

OIL & GAS 101

The Nunavut Context



2015 Nunavut Oil & Gas Summit

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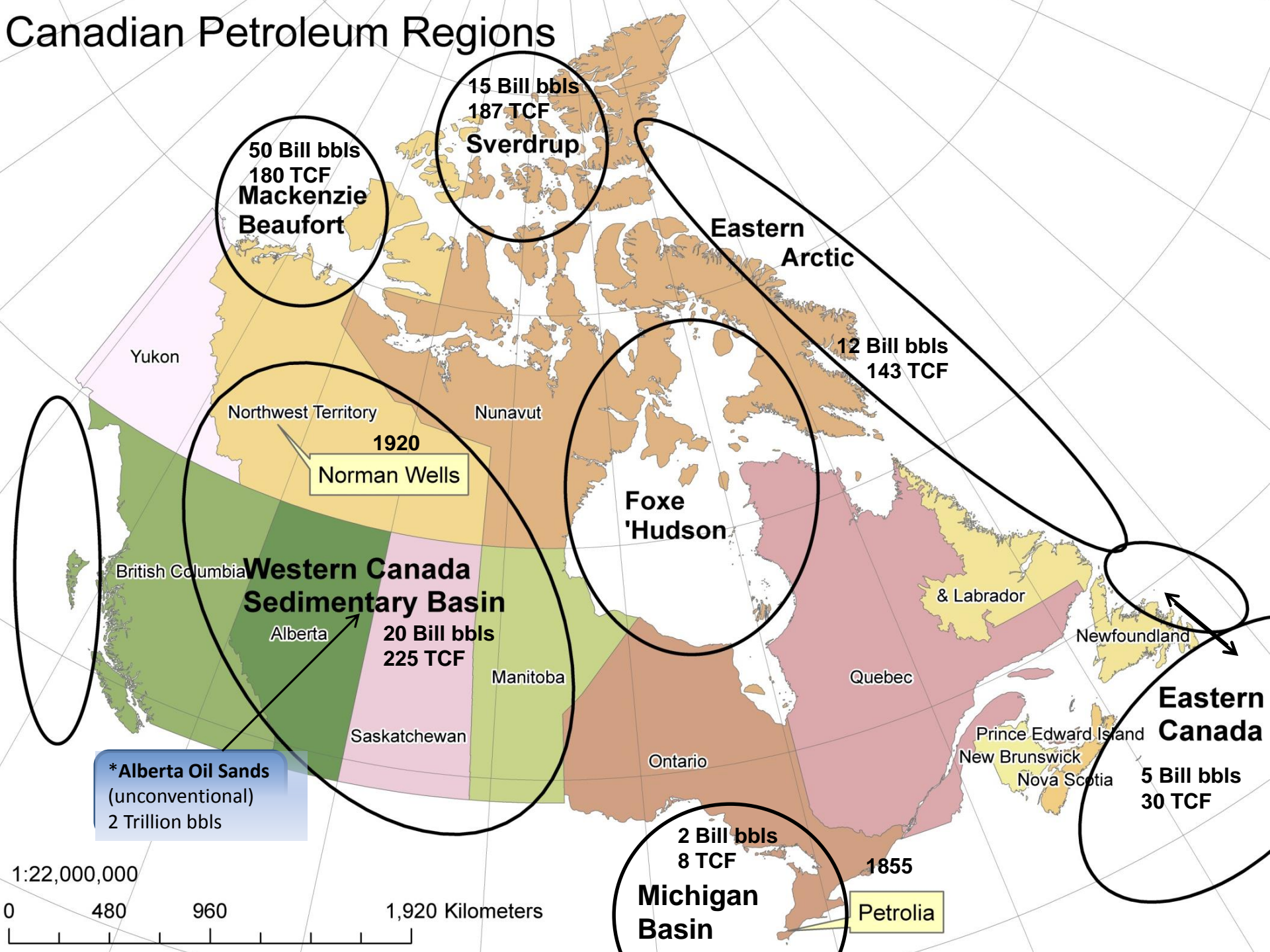
- Geological context
- Regulatory Regime
- Lifecycle of a petroleum field
- Nunavut's context
 - Historical Activity
 - Current Status
- Future potential



