fault, to the south by the Egret Fault, to the east the Voyager Fault, and to the north by the Cumberland Transfer Fault Zone (Figure 3).

The basin deepens to the north and contains over 20 km of Upper Triassic to Cenozoic sedimentary fill in its depocentre, located to the north of the Trans-Basin Fault Zone and northeast of Hibernia. The basin consists of three synrift sequences, followed by three post-rift sequences, and finally by Late Cretaceous-Tertiary drift fill (Figure 4). The basin can be divided into two major stratigraphic sequences that are clearly recognizable on seismic data:

- An extensional stage (Late Triassic to late Early Cretaceous) that is compartmentalized by normal faulting and contains numerous structures, and
- A thermal subsidence stage (Late Albian to present) that is tectonically undisturbed, *i.e.*, no extension, but contains significant deposition and erosional features, including basin margin and floor fans.

Alongside extensional tectonics, prolonged halokinesis and halotectonics played an important role in basin evolution and architecture. The early sedimentary fill was the Argo Salt that



**Figure 3.** Major structural elements in Jeanne d'Arc Basin (modified after Enachescu, 1994). Faults in red, dark green circles are salt intrusions. TBFZ: Trans-Basin Fault Zone.

## JEANNE D'ARC GEOLOGY (continued)

later became mobile and created salt-induced structures in the overlying sediments. Salt pillows underlay the Hibernia, Terra Nova, and White Rose oil fields.

Oil-prone source rocks are present in the Late Jurassic (Callovia, Oxfordian, and Kimmeridgian) with the potential for other source rocks in the Early and Late Cretaceous and Early Tertiary.

Reservoir rocks in the Jeanne d'Arc Basin are predominantly high porosity, high permeability Late Jurassic to late Early Cretaceous sandstones. Stacked sandstone intervals include the Jeanne d'Arc, Hibernia, Catalina, and Avalon/Ben Nevis formations (Figure 4), most of which are alluvial or deltaic. Other excellent reservoirs are found in Late Jurassic Voyager and Late Cretaceous Dawson Canyon formations (Otter Bay and Fox Harbour members) and the Paleocene Avondale and South Mara members of the Banquereau Formation, but to date only a couple of smaller pools have been encountered at these levels (Table 1). Early Tertiary sequences are effectively untested but show potential for large oil and gas pools, especially to the north. The extensional and thermal subsidence stages in the basin should provide good seals, having thick overlying shales, very fine-grained clastics, tight sandstones, and carbonates. Cross-faults could affect seal potential.

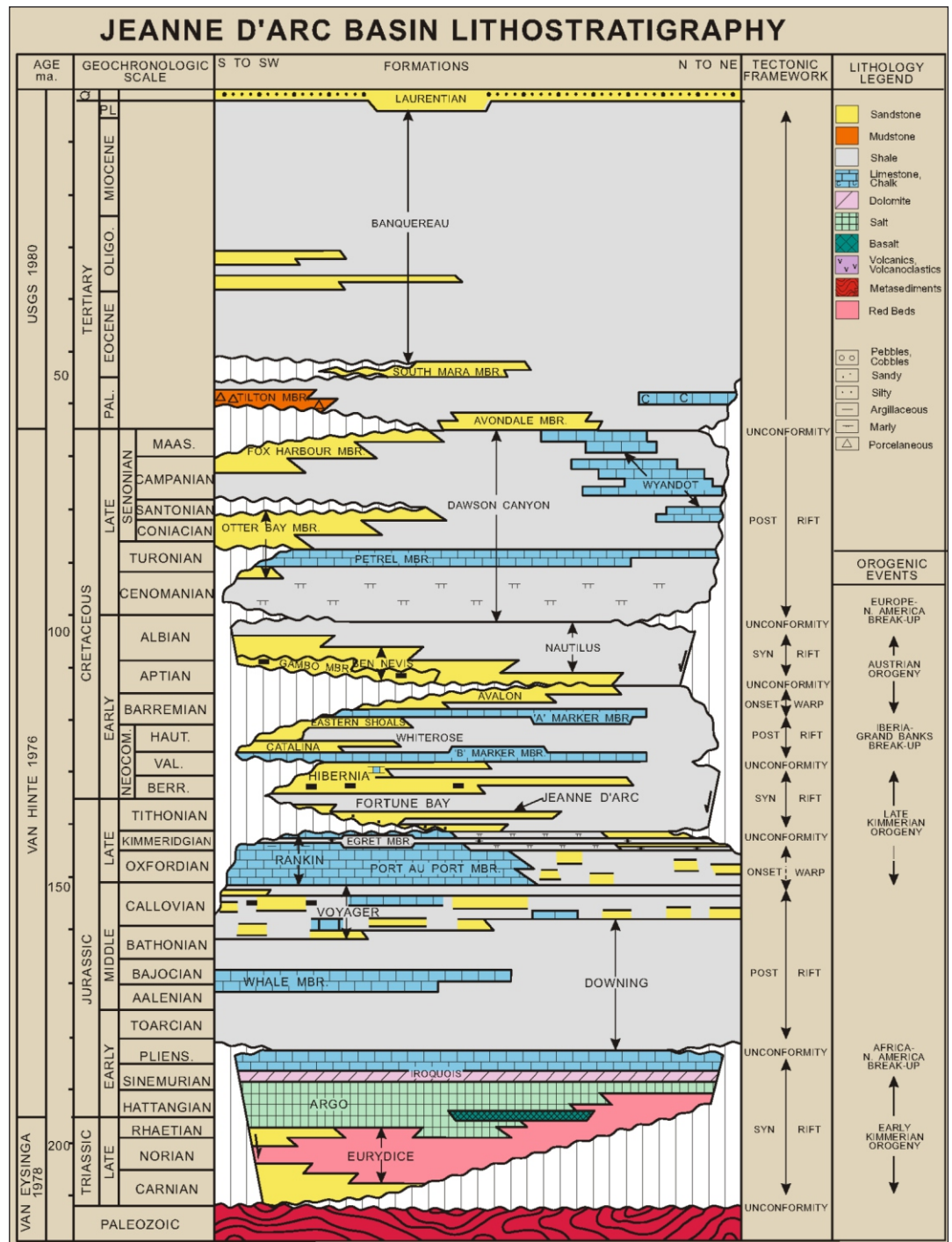
Existing fields have produced over 1.8 billion barrels of oil and considerable gas reserves and are summarized in Table 2.

