Appalachian Foreland Basins Beneath the Gulf of St. Lawrence

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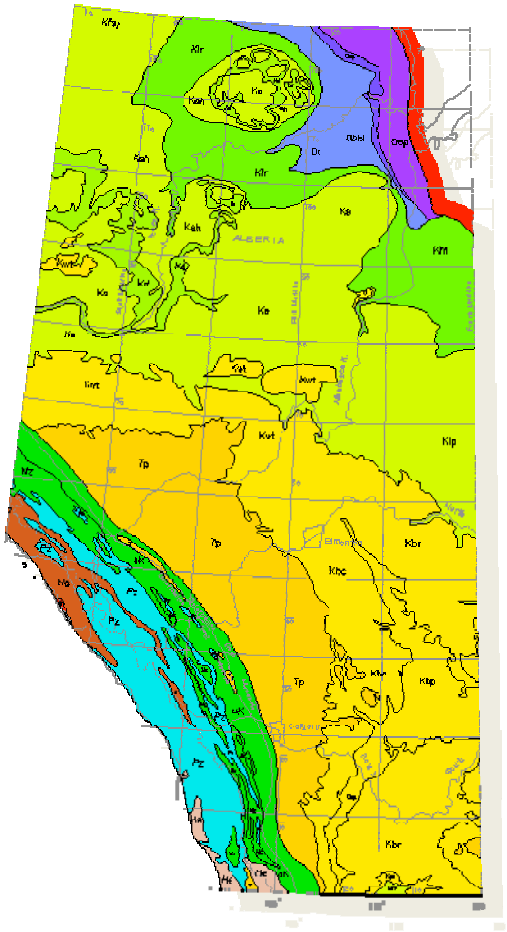
Leprechaun Resources