2015 Nunavut O&G Summit



Canadian Petroleum Regions



50 Bill bbls
180 TCF
**Mackenzie
Beaufort**

15 Bill bbls
187 TCF
Sverdrup

**Eastern
Arctic**

12 Bill bbls
143 TCF

1920
Norman Wells

**Foxe
'Hudson**

**Western Canada
Sedimentary Basin**

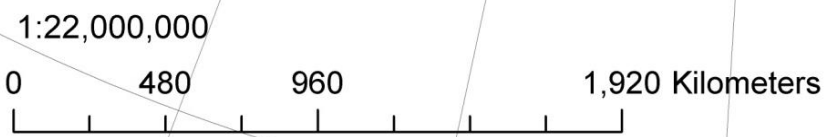
20 Bill bbls
225 TCF

***Alberta Oil Sands**
(unconventional)
2 Trillion bbls

1855
Petrolia

**Michigan
Basin**

**Eastern
Canada**
5 Bill bbls
30 TCF

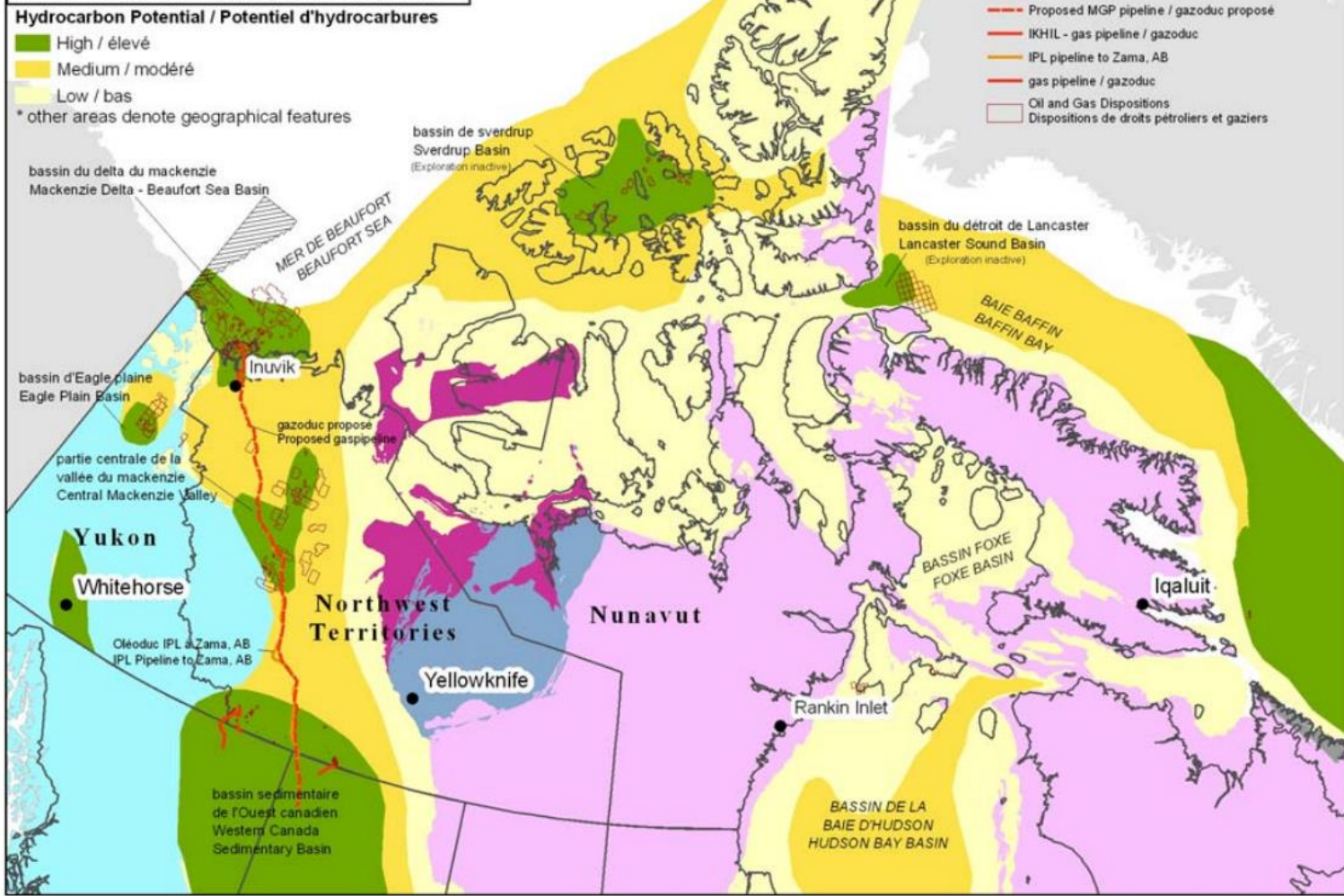


Hydrocarbon Potential / Potentiel d'hydrocarbures

- High / élevé
- Medium / modéré
- Low / bas

* other areas denote geographical features

- Area subject to work prohibition / région sujette à décrets d'interaction
- Proposed MGP pipeline / gazoduc proposé
- IKHIL - gas pipeline / gazoduc
- IPL pipeline to Zama, AB
- gas pipeline / gazoduc
- Oil and Gas Dispositions / Dispositions de droits pétroliers et gaziers

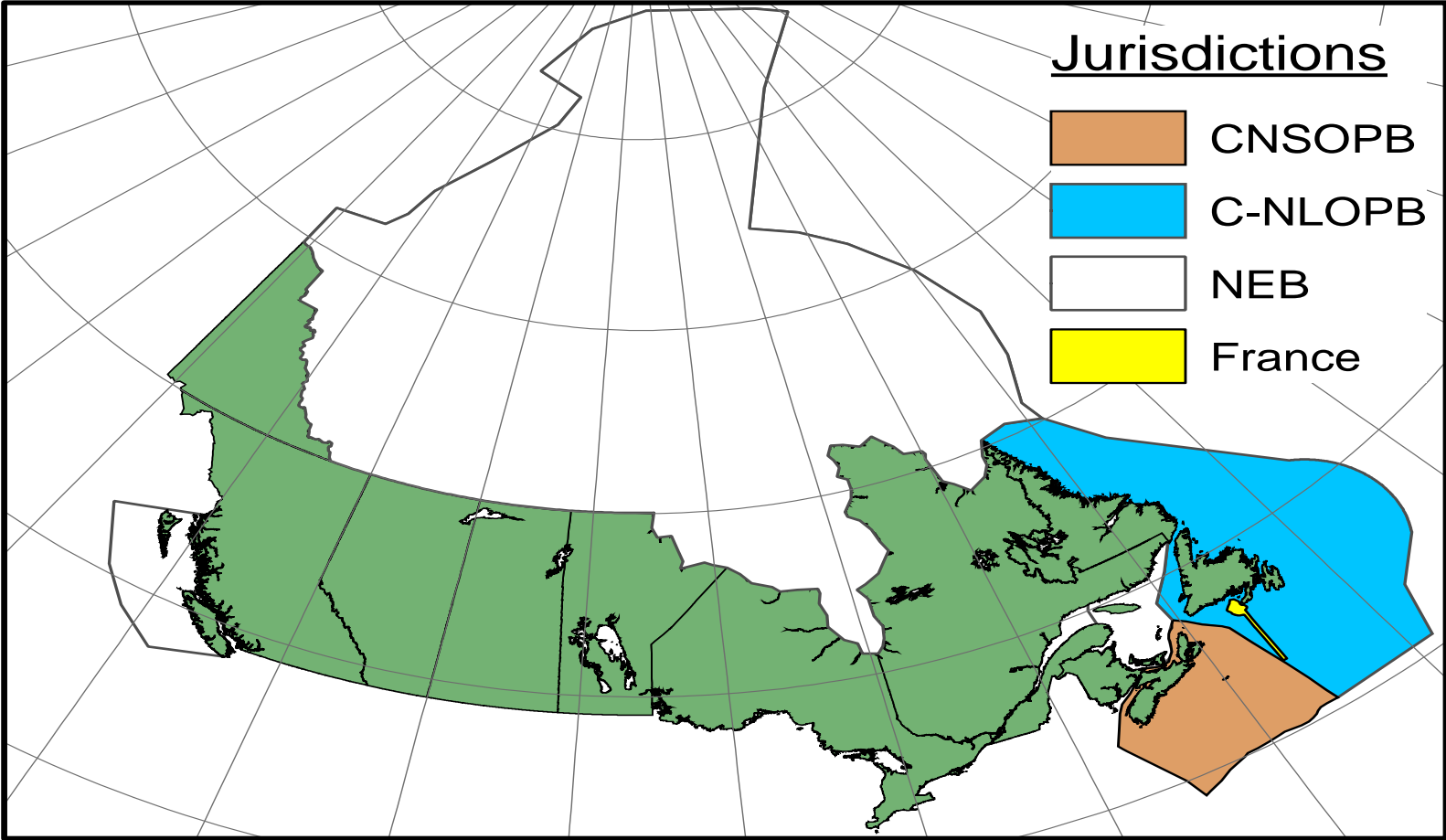


PETROLEUM RESOURCES North of 60 (from AANDC)



Canadian Regulatory Regime Regulatory Regions

(after Canada – Nova Scotia Offshore Petroleum Board [CNOSPB])



Regulatory Regime in Nunavut

- Federal Oil & Gas Legislation
 - Canada Petroleum Resources Act (CPRA)
 - Canada Oil and Gas Operations Act (COAGOA)
 - National Energy Board Act
- Nunavut Land Claims Agreement
- Federal Regulators
 - Aboriginal Affairs and Northern Development Canada (grants licences through the Canada Petroleum Resources Act).
 - National Energy Board (declares an area as a 'significant discovery' through the Canada Oil & Gas Operations Act).
- Government of Nunavut has no regulatory authority over petroleum resources and development



110°0'0"W 100°0'0"W 90°0'0"W 80°0'0"W 70°0'0"W 60°0'0"W 50°0'0"W 40°0'0"W



Legend

Petroleum Projects Importance

- Major Oil (Red circle)
- Major Gas (Blue circle)
- Major Exploration (Green circle)