Well Name	Year Drilled	Water Depth (m)	Total Depth (MD) (m)	Discovery? (Significant or measurable oil/gas shows)	Formation at TD	Reservoir Intervals	Well Status
<b>Wells Within the 2019 Call for Bids</b>							
Dominion O-23	1974	162	3,998	No	Fortune Bay	Thin Tertiary & Cretaceous	Abandoned
Bonanza M-71	1982	195	5,295	Yes	Basement	Upper Jurassic	Abandoned
Conquest K-09	1984	136	4,968	No	Fortune Bay	Not Present	Abandoned
South Brook N-30	1988	90	1,789	Yes	Rankin Fm (Egret Mbr)	South Mara, Ben Nevis, Hibernia	Abandoned Oil Show
Glenwood H-69	2010	127	3,668	Yes	Nautilus	Nautilus	Abandoned Gas Show
Fiddlehead D-83	2011	94	1,870	Yes	Rankin	Hibernia & Jeanne d'Arc	Abandoned
Federation K-87	2013	103	1,874	Weak hydrocarbon shows	Rankin	South Mara Mbr, Ben Nevis, Hibernia & Jeanne d'Arc	Abandoned
<b>Wells Near the 2019 Call for Bids</b>							
Voyager J-18	1984	101	3,743	No	Voyager	Cretaceous & Jurassic	Abandoned
Port au Port J-97	1984	71	2,700	No	Voyager	Hibernia & possible upper Jurassic	Abandoned
Gambo N-70	1985	84	2,515	No	Rankin	Lower Jeanne d'Arc & Lower Hibernia	Abandoned
Bonne Bay C-73	1987	107	4,205	Yes	Jeanne d'Arc Fm (Terra Nova Mbr)	Hibernia, Jeanne d'Arc	Abandoned Oil Show
Springdale M-29	1989	98	3,192	Yes, SDL (1014) created	Rankin Fm (Egret Mbr)	Ben Nevis, South Mara	Abandoned Oil and Gas Well
Riverhead N-18	2000	68	2,626	No	Downing Fm (Whale Mbr)	Jeanne d'Arc, Hibernia, Ben Nevis/Avalon, Eider	Abandoned
Gros Morne C-17	2002	117	2,273	No	Hibernia	Avalon & Upper Hibernia	Abandoned
Searcher C-87	2012	121	2,033	No	Jeanne d'Arc (C-NLOPB) or Ben Nevis/Avalon (Husky)	Nautilus, Ben Nevis & Jurassic	Abandoned