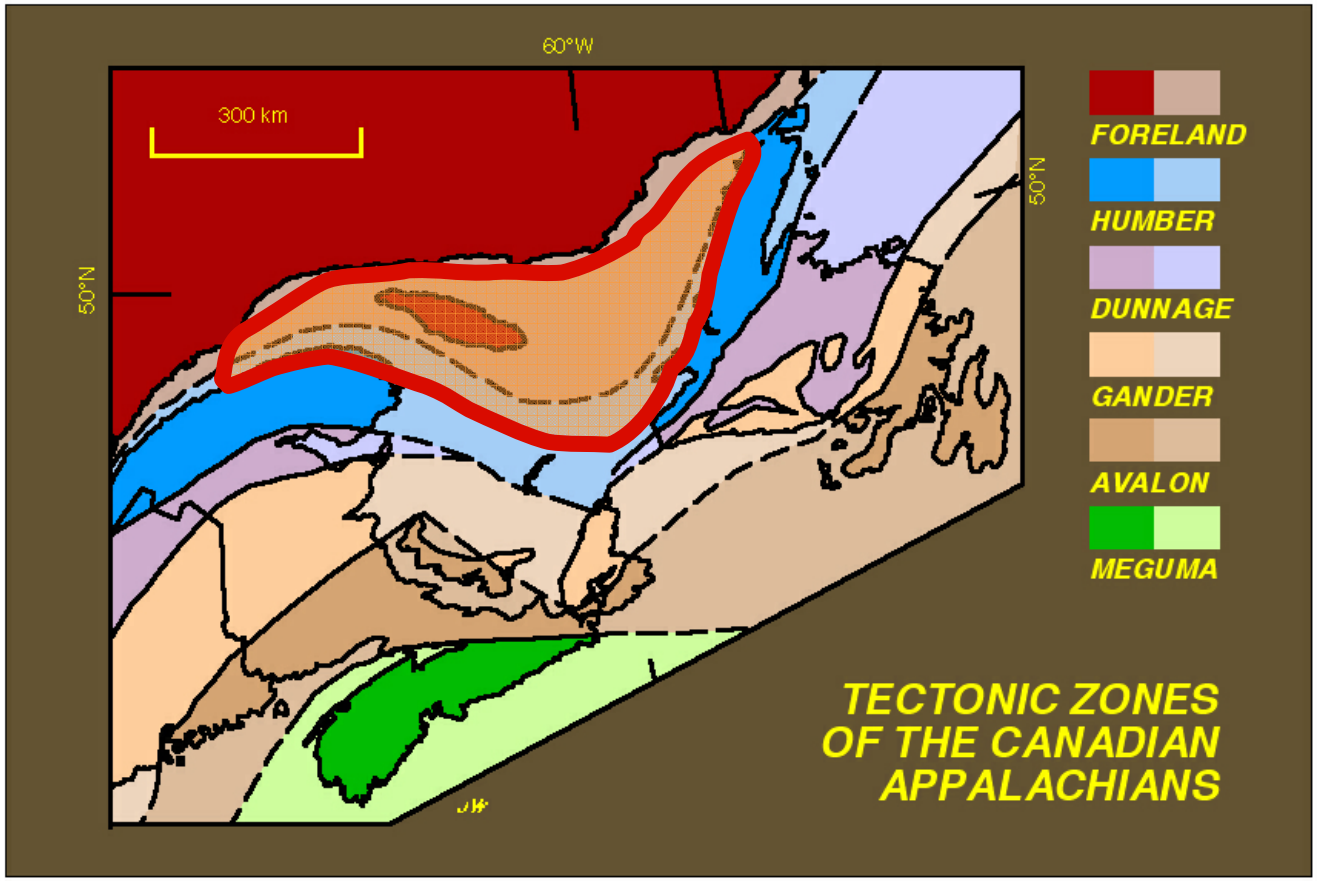
Newfoundland Labrador

nalcor energy OIL AND GAS

Petroleum Exploration Enhancement Program

Foreland Basin of Newfoundland Appalachians

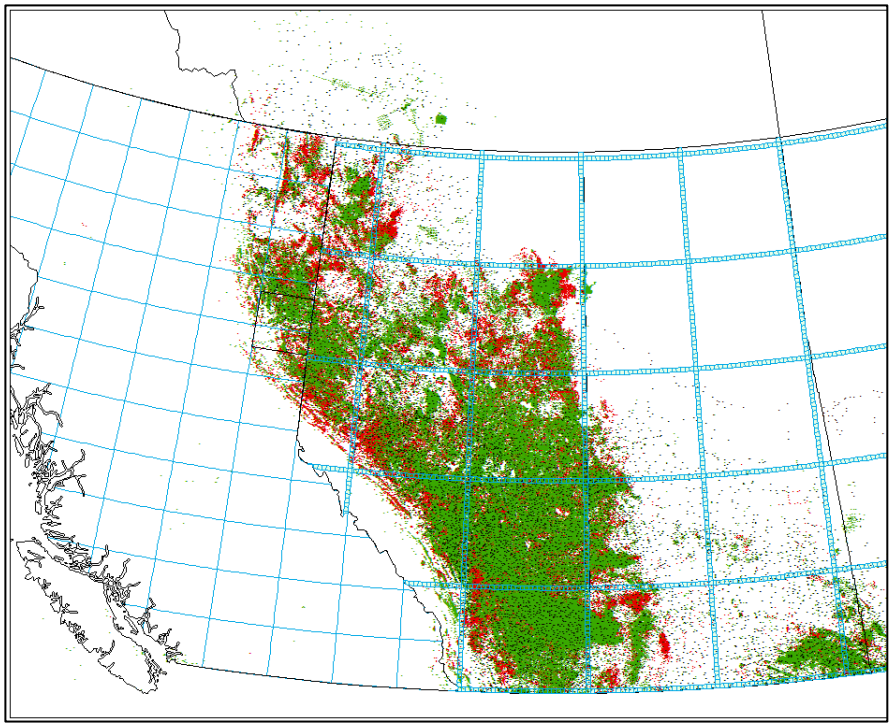




Alberta to the same scale