SurveyType

- Seismic (Yellow hatched area)
- NunuvutSettlementArea (Blue outline)
- Nunavut_Act (Red outline)
- Fed Admin Petroleum (Green outline)

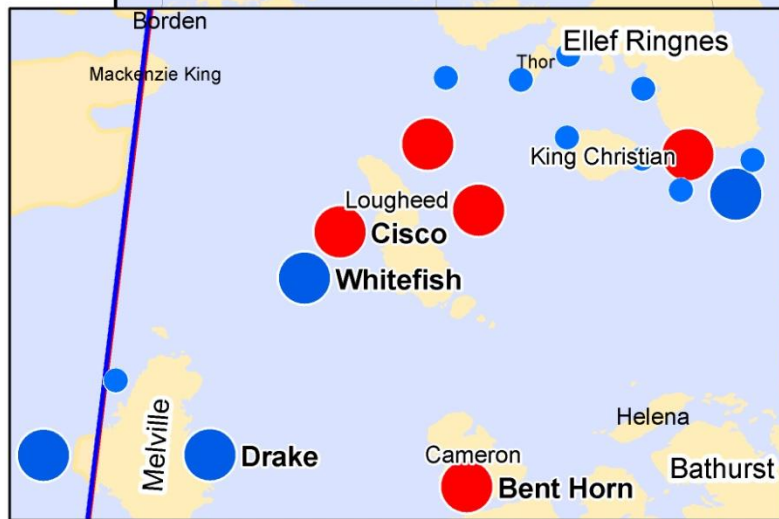
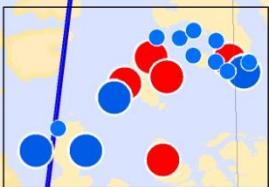
70°0'0"N