**Table 1.** Exploration wells drilled in vicinity of the Calls for Bids. Data from C-NLOPB.

Field	On Production Year	Reserves and Resources			Cumulative Production (mmbbls)	Discovery Well	Reservoir
		Oil (mmbbls)	Gas, 2P (bcf)	NGLs, 2P (mmbbls)			
Hibernia	1997	1,644	2,353	225	1,103	Hibernia P-15	Ben Nevis/Avalon, Catalina, Hibernia & Jeanne d'Arc
Terra Nova	2002	506	64	5	416	Terra Nova K-08	Jeanne d'Arc
White Rose	2005	404	3,018	92	241	White Rose E-08	Ben Nevis/Avalon & Hibernia
North Amethyst	2010	64	315		52.8	North Amethyst K-15	Avalon
Hebron	2017	707	451	30	28.2	Hebron I-13	Ben Nevis, Hibernia & Jeanne d'Arc

**Table 2.** Reserves and resources summary table of Jeanne d'Arc major fields as of March 2019. Data from C-NLOPB.



**Figure 4.** Lithostratigraphic chart of Jeanne d’Arc Basin. Modified after Sinclair, 1992.

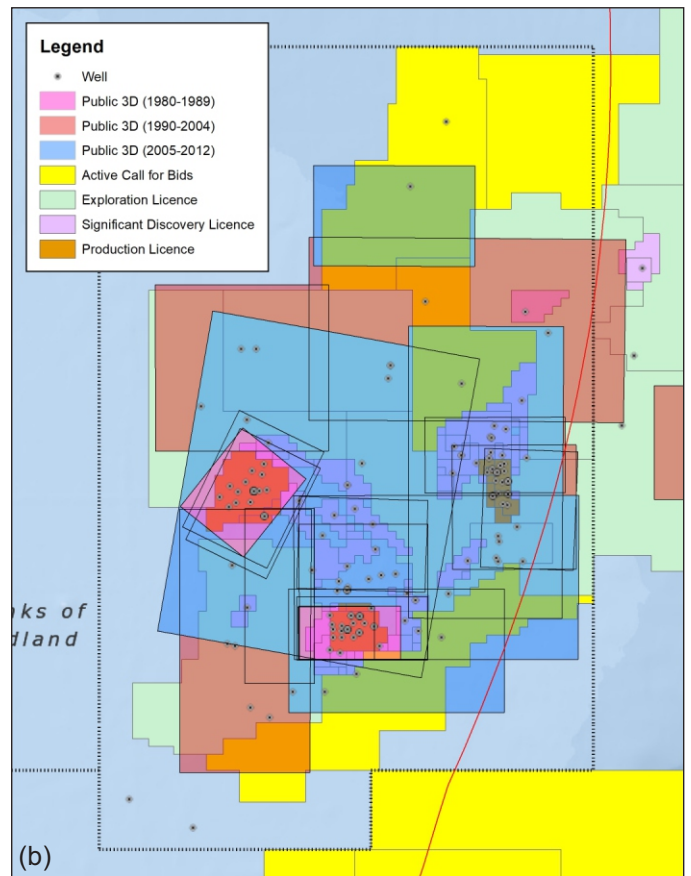
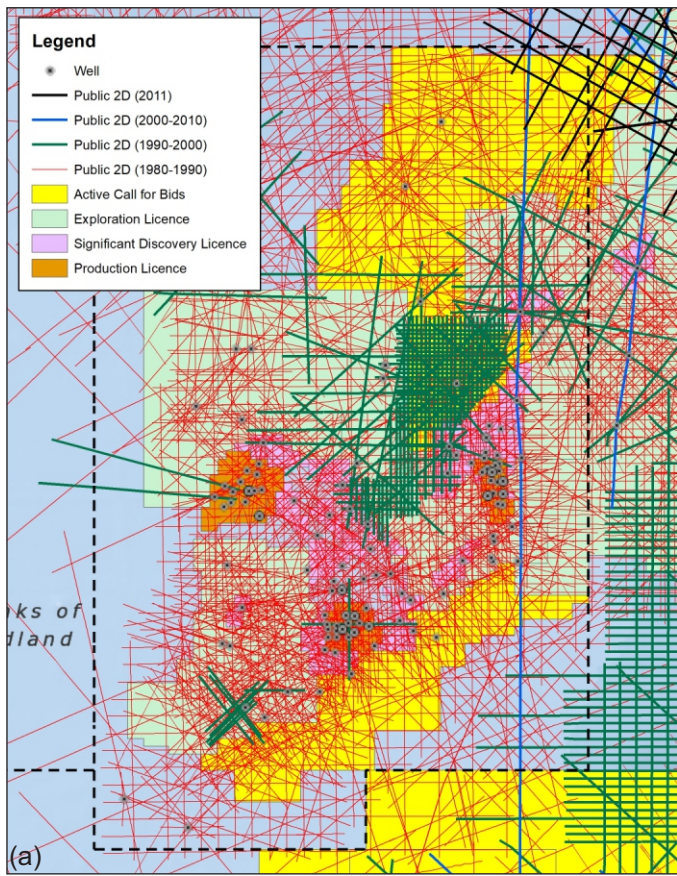
## SEISMIC DATA

There is good to excellent public 2D and 3D seismic available in the area (Figure 5). Privileged seismic data is also available for purchase.