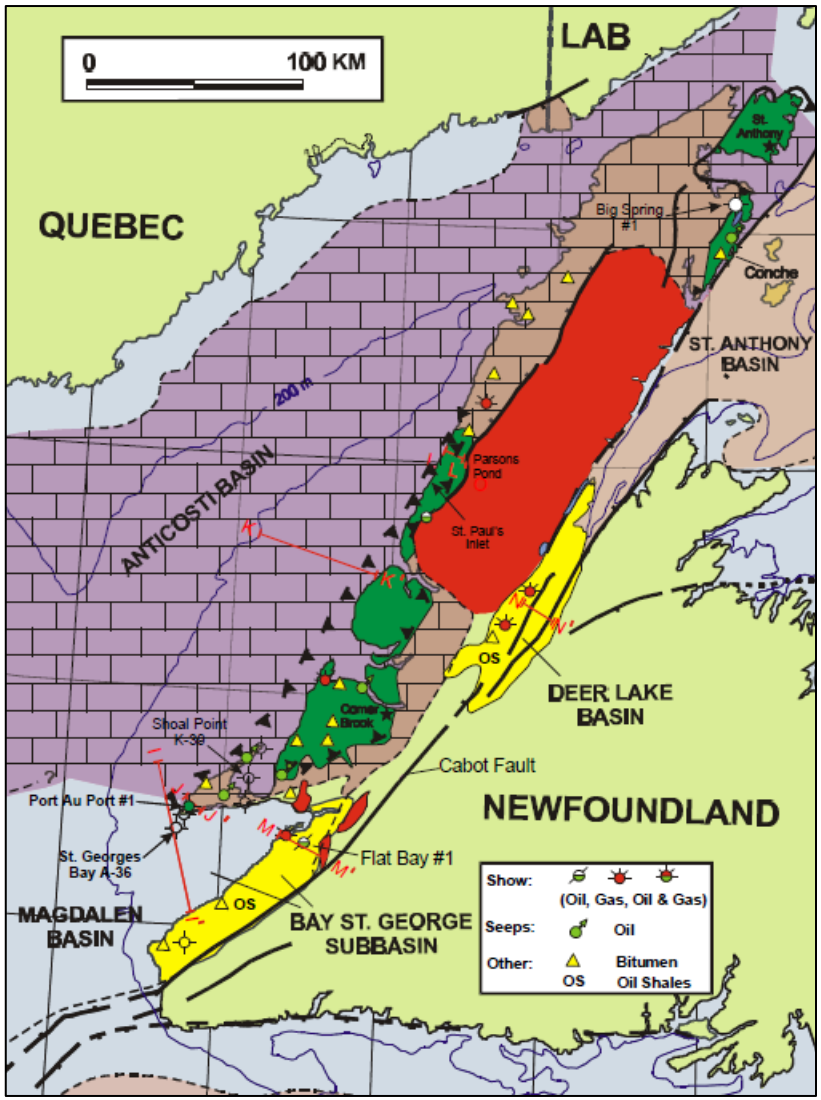
Wells Drilled in Canadian Foreland Basins

Western Canada



McKenzie, 2010

Eastern Canada



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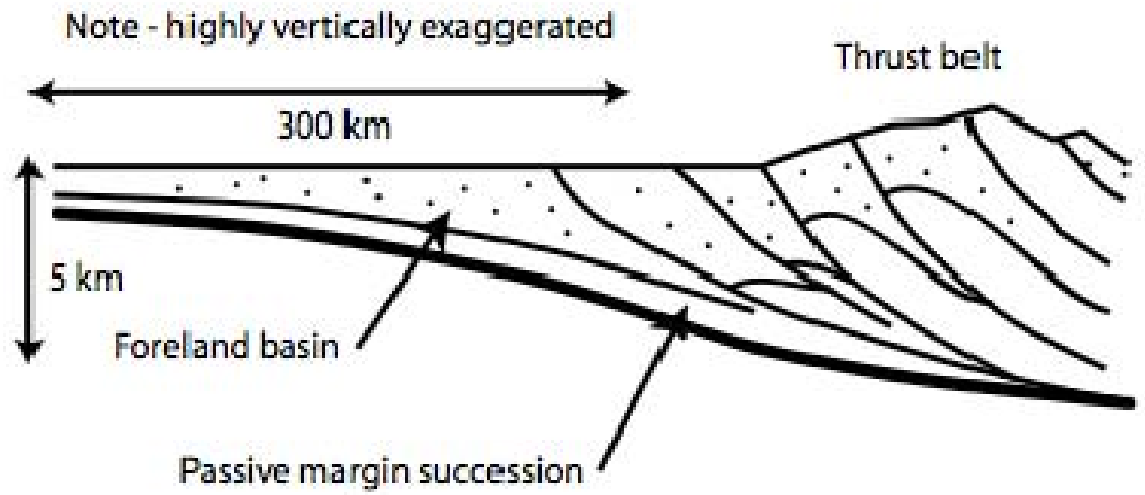
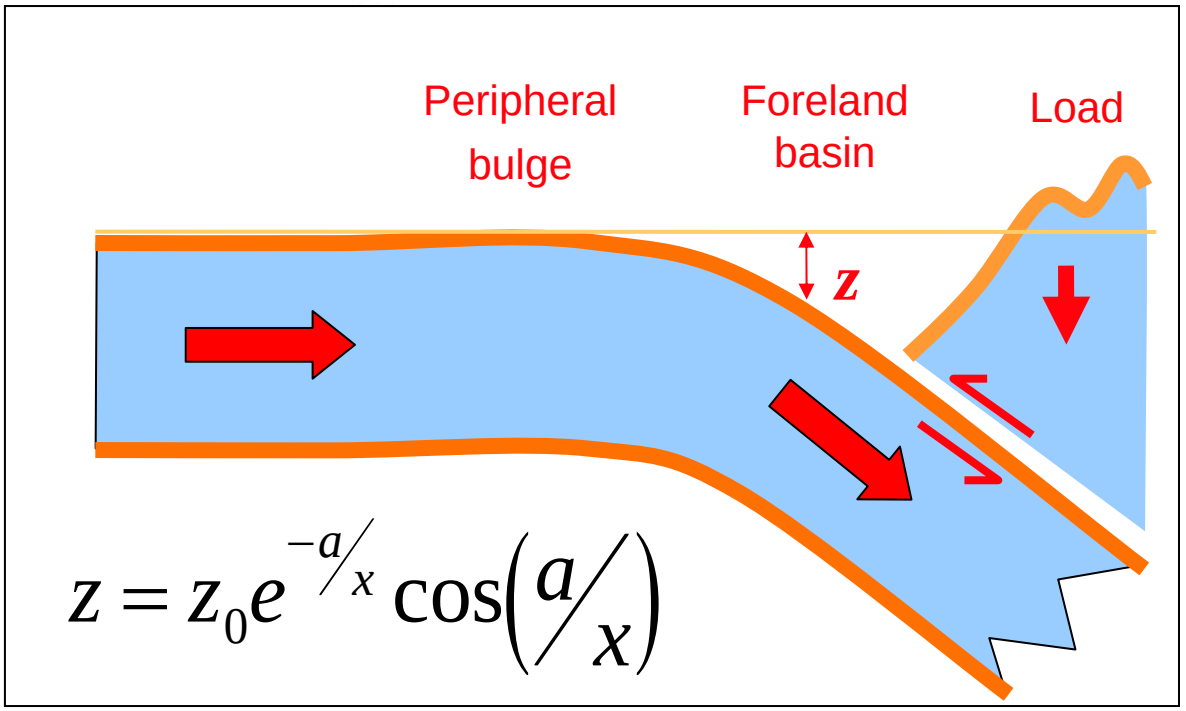
Foreland Basin