75°0'0"N

70°0'0"N

65°0'0"N

60°0'0"N



Ellesmere

Grise Fjord

Resolute

Arctic Bay

Pond Inlet

Clyde River

NIRB

Baffin

CEAA

Qikiqtarjuaq

Pangnirtung

Victoria

Cambridge Bay

Taloyoak

Gjoa Haven

Kugaaruk

Igloolik

Hall Beach

INAC

Repulse Bay

Hekja

Iqaluit

Cape Dorset

Kimmirut

NRCAN

Coral Harbour

Hesterfield Inlet

In Inlet

Cove

CEAA

Quebec

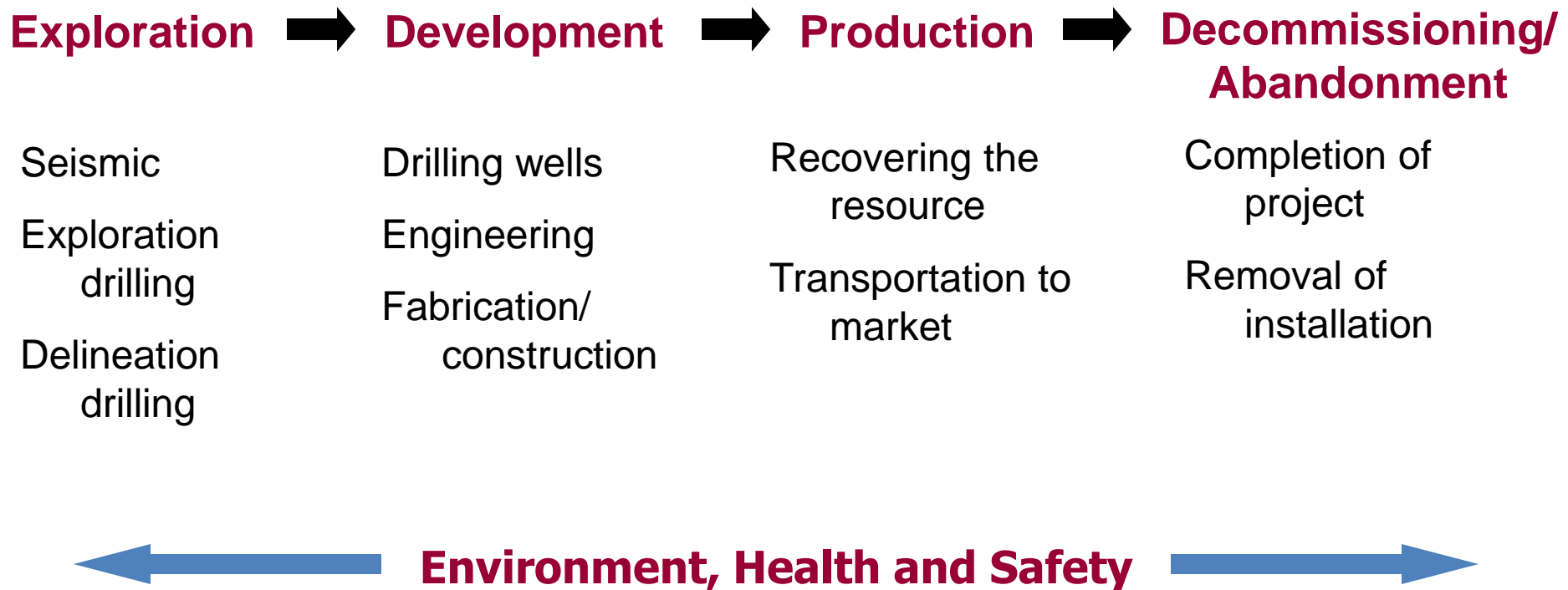
0°0'0"W

80°0'0"W

70°0'0"W

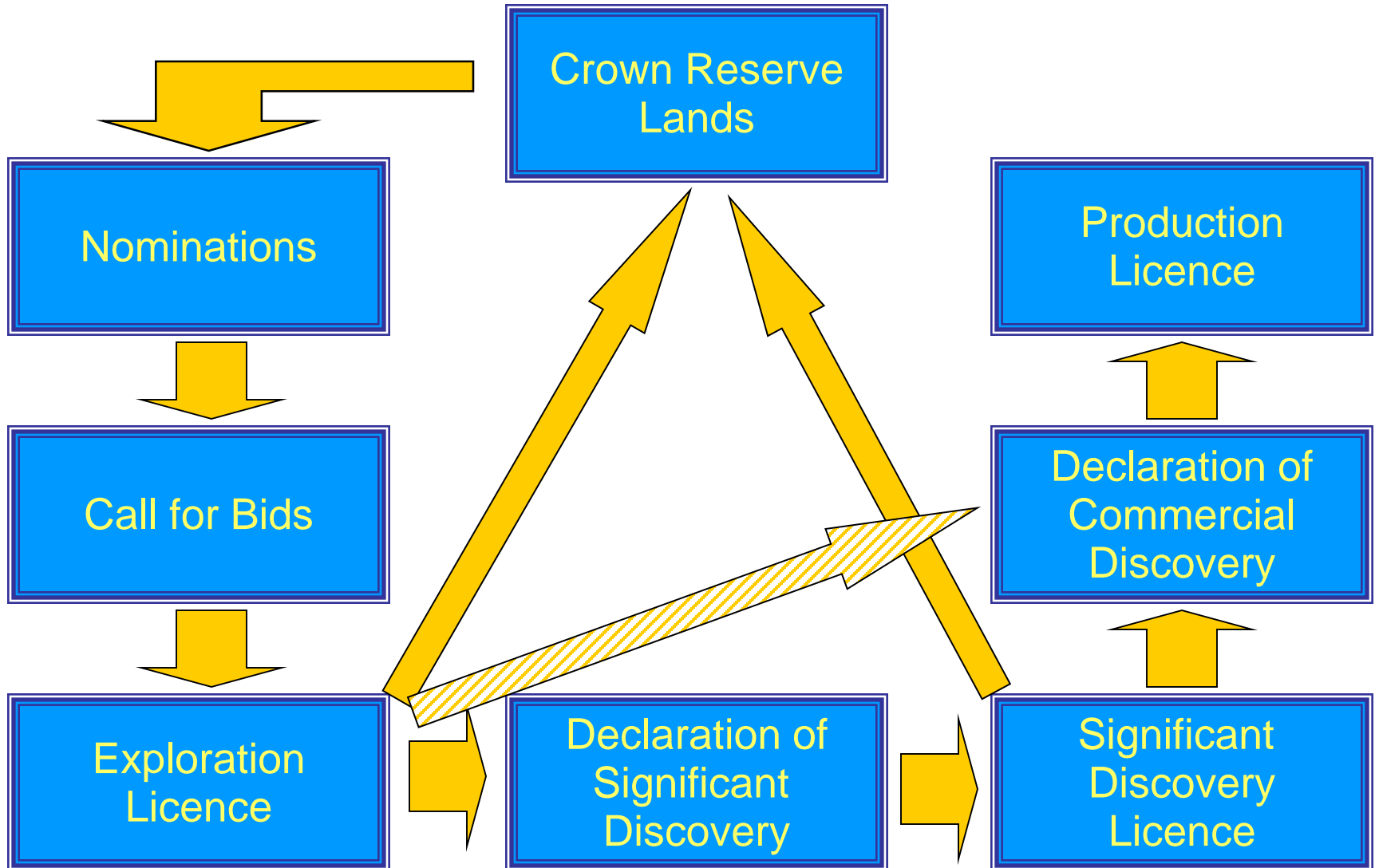
Lifecycle of an oil and gas field

(after *Canadian Association of Petroleum Producers [CAPP]*)



Rights Issuance Cycle

(taken from Canada-Nova Scotia Offshore Energy Board)



Significant Discovery Licence

(taken from Canada-Nova Scotia Offshore Energy Board)

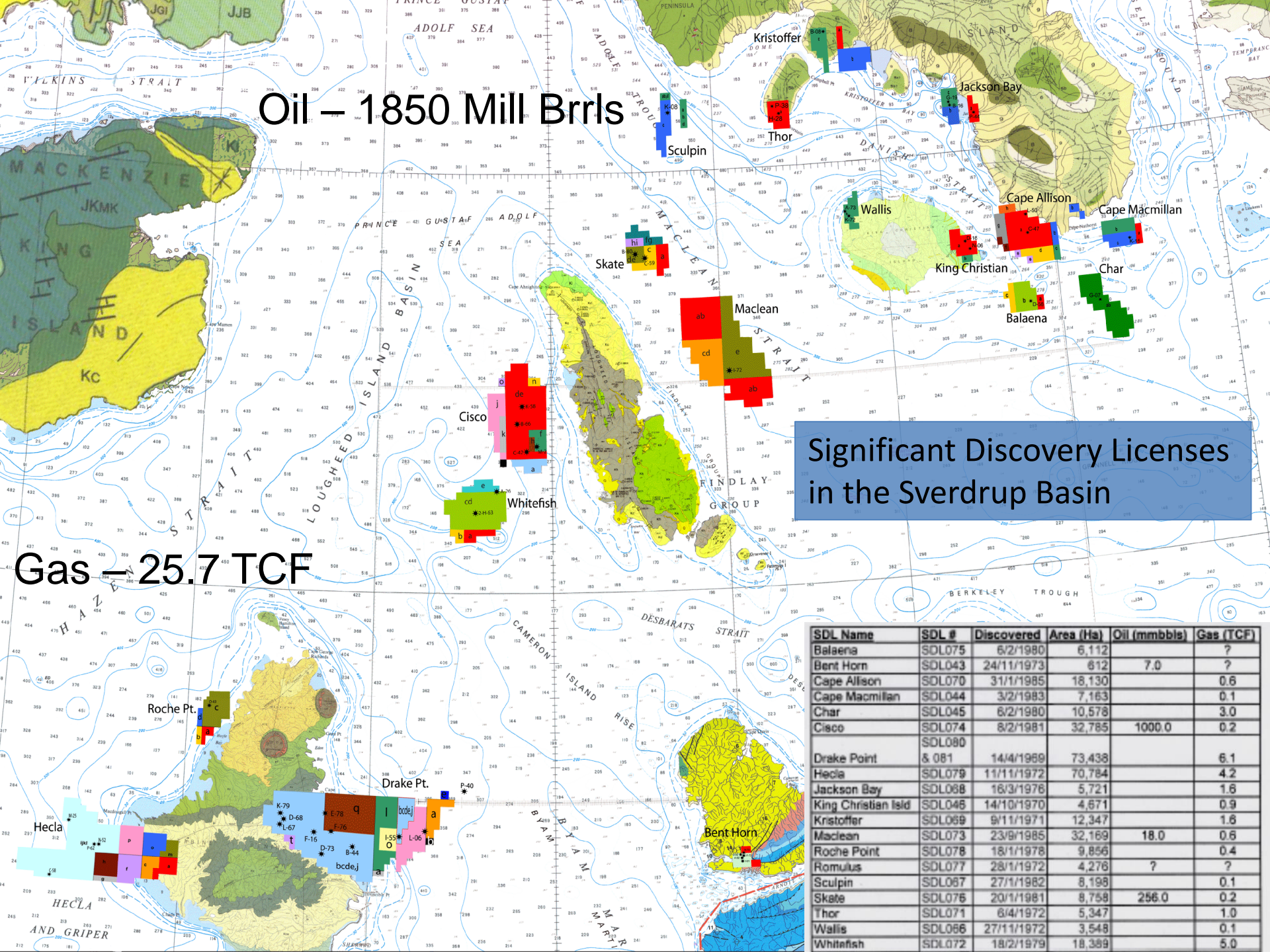
- Right to explore
- Exclusive right to drill
- Exclusive right to develop
- Exclusive right to obtain Production Licence
- Term - Indefinite