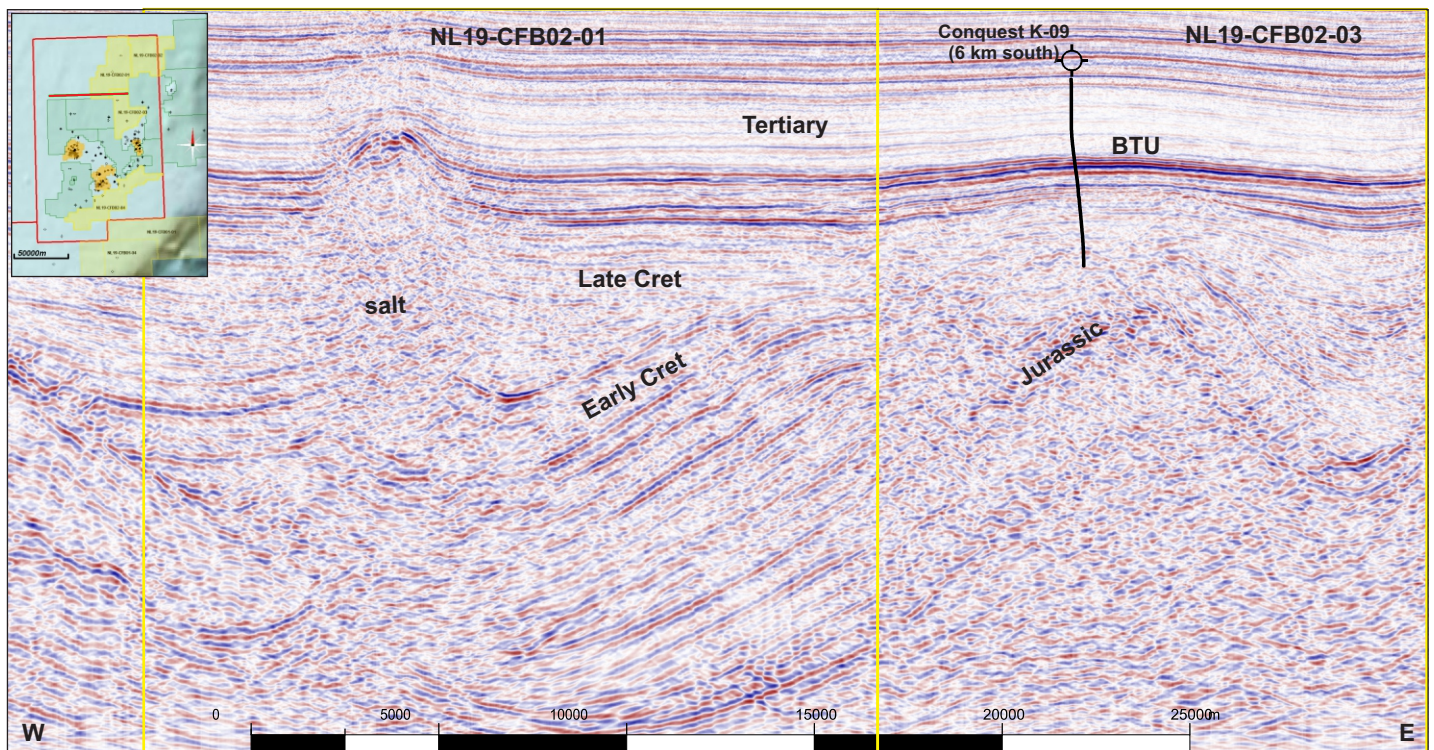
Seismic data quality is good to excellent in most of the parcels but deteriorates around salt features and due to the presence of multiples in steep slope areas.

Seismic mapping is possible using high quality regional seismic markers such as carbonate intervals within clastics and several wide-spread unconformities. Good local markers and detachment surfaces within the post-rift sedimentary wedge can also be easily mapped and main and secondary faults are readily traceable.

