

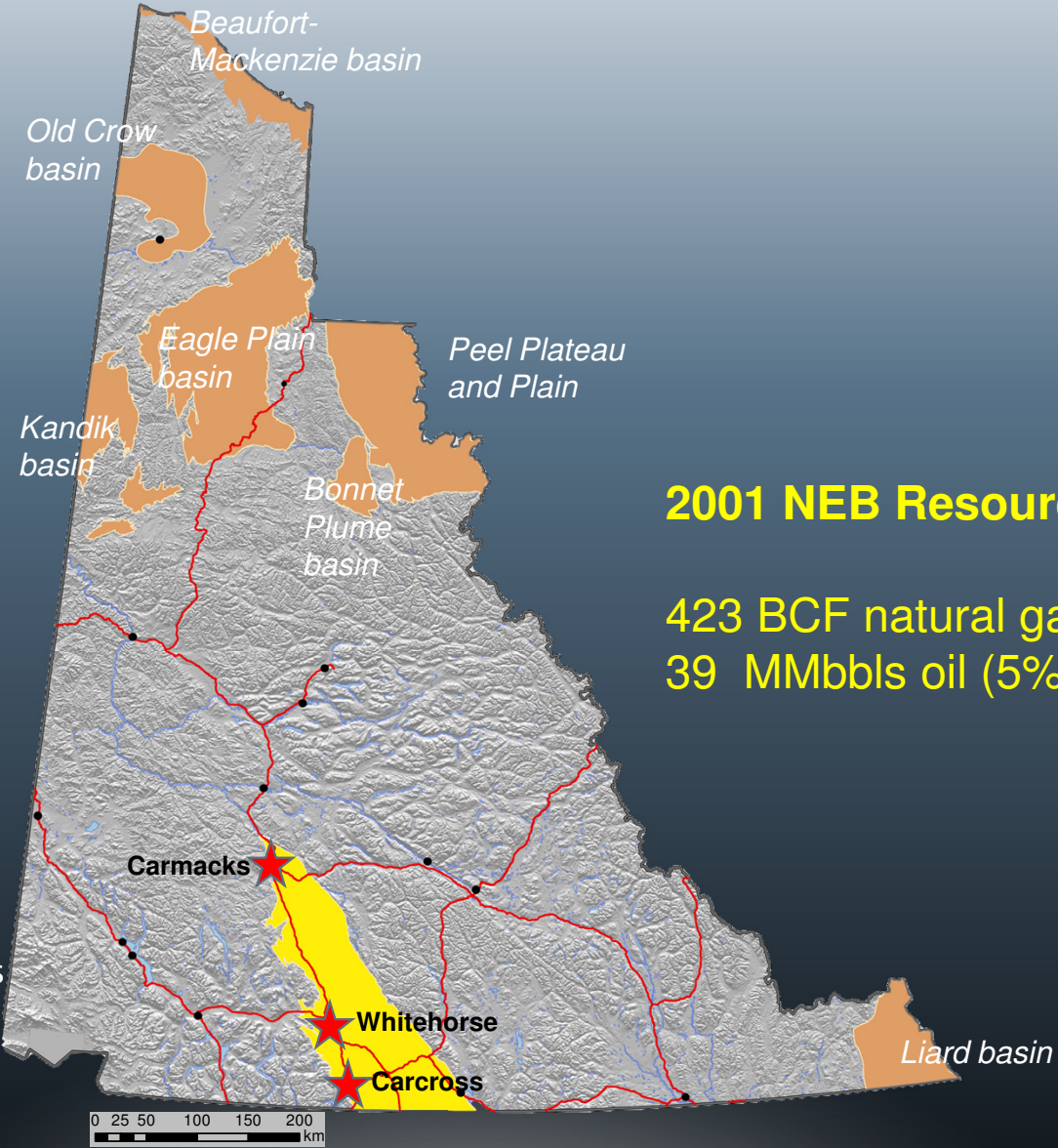
Petroleum Resource Assessment of Whitehorse Trough, Yukon



Outline

- Rationale for study
- Geology of Whitehorse trough
- Methodology
- Results
- Conclusions