Oil – 1850 Mill Brrls

Gas – 25.7 TCF

Significant Discovery Licenses
in the Sverdrup Basin



SDL Name	SDL #	Discovered	Area (Ha)	Oil (mmbbls)	Gas (TCF)
Balaena	SOL075	6/2/1980	6,112	?	?
Bent Horn	SOL043	24/11/1973	612	7.0	?
Cape Allison	SOL070	31/1/1985	18,130	?	0.6
Cape Macmillan	SOL044	3/2/1983	7,163	?	0.1
Char	SOL045	6/2/1980	10,578	?	3.0
Cisco	SOL074	8/2/1981	32,785	1000.0	0.2
Drake Point	& 081	14/4/1989	73,438	?	6.1
Hecla	SOL078	11/11/1972	70,784	?	4.2
Jackson Bay	SOL088	16/3/1978	5,721	?	1.6
King Christian Isld	SOL048	14/10/1970	4,671	?	0.9
Kristoffer	SOL069	9/11/1971	12,347	?	1.6
Maclean	SOL073	23/9/1985	32,169	18.0	0.6
Roche Point	SOL078	18/1/1978	9,856	?	0.4
Romulus	SOL077	28/1/1972	4,278	?	?
Sculpin	SOL087	27/1/1982	8,198	?	0.1
Skate	SOL076	20/1/1981	8,758	256.0	0.2
Thor	SOL071	6/4/1972	5,347	?	1.0
Wallis	SOL066	27/11/1972	3,548	?	0.1
Whitefish	SOL072	18/2/1979	18,389	?	5.0

Nunavut Petroleum Regions

- Regions based around sedimentary basins, 35 in total in Nunavut, of various geological ages.
- Previous work and studies estimate potential, but estimates based on limited exploration to date.
- Even low estimates indicate significant petroleum potential in Nunavut.
- More work and mapping is needed to further define potential.
- 20% of Canada's undiscovered petroleum resources are in Nunavut.
- There are 18 significant discoveries with nearly 2 billion barrels of crude oil and 26 trillion cubic feet of natural gas.



Nunavut Petroleum Basins

References (GSC)

- Meyerhoff, 1982
- Srivastava et al., 1982
- Okulutch, 1988
- Trettin, 1989
- Harrison et al., 2006

Cenozoic

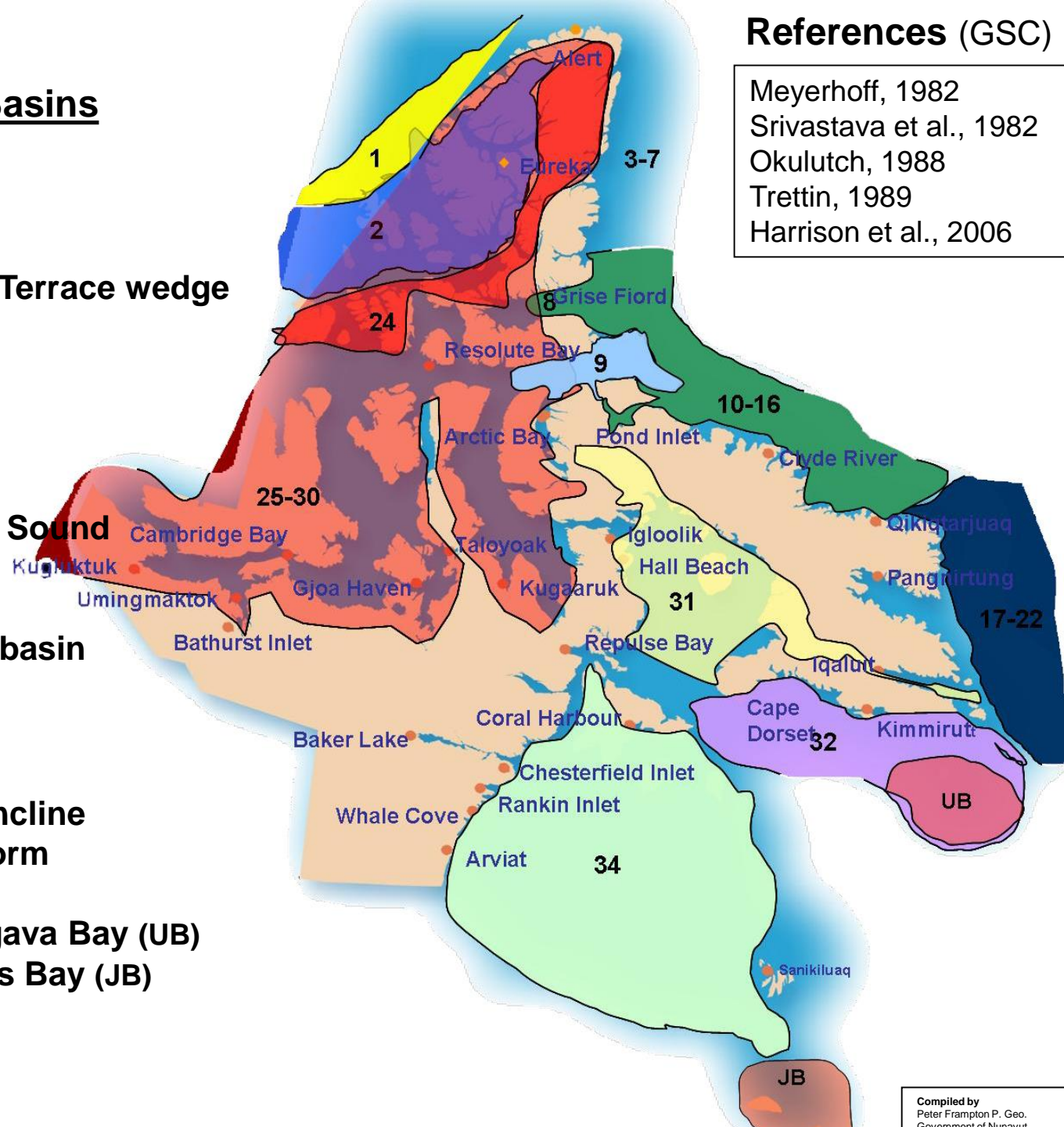
- 1. Arctic Continental Terrace wedge

Mesozoic

- 2. Sverdrup Basin
- 3-7. Nares Strait
- 8, 9. Jones & Lancaster Sound
- 10-16. Baffin Shelf
- 17-22. Davis Strait
- 23. Southampton Sub-basin

Paleozoic

- 24. Franklinian Geosyncline
- 25-30. Arctic Stable Platform
- 31. Foxe Basin
- 32, 33. Hudson Strait, Ungava Bay (UB)
- 34, 35. Hudson Bay, James Bay (JB)







Historical Activity in Nunavut

- Nunavut already familiar with petroleum exploration and production
- Panarctic Oil was created in 1968 by the federal government to explore and develop Arctic resources
- Seismic surveying and drilling work was undertaken in the High Arctic
- Work determined essentially 15 petroleum fields in the Sverdrup Basin; some containing oil, some containing gas, some containing both oil and gas.