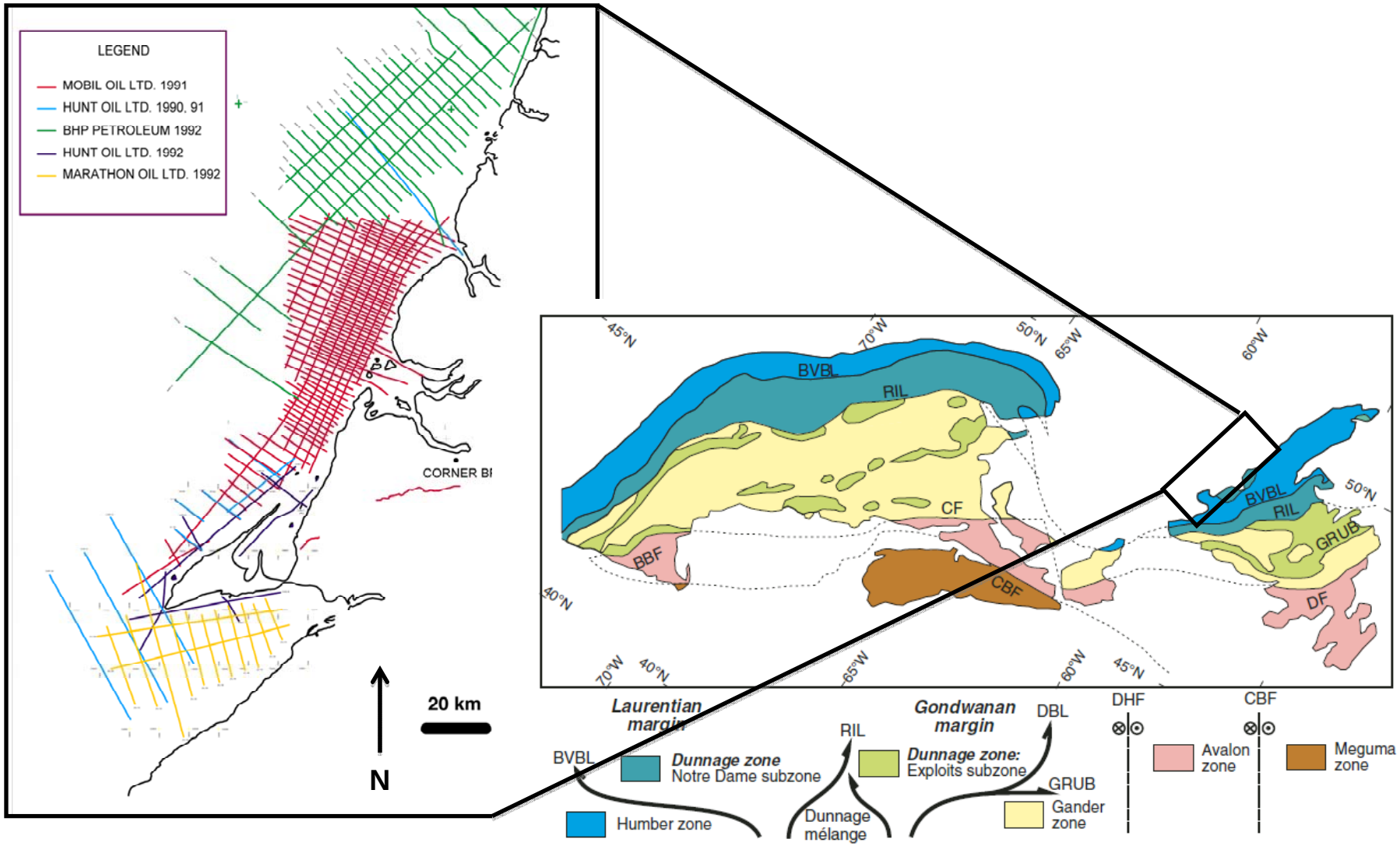




Why Study the Appalachian Foreland Basin?

- **From an Economic Perspective**
  - Hydrocarbon potential
  - Relatively underexplored
- **From a Scientific Perspective**
  - The structure and sediments within foreland basin can tell us about the orogen and orogenic events