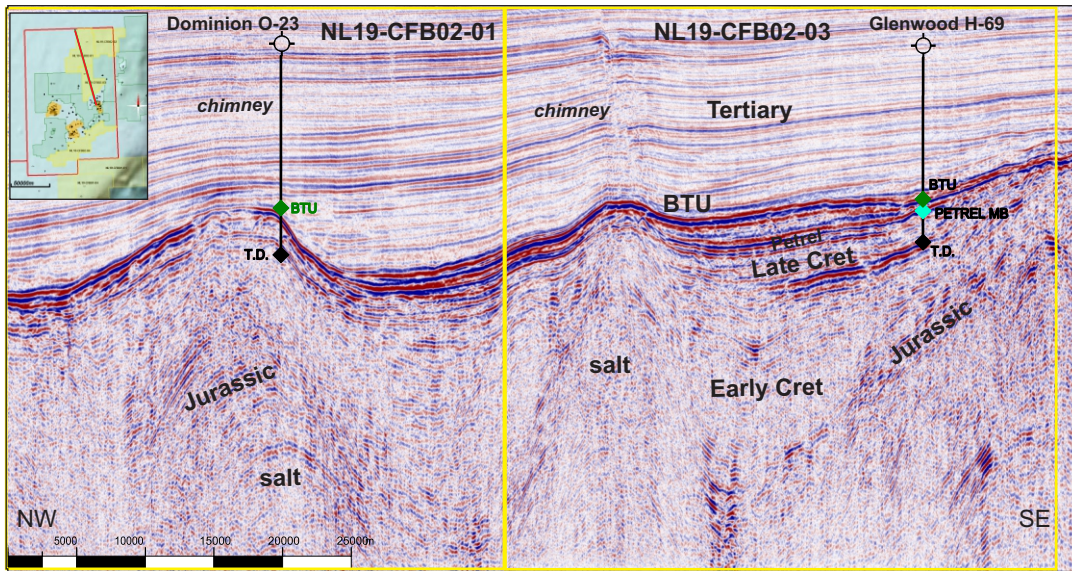
Seismic ties to the nearest oil discoveries (Hibernia, Terra Nova, Hebron, and White Rose) are possible using the long regional lines across the basin.



**Figure 5.** Public seismic coverage of (a) 2D and (b) 3D data in Jeanne d'Arc Basin. Data available through the C-NLOPB and in Newfoundland and Labrador's virtual exploration data room on a subscription-basis at [www.hydrocarbondeals.com](http://www.hydrocarbondeals.com).