Rationale



- Other Yukon sedimentary basins
- Whitehorse Trough

YGS Field studies



Unconventional reservoirs



Richthofen Fm shale at
Five Finger Rapids

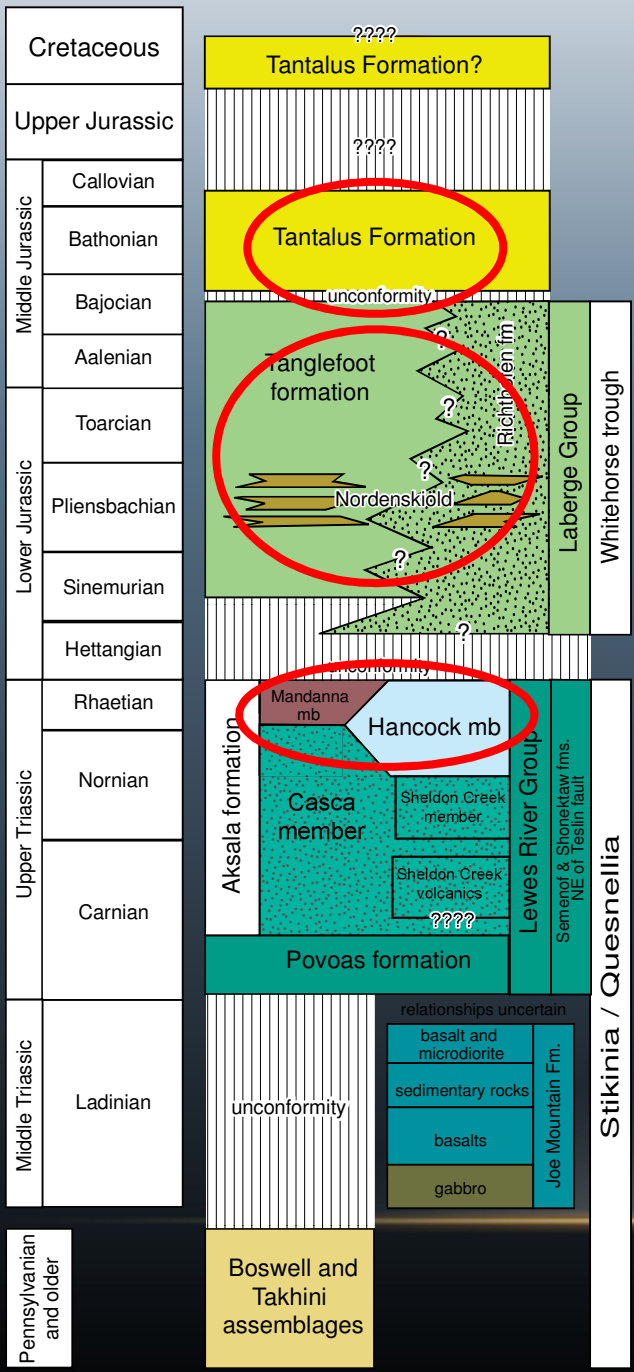


Coal seams in Tantalus Fm, Tantalus Butte

Yukon Terranes



Stratigraphy

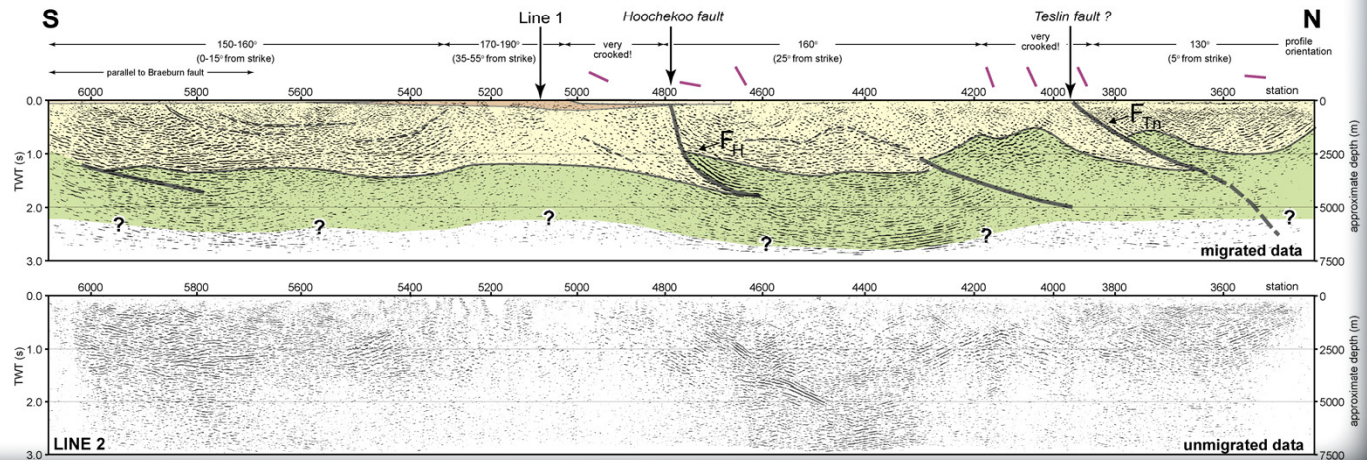
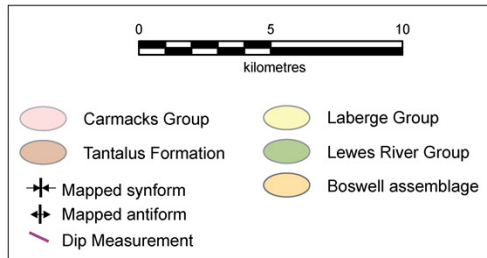