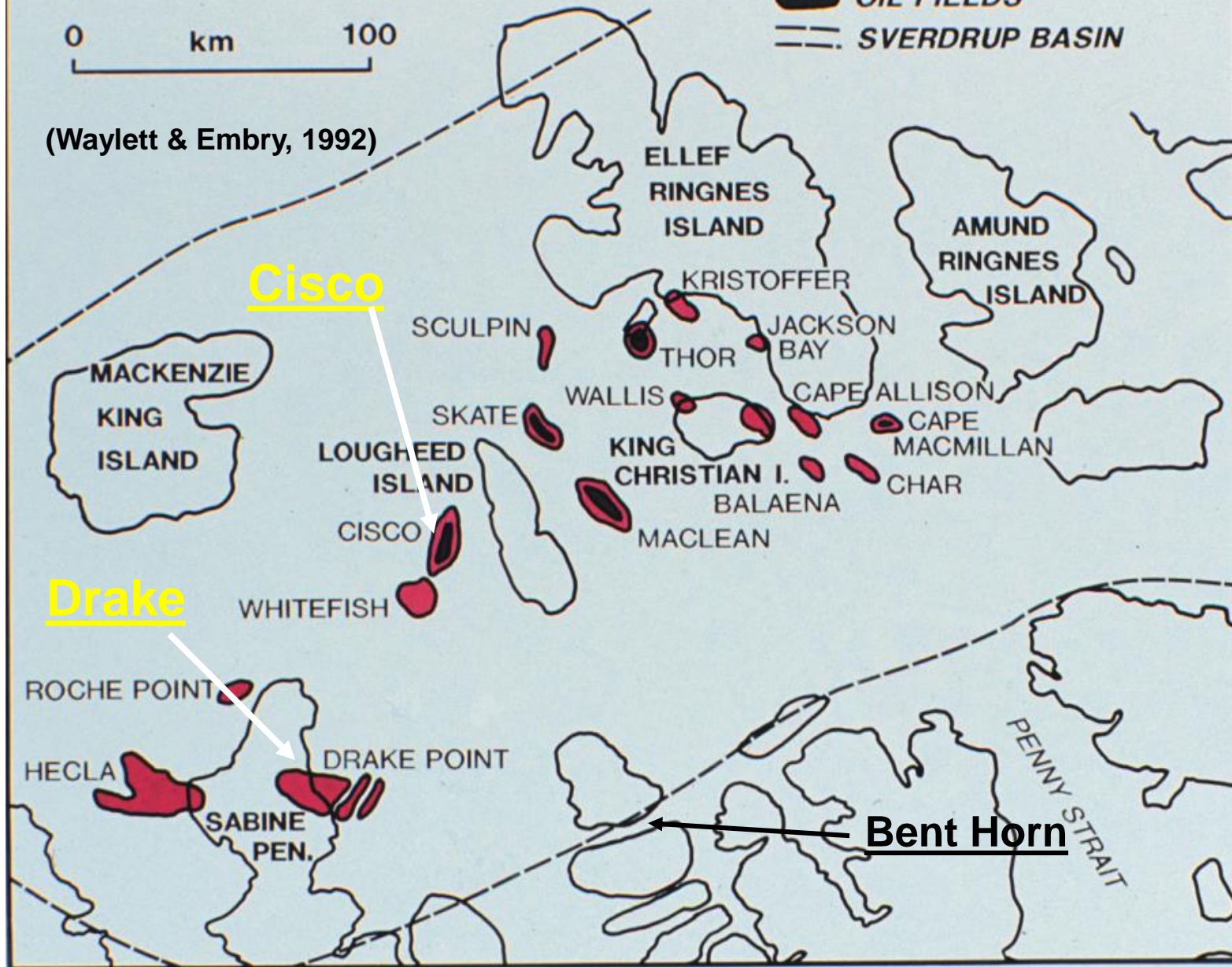


OIL AND GAS FIELDS SVERDRUP BASIN

-  OIL AND GAS FIELDS
-  GAS FIELDS
-  OIL FIELDS
-  SVERDRUP BASIN

0 km 100

(Waylett & Embry, 1992)



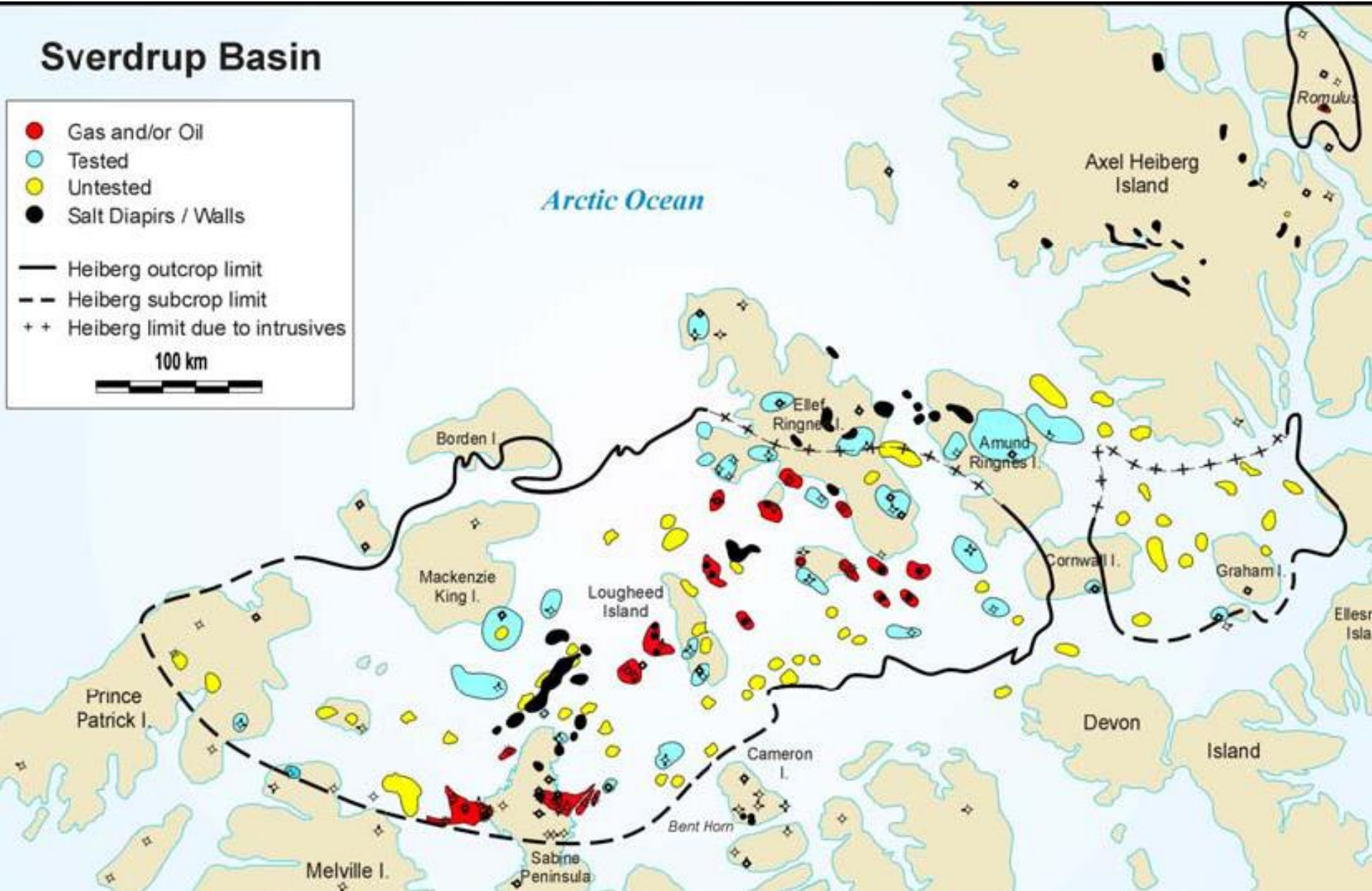
Tested and untested petroleum reserves in the Sverdrup Basin