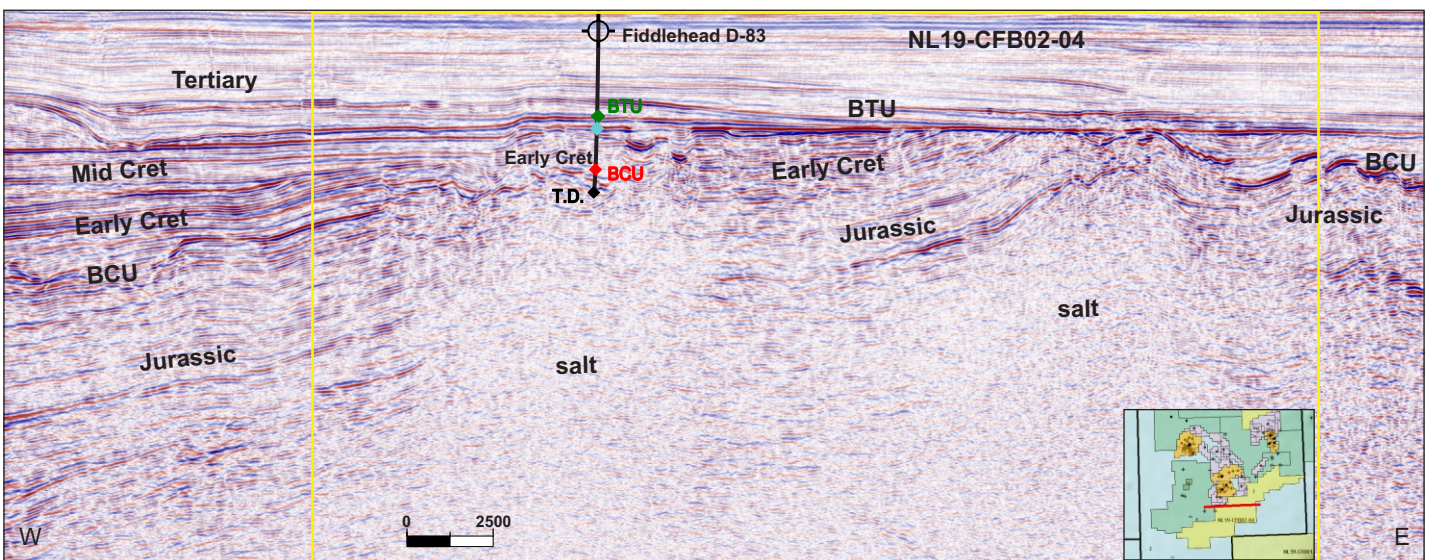
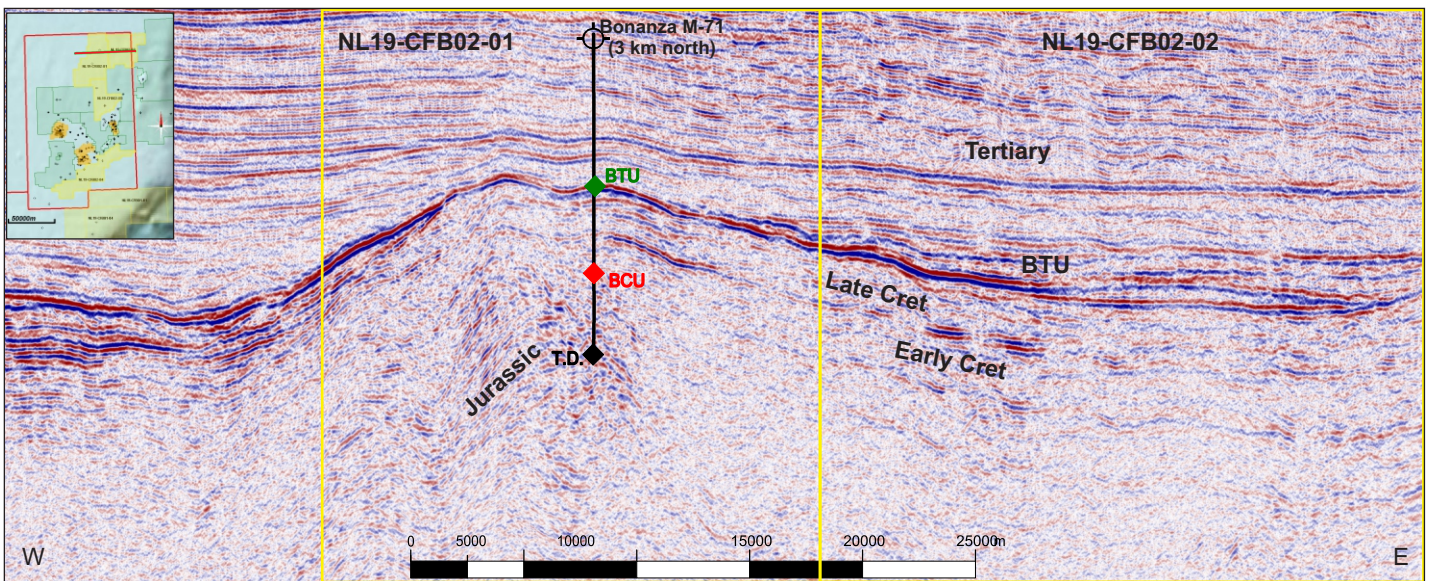


**Figure 6.** Public 2D seismic line through Call for Bids NL19-CFB02-01 parcel. Line 98-2273-002\_003 from survey CA-3000703-GOA, acquired by Mobil Oil Canada Ltd. in 1998. Data courtesy C-NLOPB.