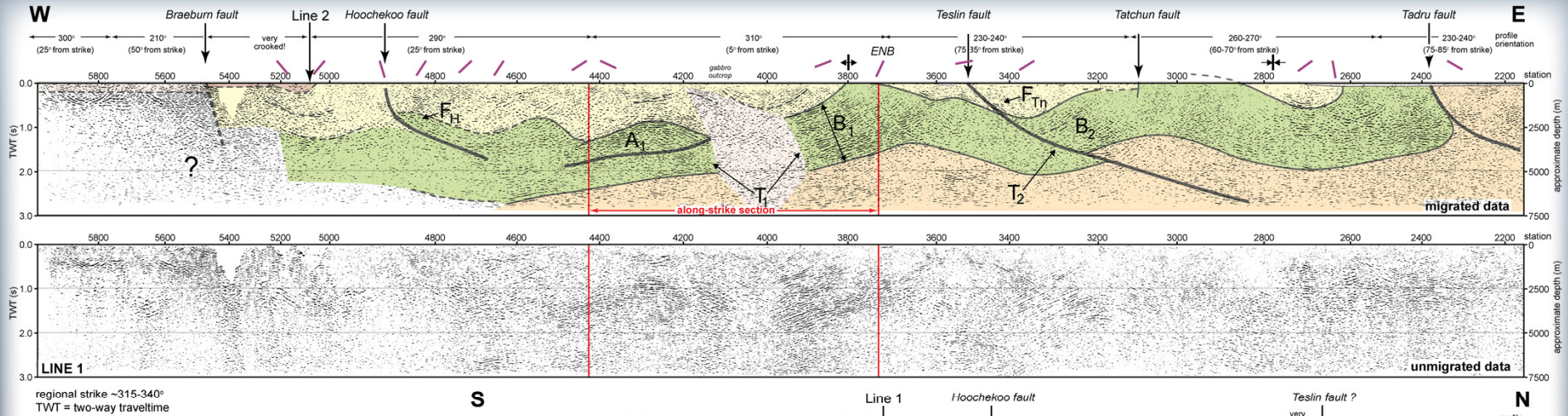


- ◆ Jurassic - Cretaceous Tantalus Fm
 - conglomerate, sandstone, coal
- ◆ Jurassic Laberge Group
 - Tanglefoot Fm – sandstone, cgl, shale
 - Richthofen Fm – sandstone, shale, cgl
- ◆ Upper Triassic Lewes River Group
 - Hancock Mbr - limestone
 - Mandanna Mbr – sandstone, siltstone, cong.