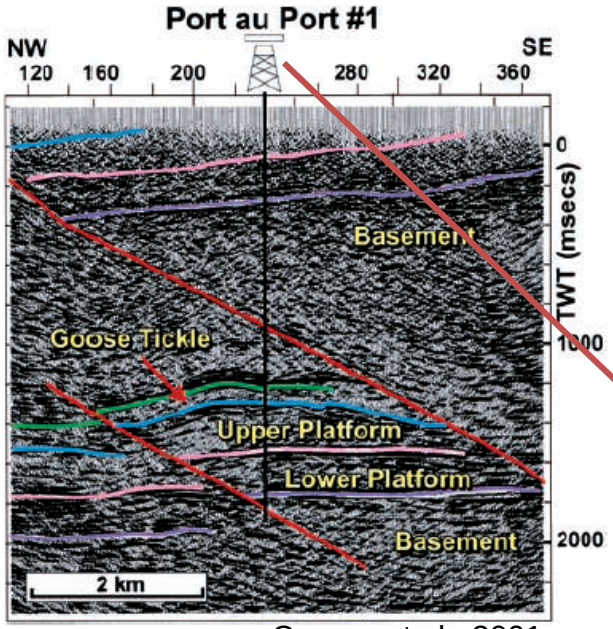
Seismic Data



Hibbard et al., 2007

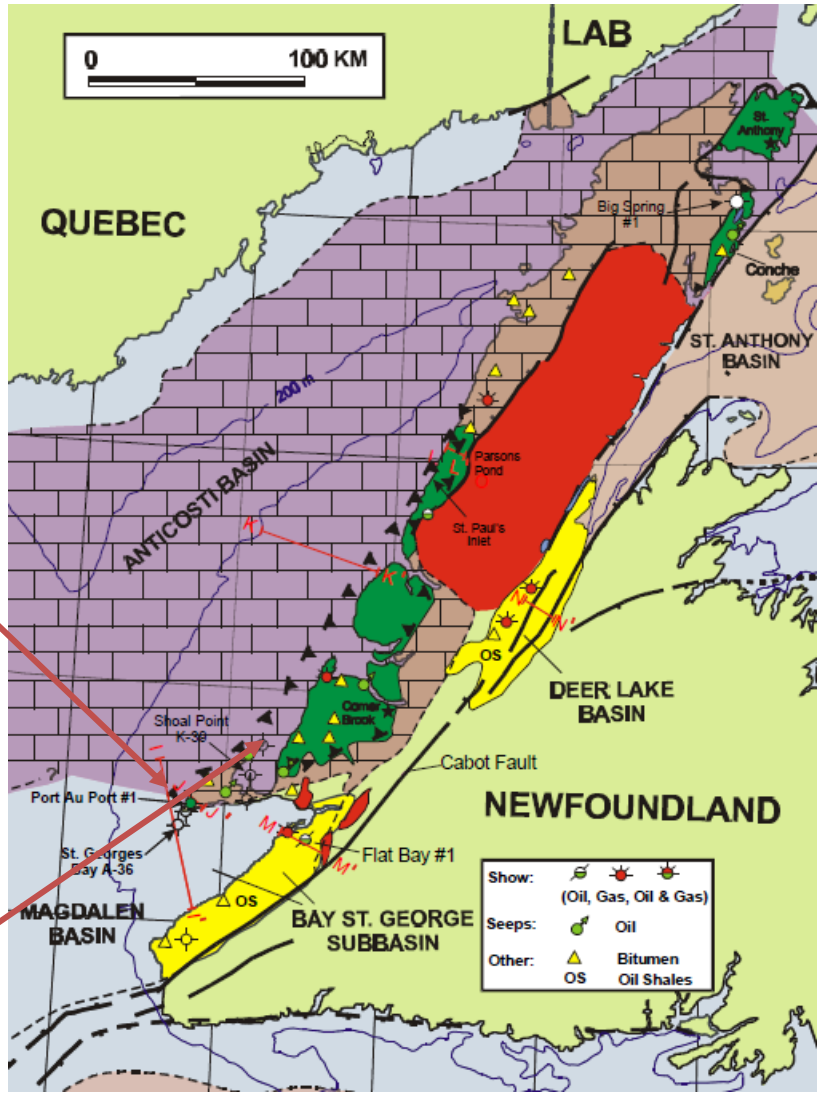
Ties to Seismic Reflectors

1.) Few well ties



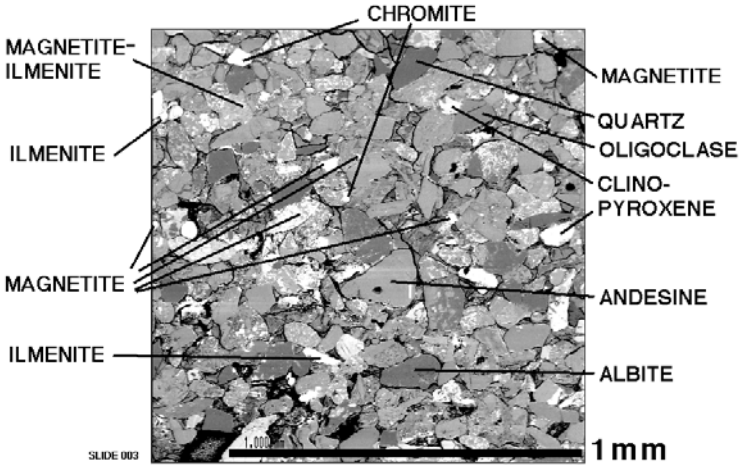
Cooper et al., 2001

2.) Links to outcrops



Ties to Seismic Reflections

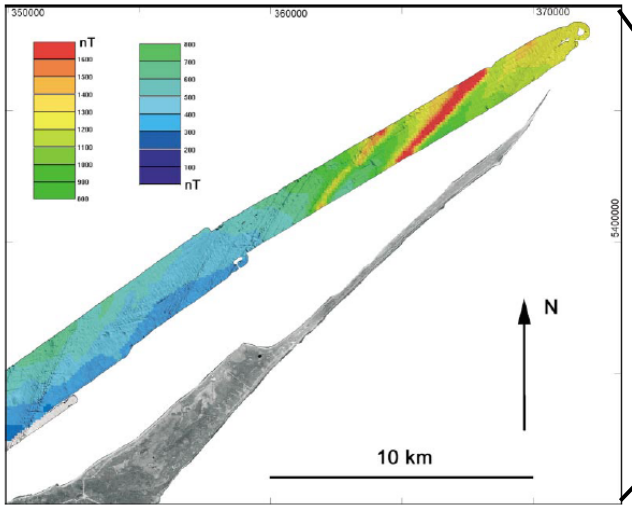
3.) Magnetic Anomalies

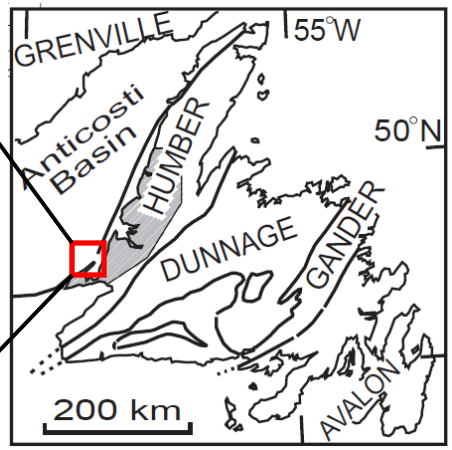


Waldron et al., 2002

-Detrital magnetite in sandstones.

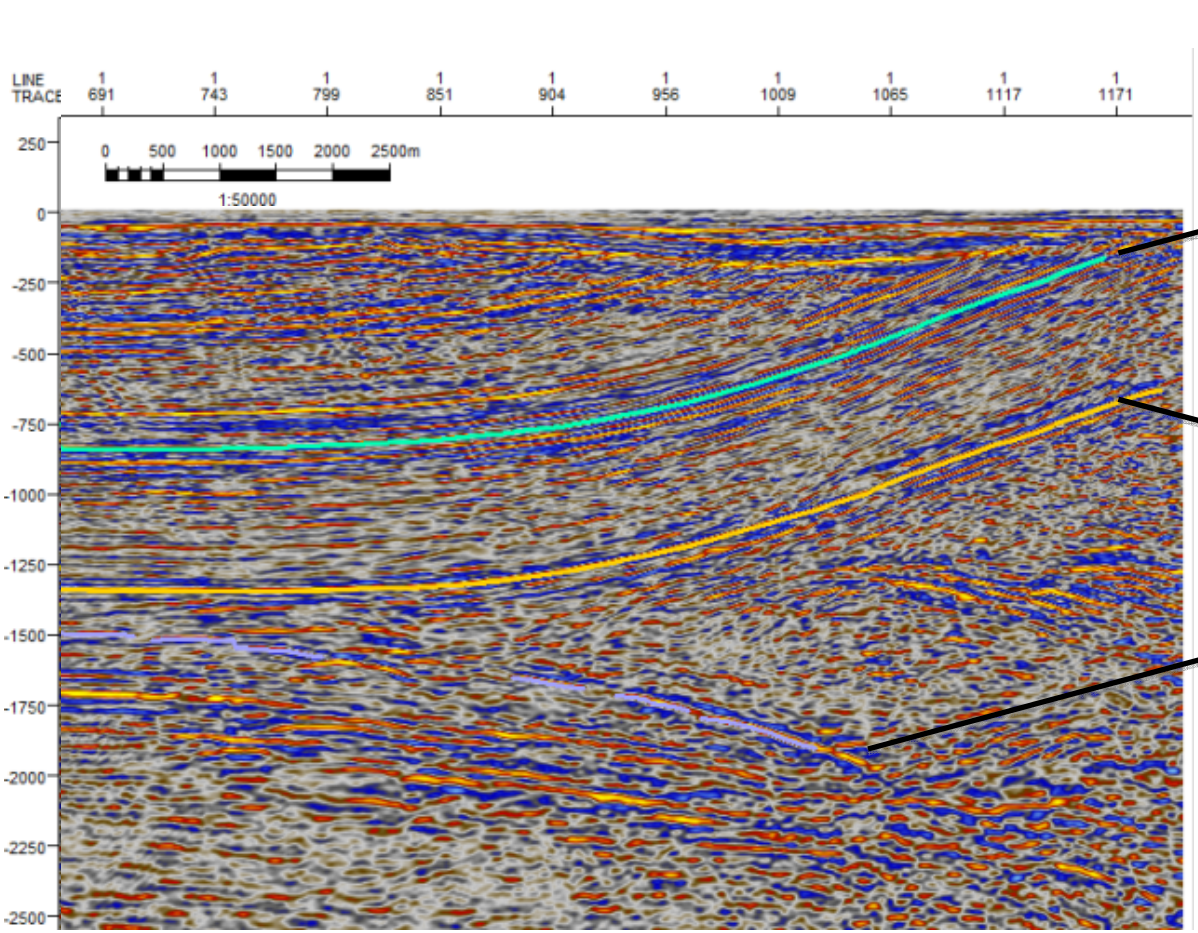
-Stratigraphically controlled.