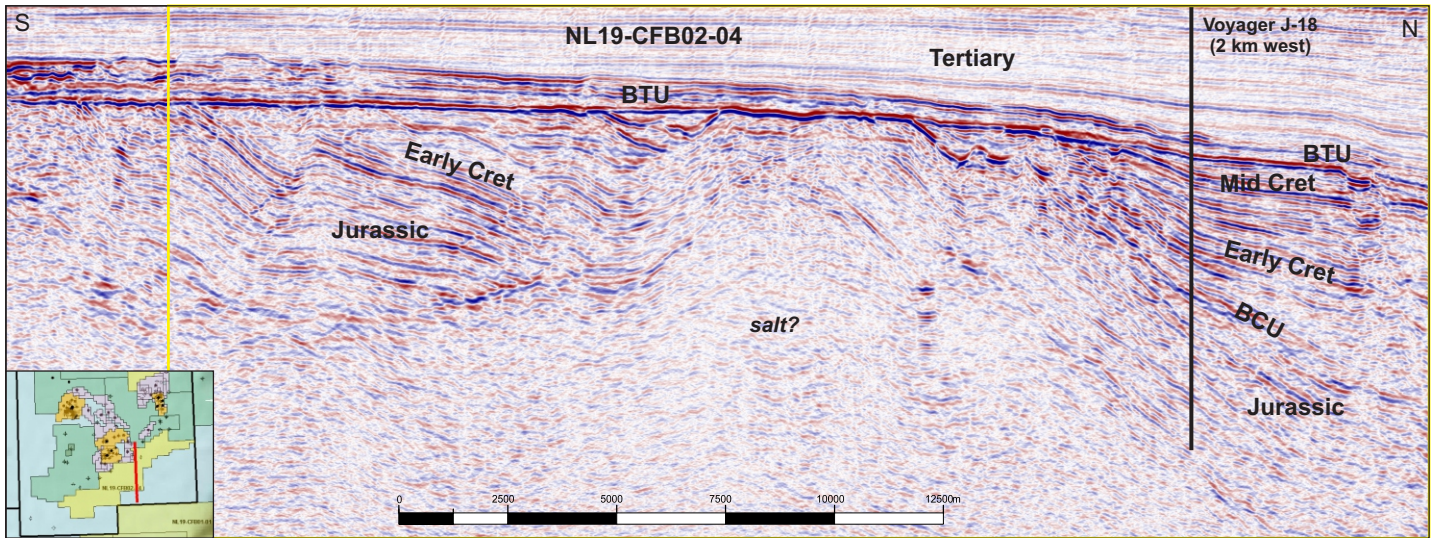


**Figure 7 (left).** Public 2D seismic line through Call for Bids NL19-CFB02-01 & -03 parcels. Line CNF82-107 from survey CA-3000171-GOA acquired by Canterra Energy Ltd. in 1982. Data courtesy C-NLOPB.

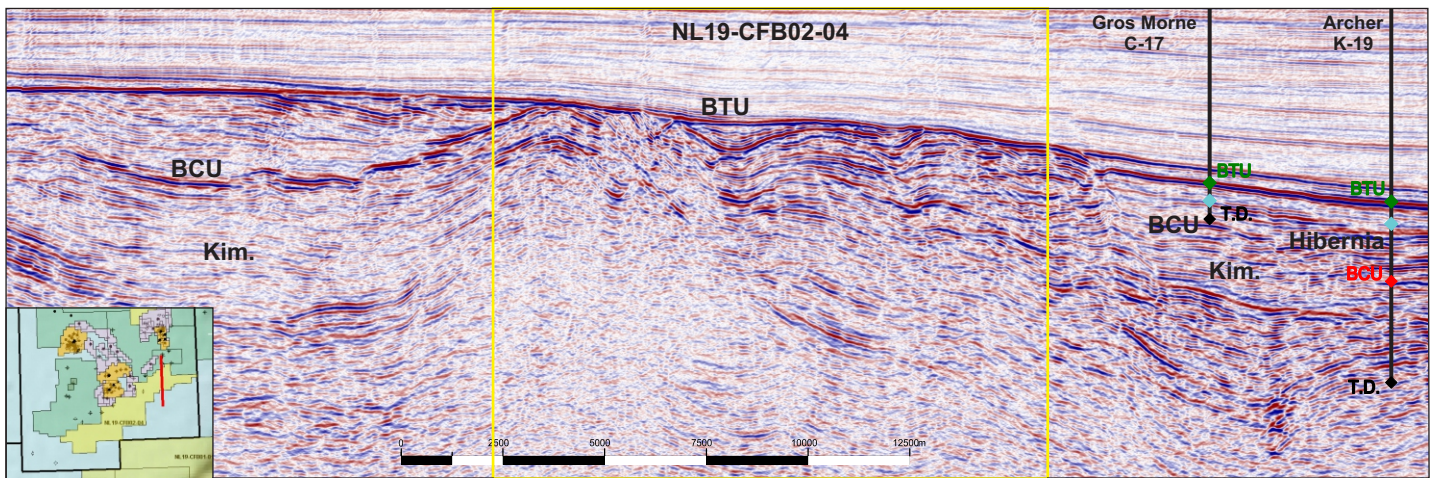
**Figure 8 (below).** Public 2D seismic line through Call for Bids parcels NL19-CFB02-01 & -02. Line 83-5228A from survey CA-3000095-GOA acquired by La Société Québécoise d'Initiatives Pétrolières in 1983. Data courtesy C-NLOPB.