Structure

Robert Campbell highway

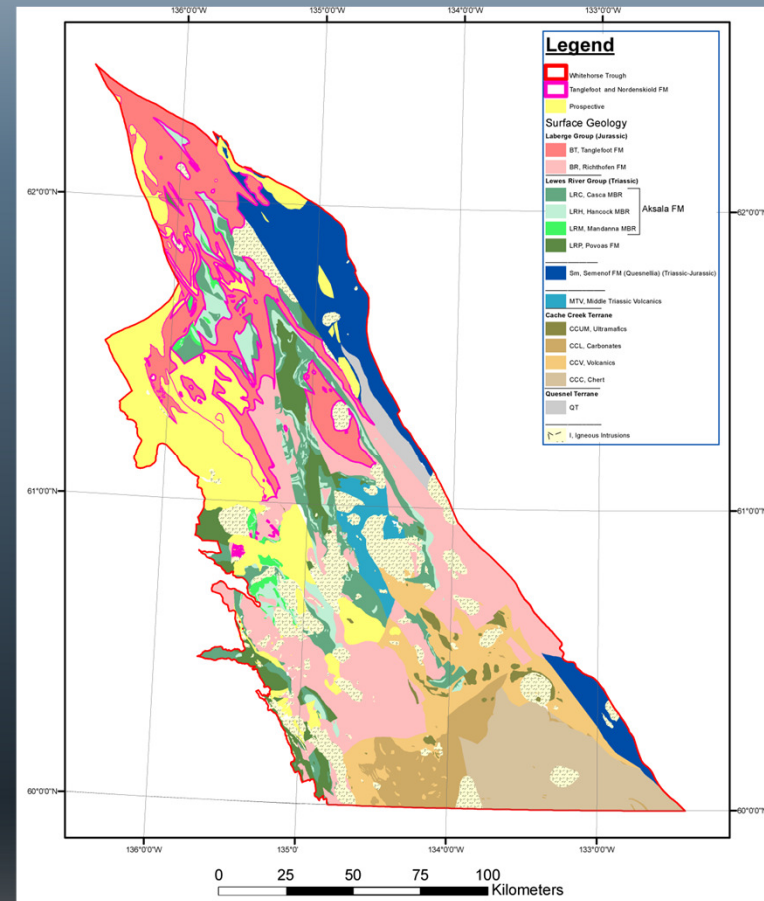
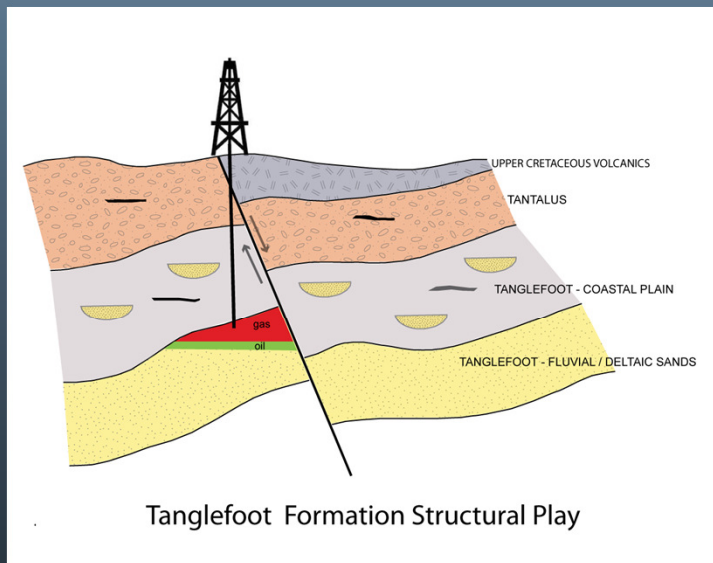


North Klondike highway

Resource Assessment Methodology

- Compile existing regional petroleum geology
- Define potential conventional/unconventional plays
- Statistical analysis
- Reporting

Petroleum Plays: prospects that share common geological characteristics and history of petroleum generation



Types of Petroleum Plays

NEB play definitions:

- **Established:** >6 discoveries, assigned reserves
- **Immature:** <6 discoveries, demonstrated to exist
- • **Conceptual:** Reasonable certainty for existence, but no discoveries or shows
- • **Speculative:** Possibility of existence, but no shows, insufficient data to support resource estimates ** not included in statistical analysis**

Results

- 9 play types: 5 conceptual (all conventional)
4 speculative (1 conventional, 3 unconventional)
- Volumetric calculations: in-place; marketable

Results: 4 Speculative Plays*

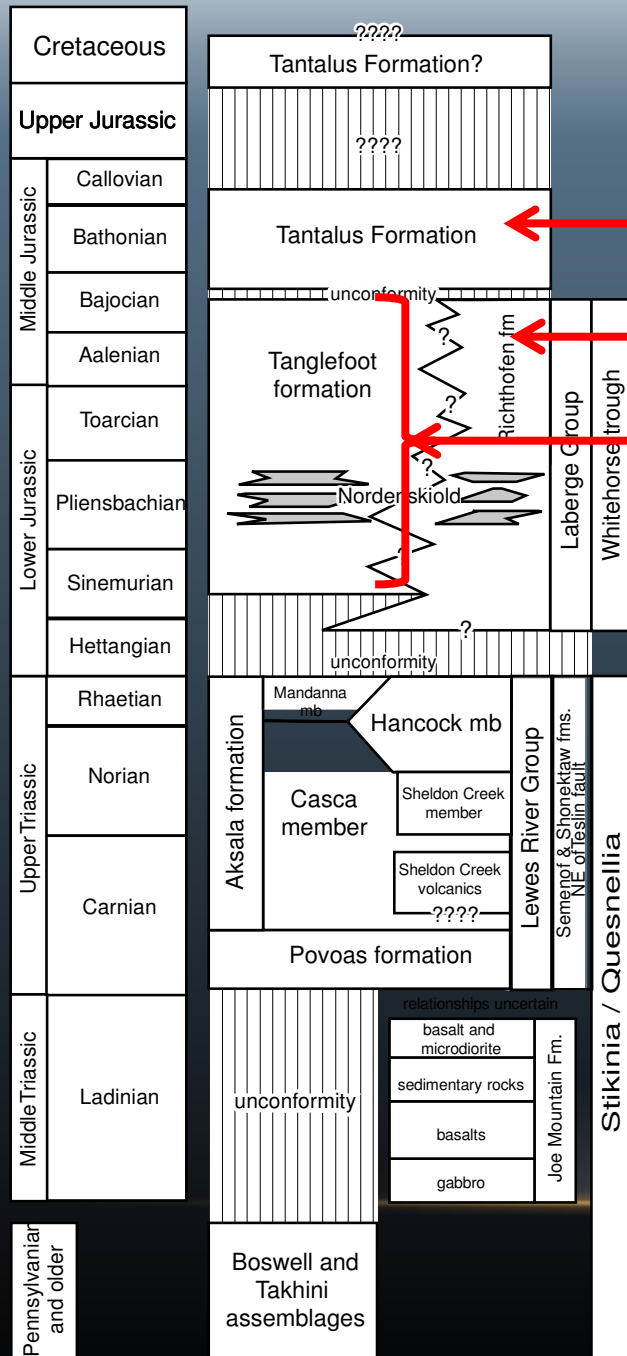
Tantalus Unconventional coalbed methane (Gas)