Sverdrup Basin

- Gas and/or Oil
- Tested
- Untested
- Salt Diapirs / Walls

— Heiberg outcrop limit
- - Heiberg subcrop limit
+ + Heiberg limit due to intrusives

100 km



Modified from Okulitch, 1991 and CGPC, 2001

Bent Horn (Crude Oil)

- In 1973, oil was discovered at Bent Horn on Cameron Island; was in production 1985 – 1996
- Total resources at Bent Horn are: 7.0 million barrels of crude oil
- 13 wells were drilled; there are a total of 5 wells within this Significant Discovery Licence (SDL).
- Bent Horn produced at a rate of 126 to 315 thousand barrels (20 to 50 thousand cubic meters) per year, unaided.
- The Bent Horn discovery well flowed sweet (low sulphur), low viscosity oil at 500 barrels per day and was burned unrefined at the Polaris mine site.
- This oil was a premium crude that obtained the highest prices on the open market.





Bent Horn: Storage and Shipping on MV Arctic

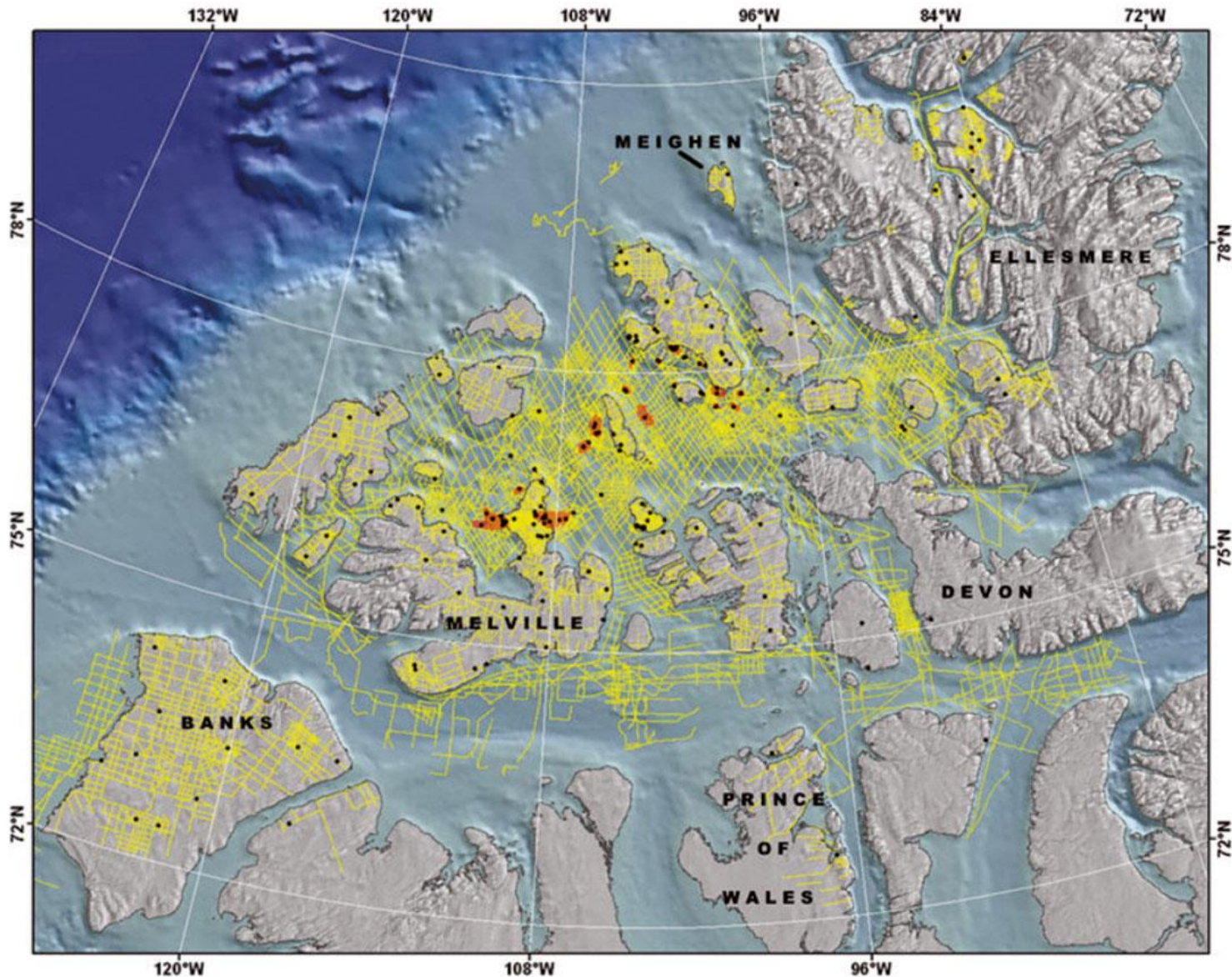


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Historical Activity

- Over 80,000 km of seismic lines in High Arctic islands; this work covers only a small portion of overall area
- After the 1970s, the federal government withdrew support of further exploration in the Arctic
- “Old data” still valuable but new technologies can give more information and potentially discover even more resources
- Many petroleum basins still unexplored and little is known definitely about these resources





High Arctic: Seismic lines (yellow) and drilled wells (black dots) from work in the 1970s and 1980s