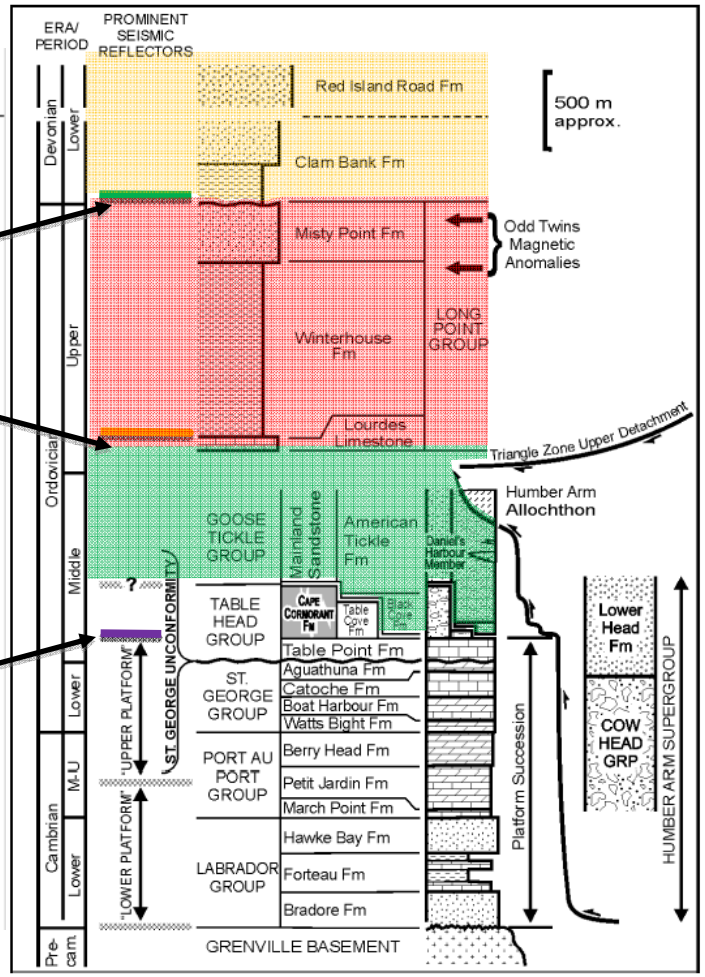




Waldron et al., 2002

Distinctive Reflectors



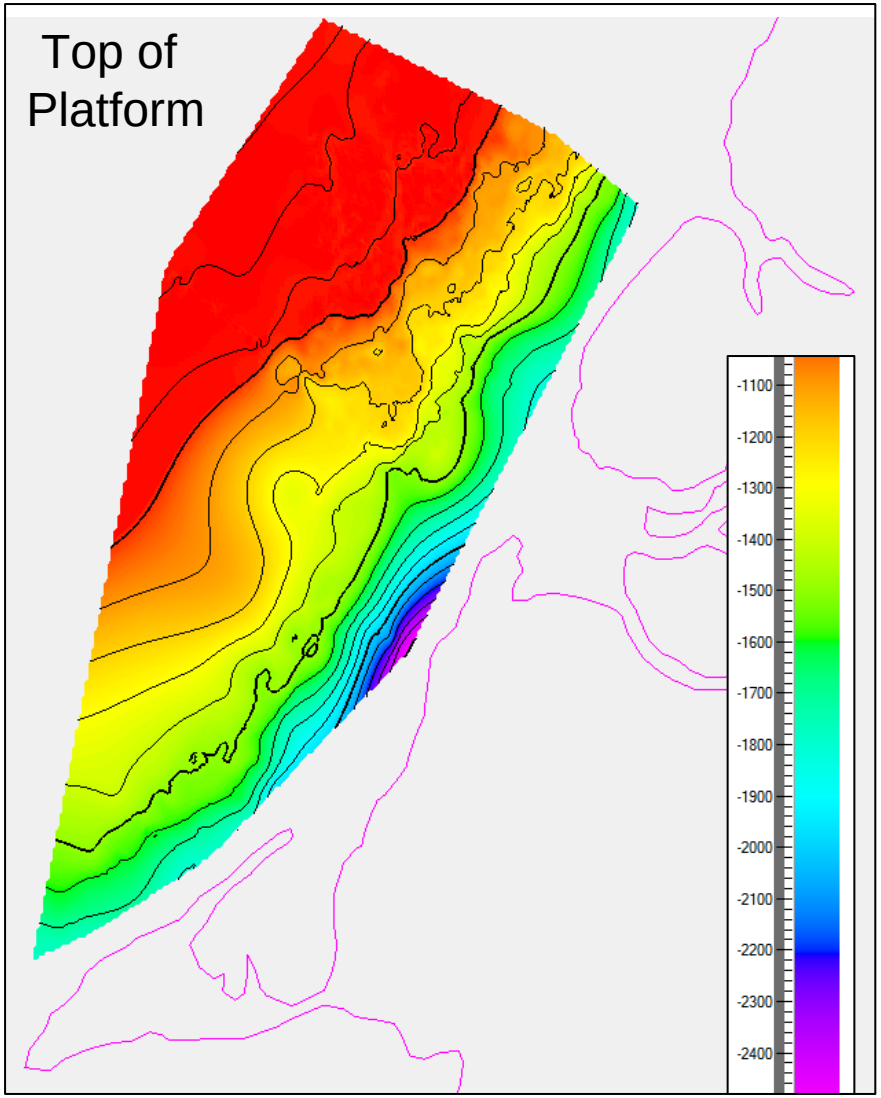


Stockmal et al., 2004

Acadian → Foreland Basin 3

??? → Foreland Basin 2

Taconian → Foreland Basin 1



Contoured Horizons