Richthofen Unconventional Tight/Shale (Gas)

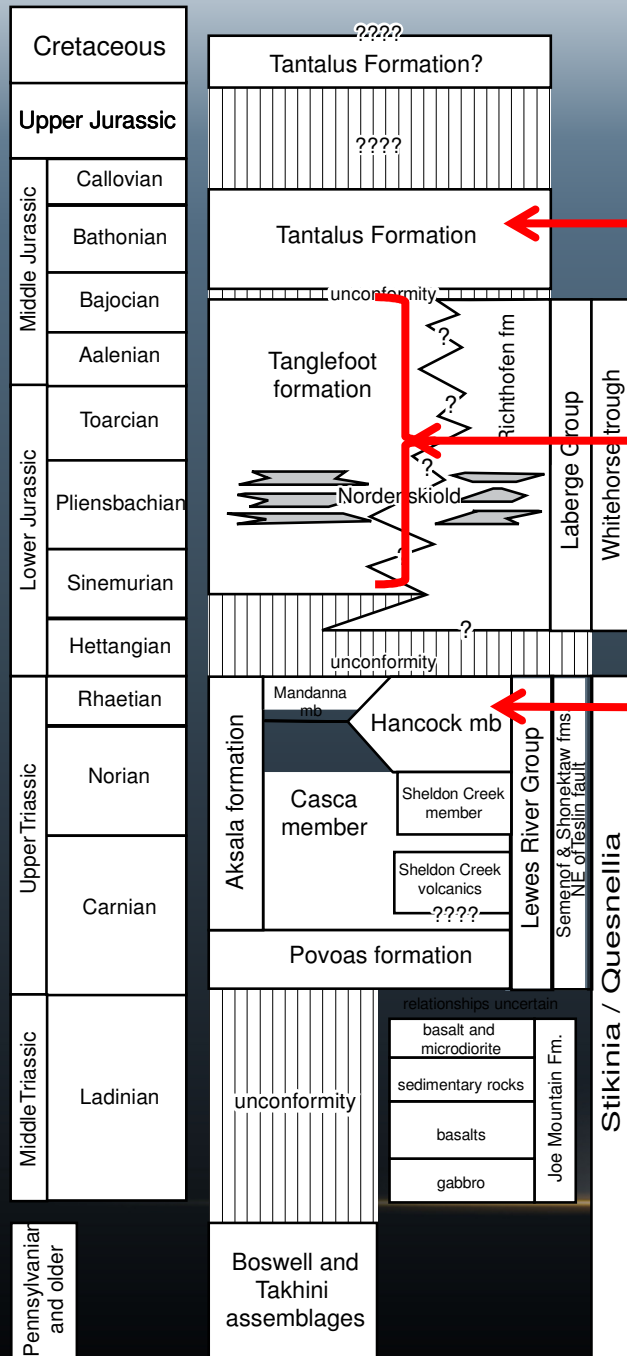
Tanglefoot Unconventional coalbed methane (Gas)

* not quantified in assessment due to lack of data

Cache Creek Structural (Gas)



Results: 5 Conceptual Plays



Tantalus Structural/Stratigraphic (Gas Oil)