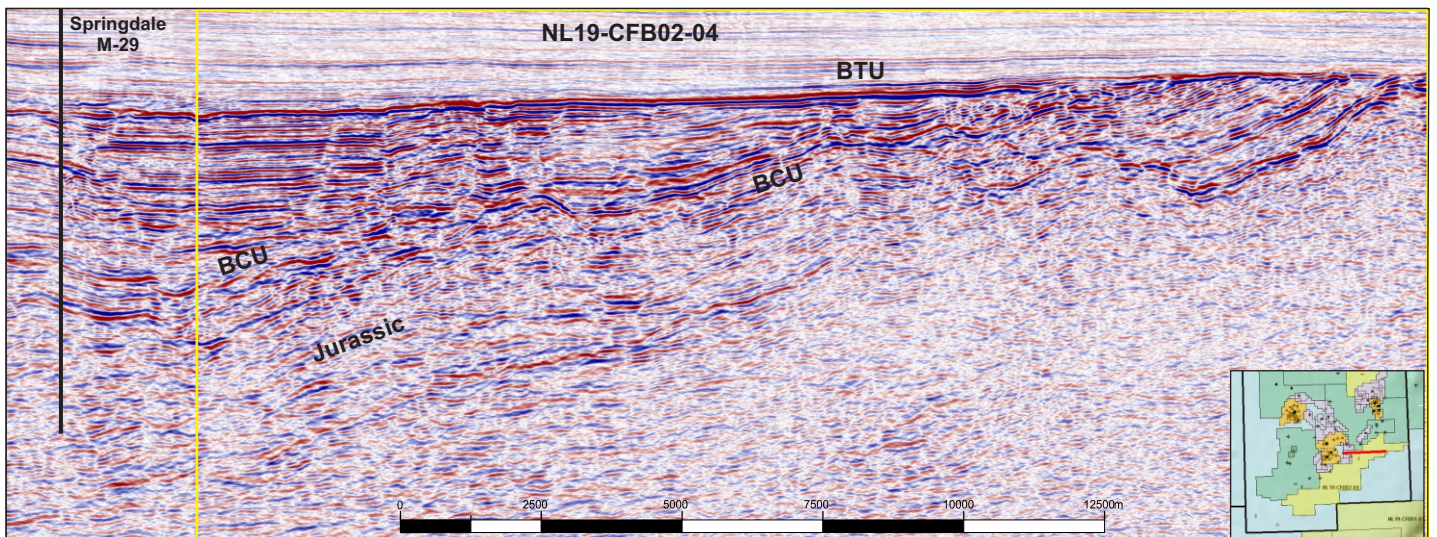
**Figure 9.** Public 2D seismic line through Call for Bids NL19-CFB02-04 parcel. Line 83-4976A from survey CA-3000095-GOA acquired by La Société Québécoise d'Initiatives Pétrolières in 1983. Data courtesy C-NLOPB.



**Figure 10.** Public 2D seismic line through Call for Bids NL19-CFB02-04 parcel. Line 83-2644A from survey CA-3000095-GOA acquired by La Société Québécoise d'Initiatives Pétrolières in 1983. Data courtesy C-NLOPB.



**Figure 11.** Public 2D seismic line through Call for Bids NL19-CFB02-04 parcel. Line 83-2676A from survey CA-3000095-GOA acquired by La Société Québécoise d'Initiatives Pétrolières in 1983. Kim.: Kimmeridgian. Data courtesy C-NLOPB.



**Figure 12.** Public 2D seismic line through Call for Bids NL19-CFB02-04 parcel. Line 83-5004BD from survey CA-3000095-GOA acquired by La Société Québécoise d'Initiatives Pétrolières in 1983. Data courtesy C-NLOPB.

## ADDITIONAL INFORMATION AND CONTACTS

For more information:

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## MANDATE AND ROLES

The **Canada-Newfoundland & Labrador Offshore Petroleum Board (C-NLOPB)** is mandated to interpret and apply the provisions of the Atlantic Accord and the Atlantic Accord Implementation Acts to all activities of operators in the Canada-Newfoundland and Labrador Offshore Area and to oversee operator compliance with those statutory provisions.

Their role is to facilitate the exploration for and development of petroleum resources, including health and safety of workers, environmental protection, effective management of land tenure, maximum hydrocarbon recovery and value, and Canada/Newfoundland and Labrador benefits.

As Offshore Regulator and Administrator for the Areas of Interest, the C-NLOPB are the primary contact for participation in this resource opportunity. They operate a registry to record exploration, significant discovery and production licences and information related to these interests for public review. They are also the curators of all geoscientific data pertaining to the Newfoundland and Labrador Offshore Area. The C-NLOPB has no active role in promotion of the Province's hydrocarbon resources.

The **Government of Newfoundland and Labrador, Department of Natural Resources** is responsible for providing marketing and promotional services to foster the exploration, development and production of the Province's hydrocarbon resources internationally as well as promoting the maximization of fiscal and industrial benefits through the negotiation, development, administration and monitoring of petroleum project agreements and legislation.

**Compiled by** A. Krakowka, J. Townsley, and K. Waterman from previously published studies, papers, and Department of Natural Resources work.

**Author:** Department of Natural Resources



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