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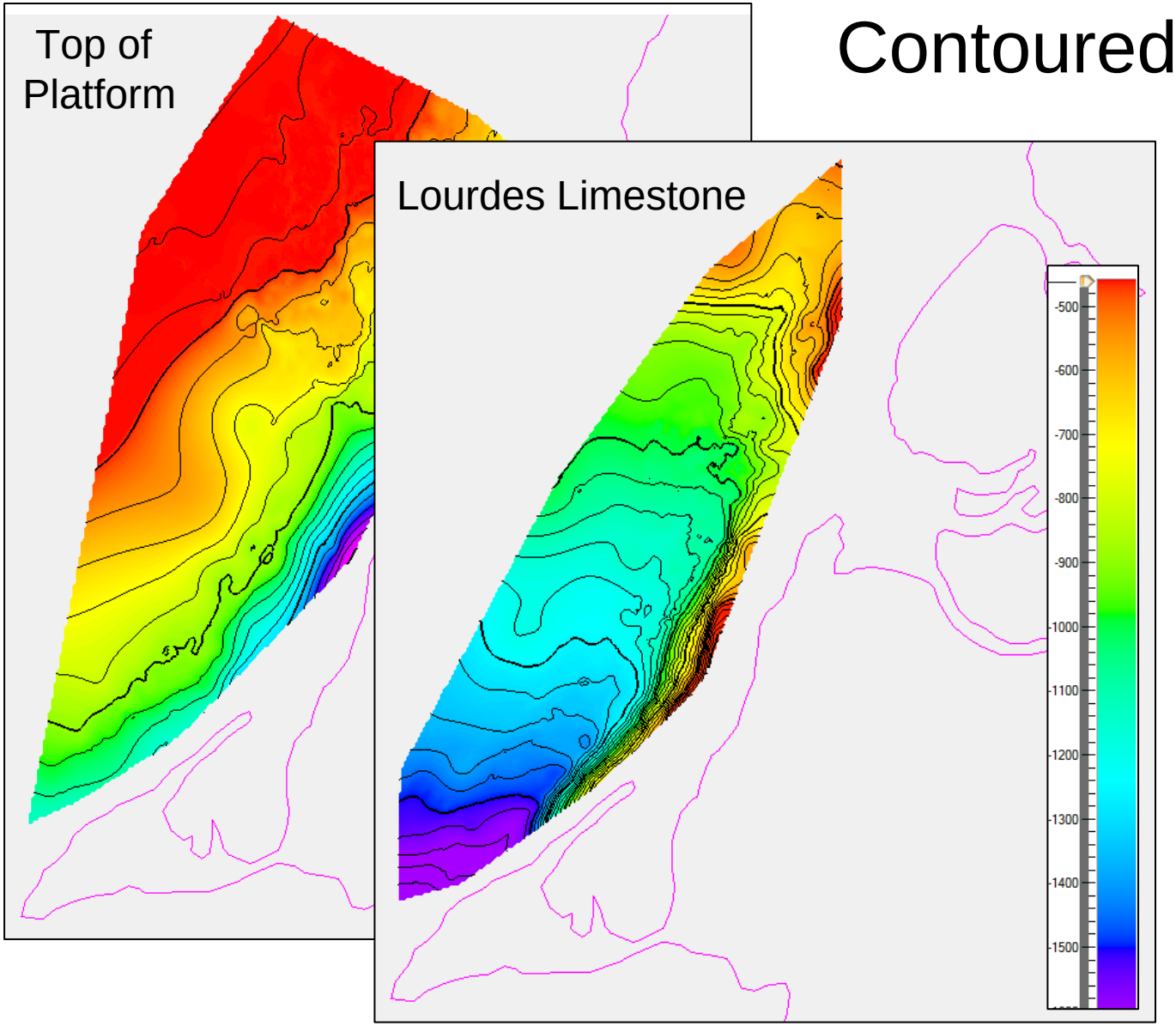

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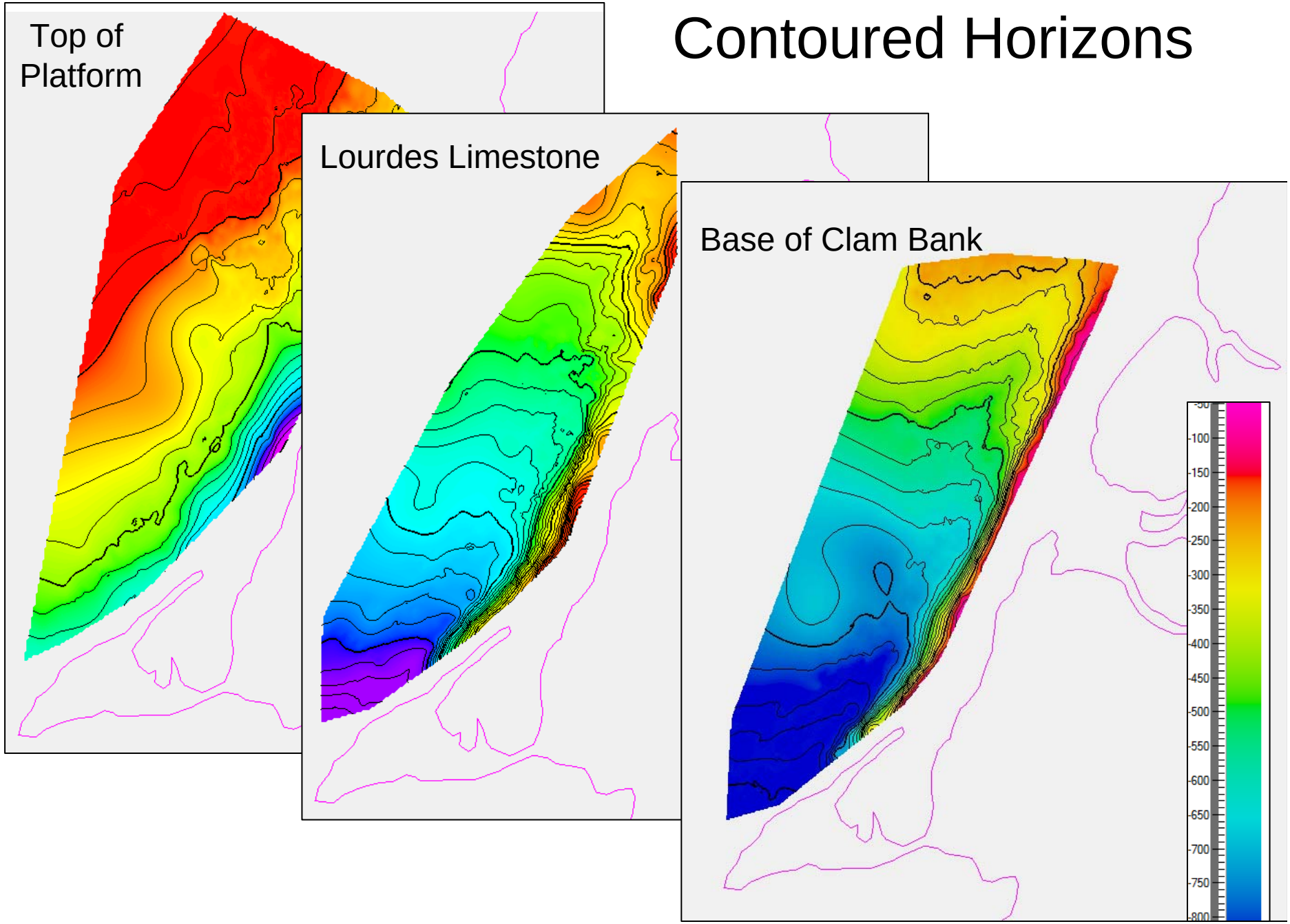
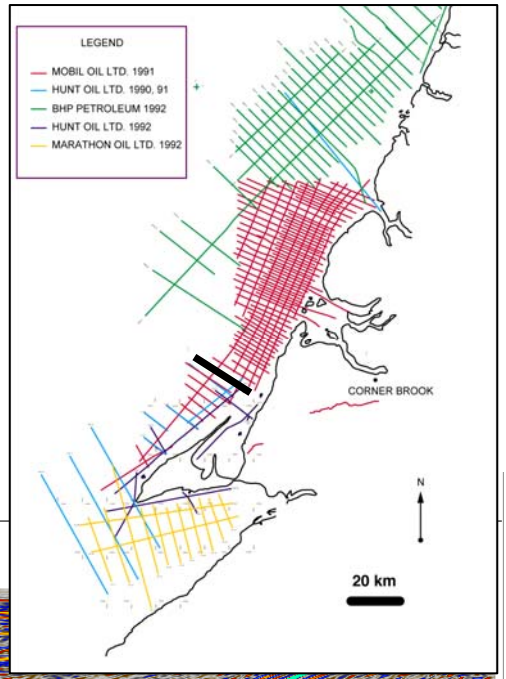
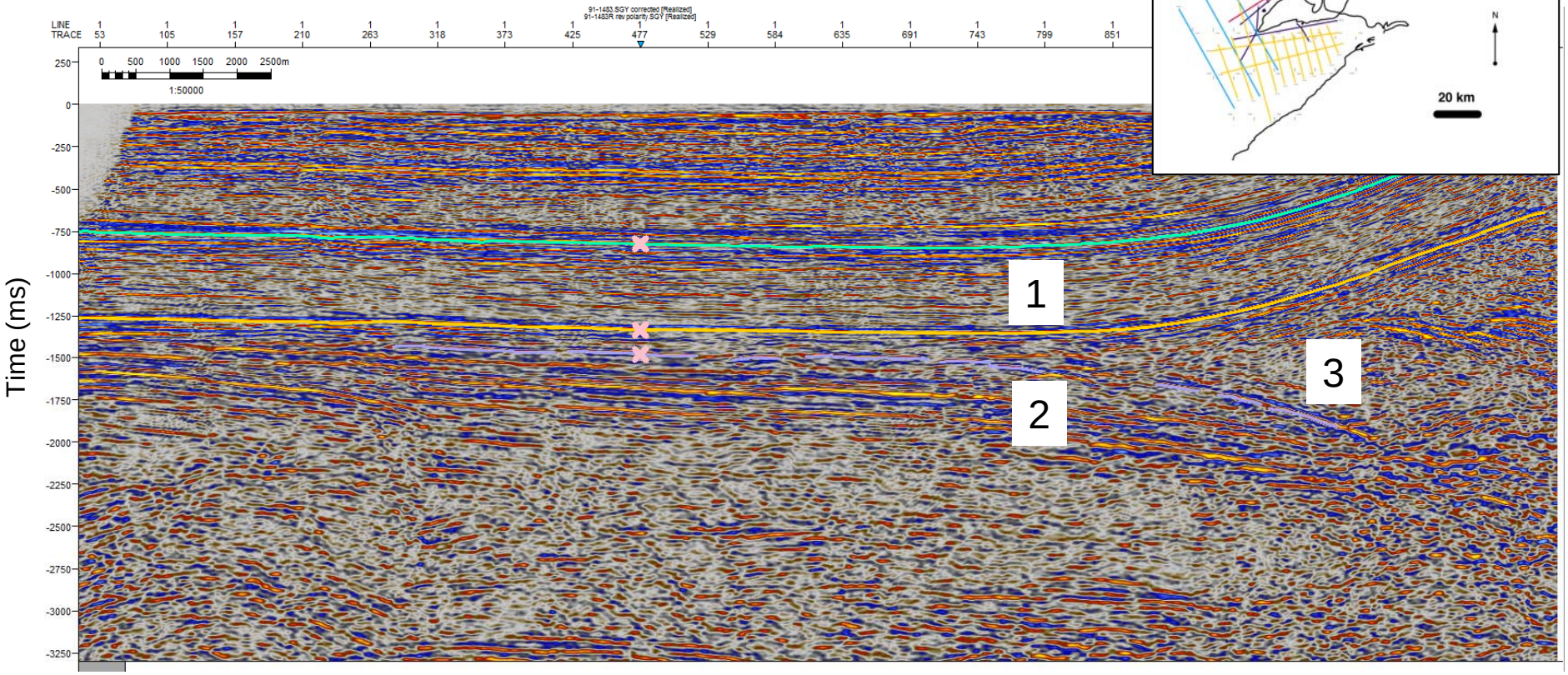