Tanglefoot Stratigraphic (Gas Oil)

Tanglefoot Structural (Gas Oil)

Hancock Stratigraphic (Gas)

Lewes River Structural (Gas)

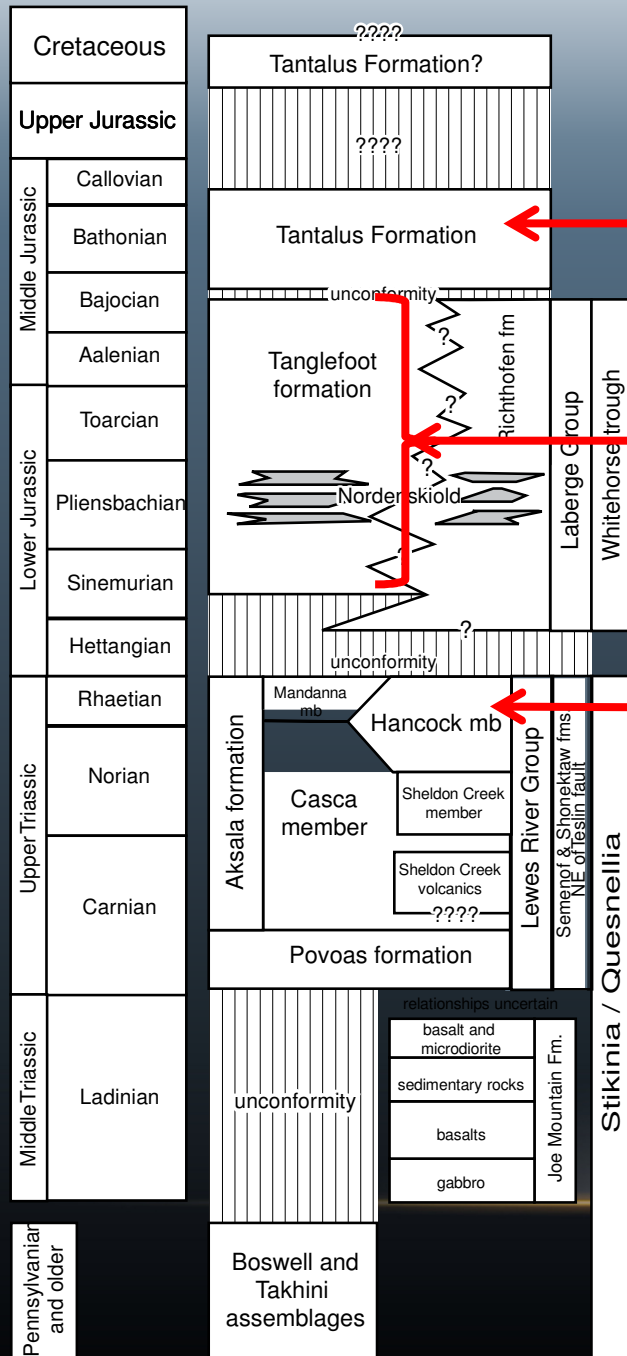
In-place volumes

PLAY	PLAY RISK	UNRISKED GAS IN PLACE (BCF)				RISKED	UNRISKED LIQUIDS IN PLACE (MMstb)				RISKED
		P90	P50	P10	MEAN	MEAN	P90	P50	P10	MEAN	MEAN
Lewes River Structural	0.03	37	243	1569	688	21	0	0.1	0.8	0.4	0.01
Hancock Stratigraphic	0.05	2.8	18	121	54	2.8	0	0	0.1	0	0
Tanglefoot Structural	0.13	103	588	3156	1393	181	3.9	25	157	68	8.9
Tanglefoot Stratigraphic	0.23	75	360	1685	741	171	2.7	16	86	36	8.4
Tantalus Struc / Strat	0.08	1	10.2	98	44	3.5	0	0.4	4.6	2.2	0.17
TOTALS					2920	379.3	106.6				17.48

Mean Gas-In-Place (BCF) **2920 379**

Mean Oil in Place (MMbbls) **107 17**

Results: 5 Conceptual Plays



Tantalus Structural/Stratigraphic (Gas Oil)

1% 1%

Tanglefoot Stratigraphic (Gas Oil)

45% 48%

Tanglefoot Structural (Gas Oil)

48% 51%

Hancock Stratigraphic (Gas)