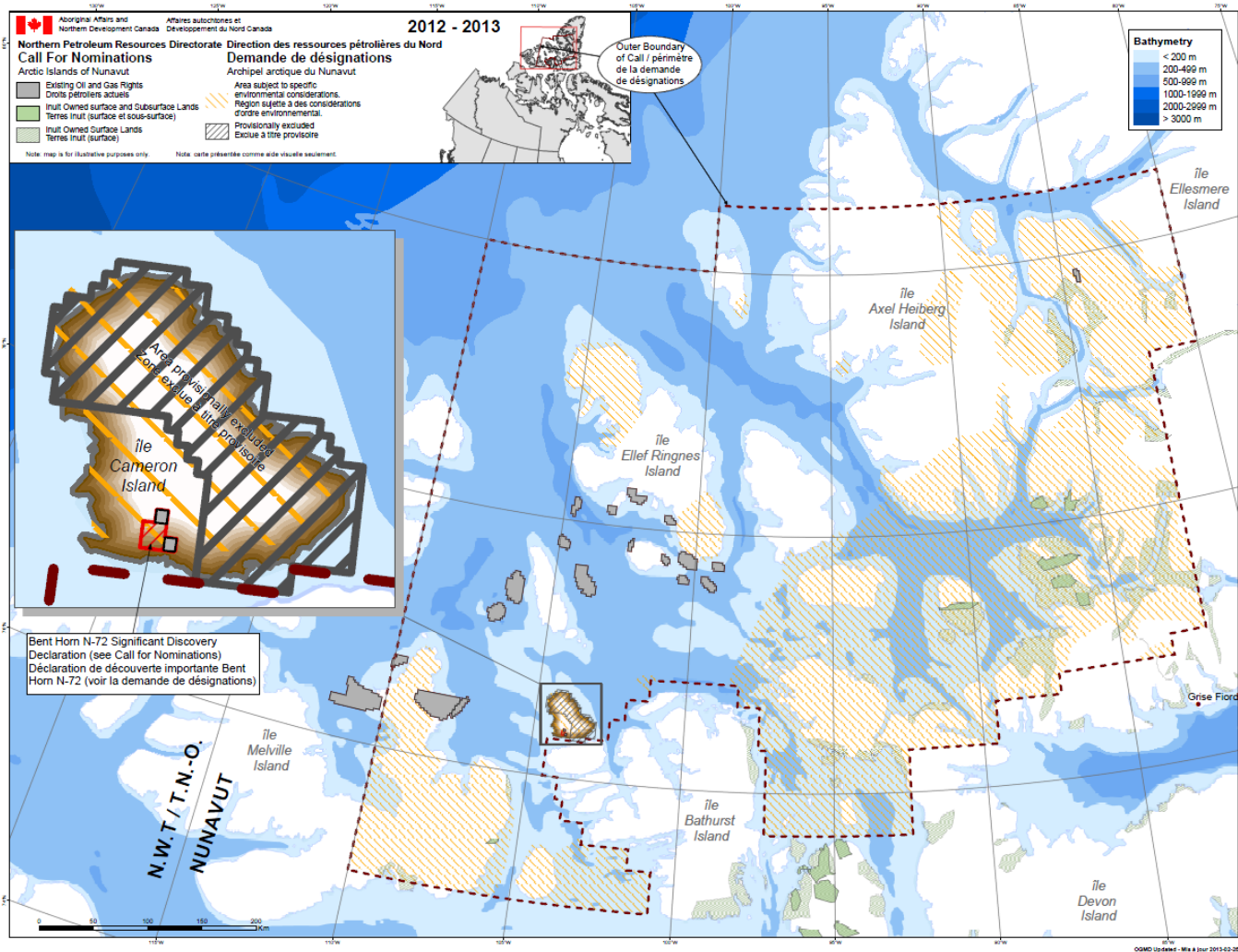
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Current Status in Nunavut

- Last oil production in 1996 (Bent Horn)
- Since then, little interest in Nunavut
- Existing Significant Discovery Licenses (SDL) in Sverdrup Basin have had little activity in last two decades
- What's old is new again (Bent Horn). In 2012-2013, there was a 'Call for Nominations' for Bent Horn. There was no interest.





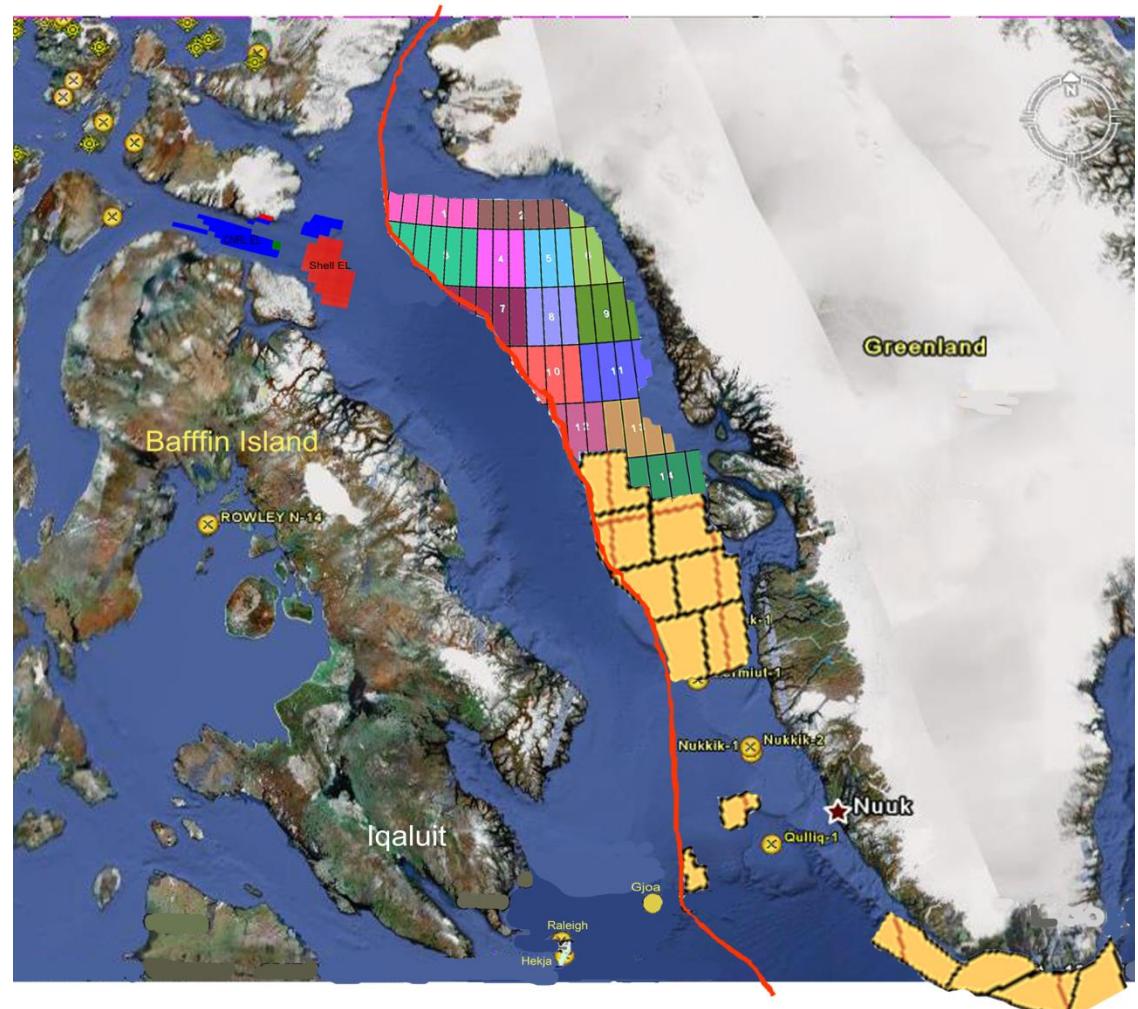
2012-2013 Call for Nominations – Bent Horn

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Beyond Sverdrup

- Increased interest in other petroleum basins in the Arctic
- Proposed seismic surveying of Baffin Bay/Davis Strait



Future Potential

- How to develop Nunavut's resources for the benefit of its people?
- How to engage and benefit from development that is outside Nunavut but impacts it?
- How do Nunavut's governments and institutions work with existing regulatory authorities?



What do we consider?

- Social license and community support
- Environmental sensitivity
- Ice conditions and safety
- Transportation infrastructure
- Regulatory processes
- Benefit Agreements
- Royalty regimes
- Sovereignty
- Devolution
- Oil prices
- ...



What can we achieve here?

- Foundation for future discussions
- Better understanding of what oil & gas development means, and could mean, for Nunavut
- A 'Made-in-Nunavut' solution
- A commitment from current regulatory authorities to work with Nunavummiut



Thank you

Merci beaucoup

Qujannamiik