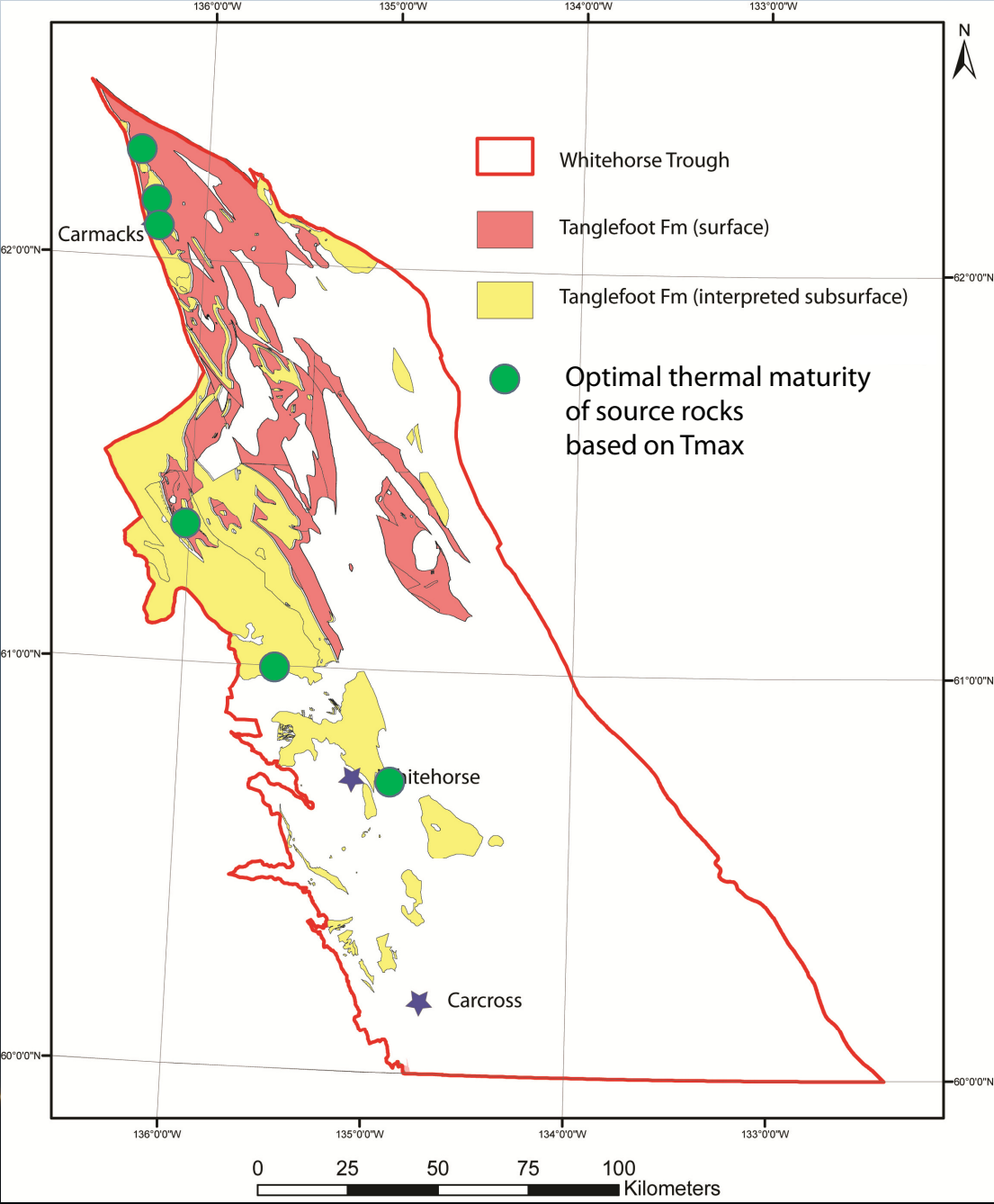
<1%

Lewes River Structural (Gas)

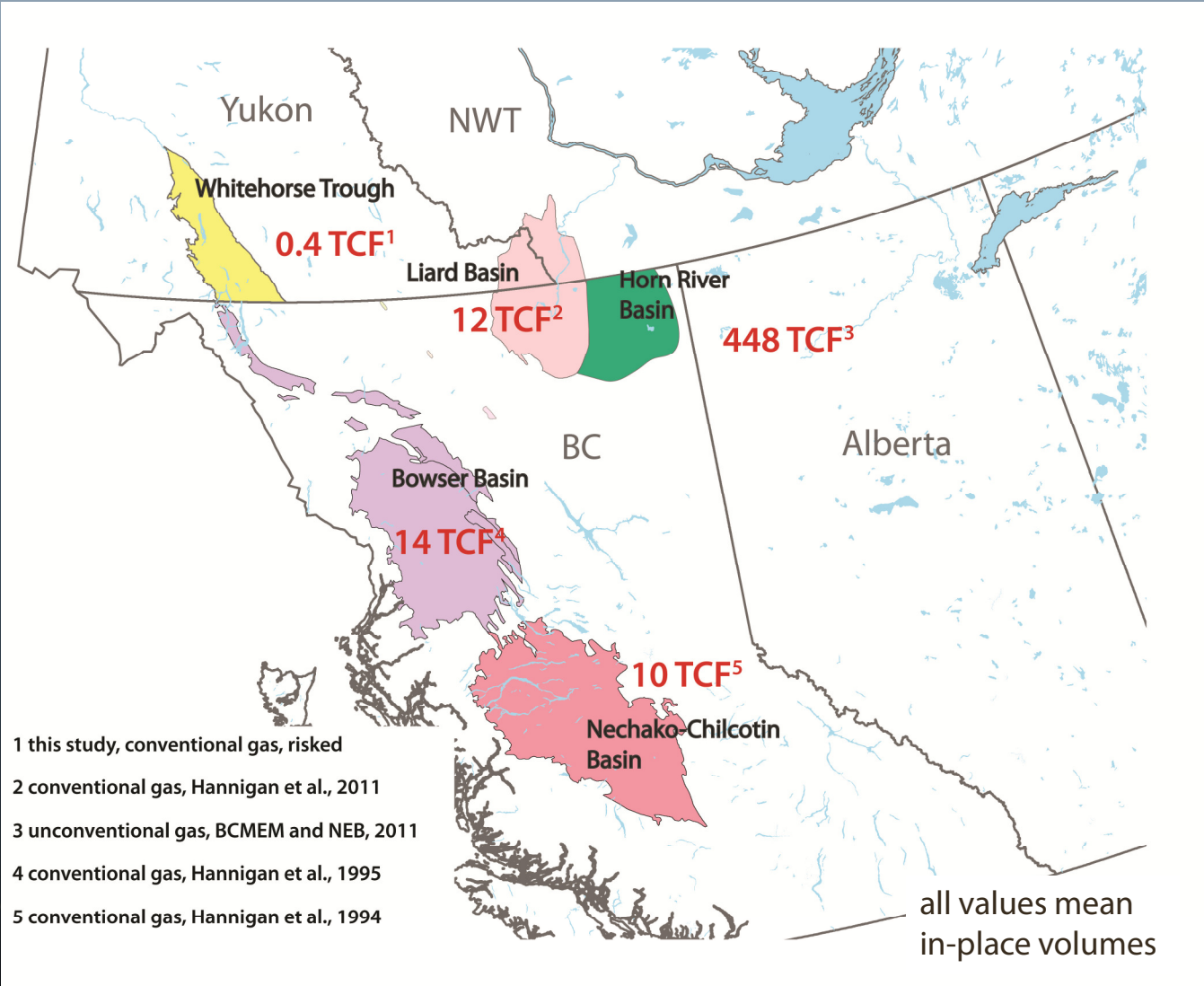
6%

% of total in-place
risked mean volumes

Tanglefoot Formation



How does WT compare to basins outside Yukon?



1 this study, conventional gas, risky
2 conventional gas, Hannigan et al., 2011
3 unconventional gas, BCMEM and NEB, 2011
4 conventional gas, Hannigan et al., 1995
5 conventional gas, Hannigan et al., 1994

How does this translate to Yukon energy needs?

2920 BCF gas (unrisked) → 1000 years electrical energy for Yukoners

379 BCF gas (risky) → 130 years electrical energy for Yukoners

Conclusions

- YGS and OGR commissioned a new petroleum RA for Whitehorse Trough
- new RA defines 5 conceptual plays and 4 speculative plays
- in-place natural gas estimates: 2920 BCF (unrisked) 379 (risked)
- in-place oil estimates: 107 MMbbls (unrisked) and 17 MMbbls oil (risked)
- Tanglefoot Formation located in the northern part of the basin is most prospective for gas and oil
- gas estimates are small, however, will likely increase when there is enough information to evaluate unconventional reservoirs
- gas estimates could provide more than 100 years of power supply to Yukoners

Petroleum resource assessment of Whitehorse trough, Yukon, Canada

Yukon Geological Survey Miscellaneous Report 6

Report prepared for Yukon Geological Survey
Report prepared by Brad J.R. Hayes, Petrel Robertson Consulting Ltd.



“...evidence for presence of both conventional and unconventional hydrocarbons in Whitehorse Trough is compelling, and assessed volumes are sufficiently substantial to support additional exploration and assessment work.”

www.geology.gov.yk.ca

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