Appalachian Structural Front

3 sets of distinct reflectors

1. Upper set folded into west facing monocline
2. Lower set that dips towards the southeast
3. Middle set of discontinuous reflectors: wedge shaped





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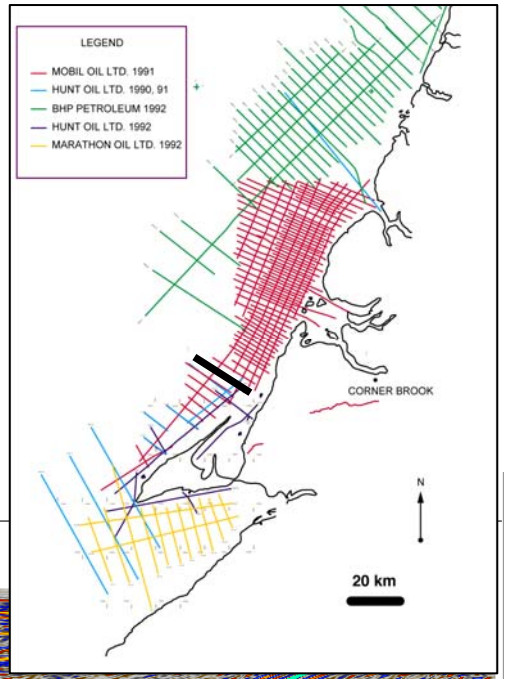
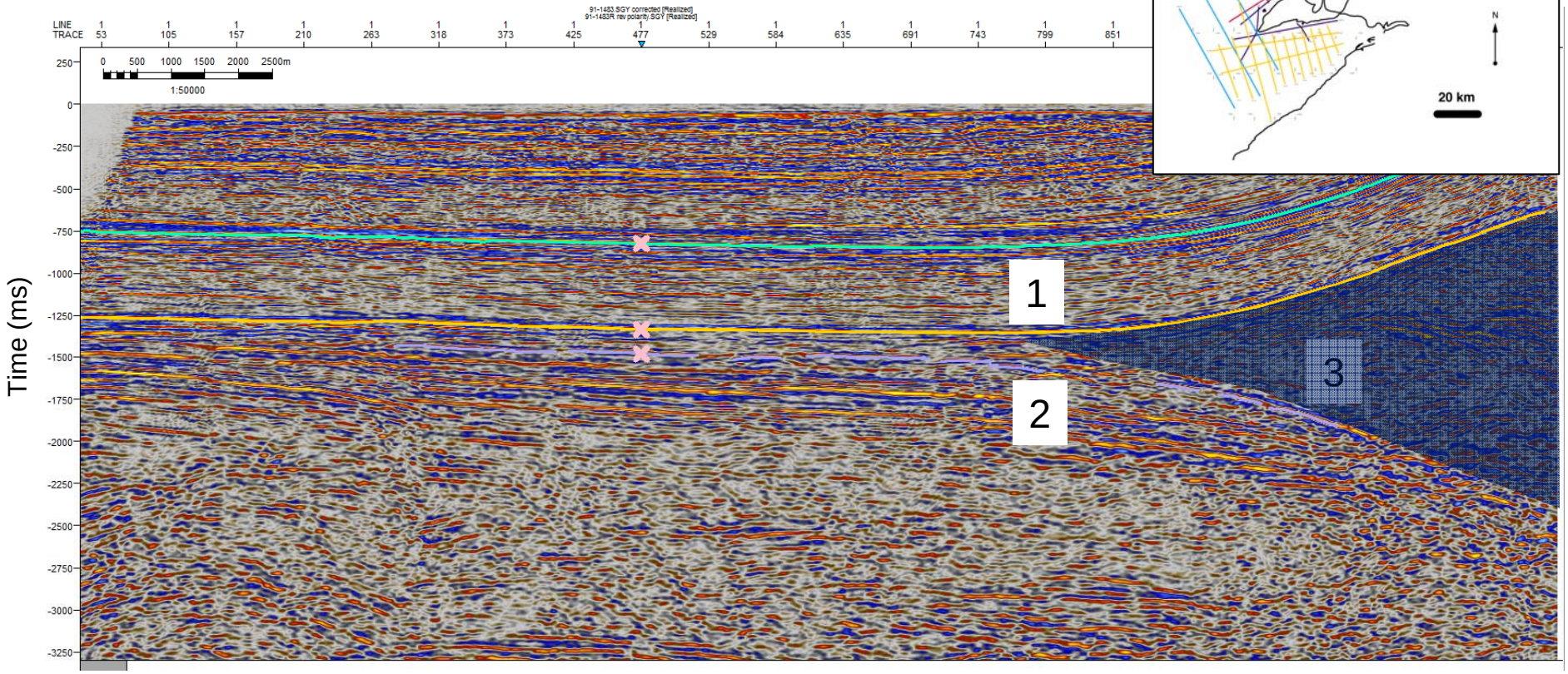
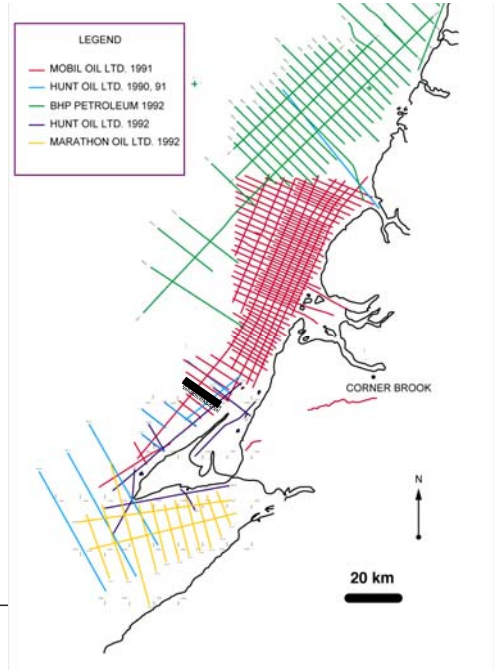
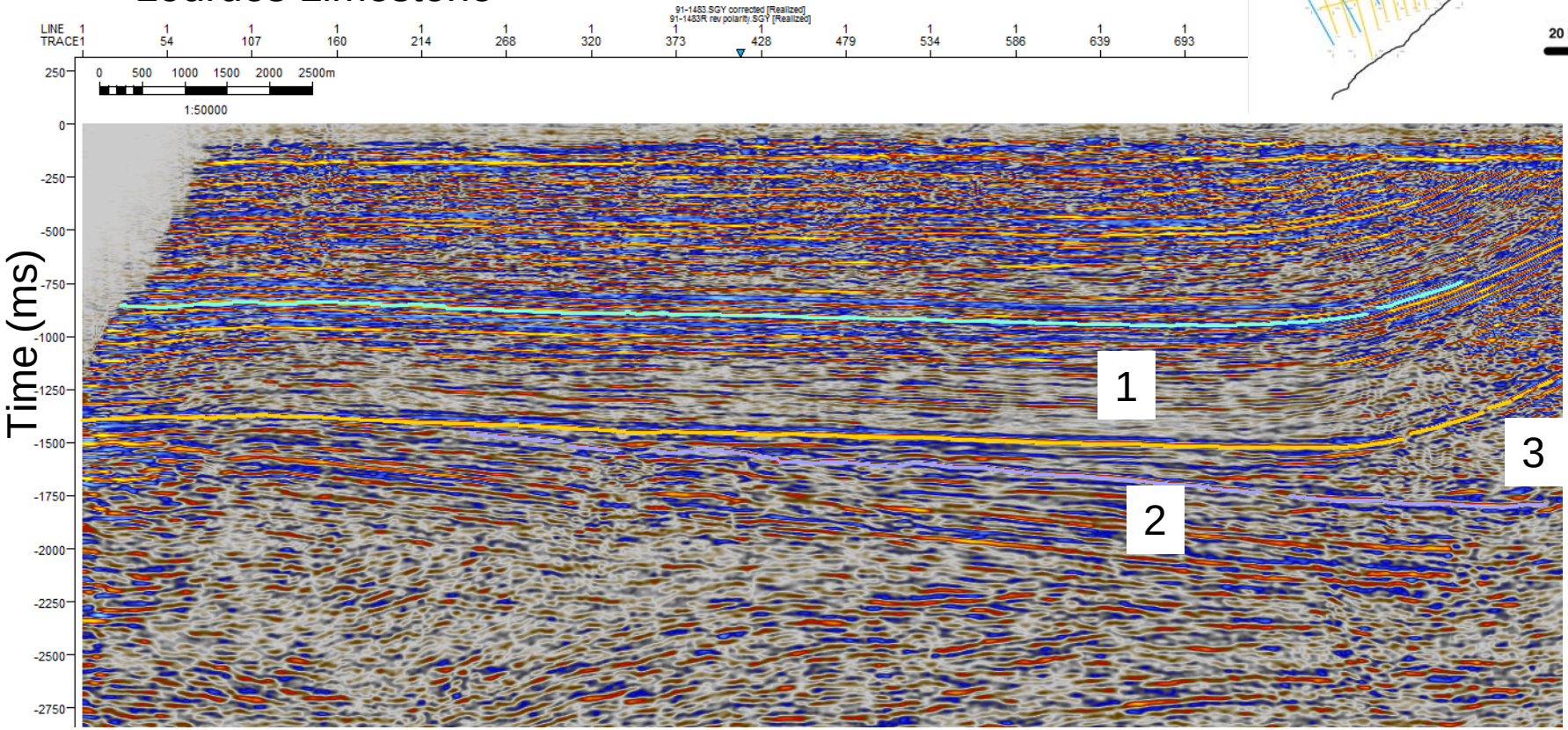




Appalachian Structural Front: South to North variation

- Base of Lourdes & base of Clam Bank are parallel.
- Goose Tickle relatively thin.
- Long Point Group relatively thick.
- Top of tectonic wedge (Tea Cove thrust) along base of Lourdes Limestone





NW SE

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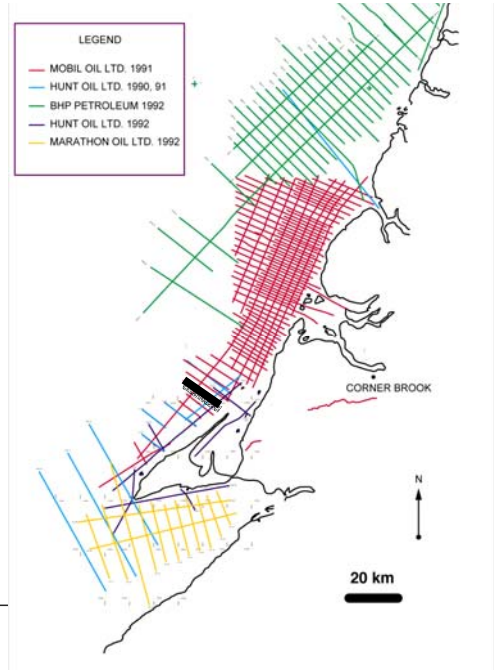

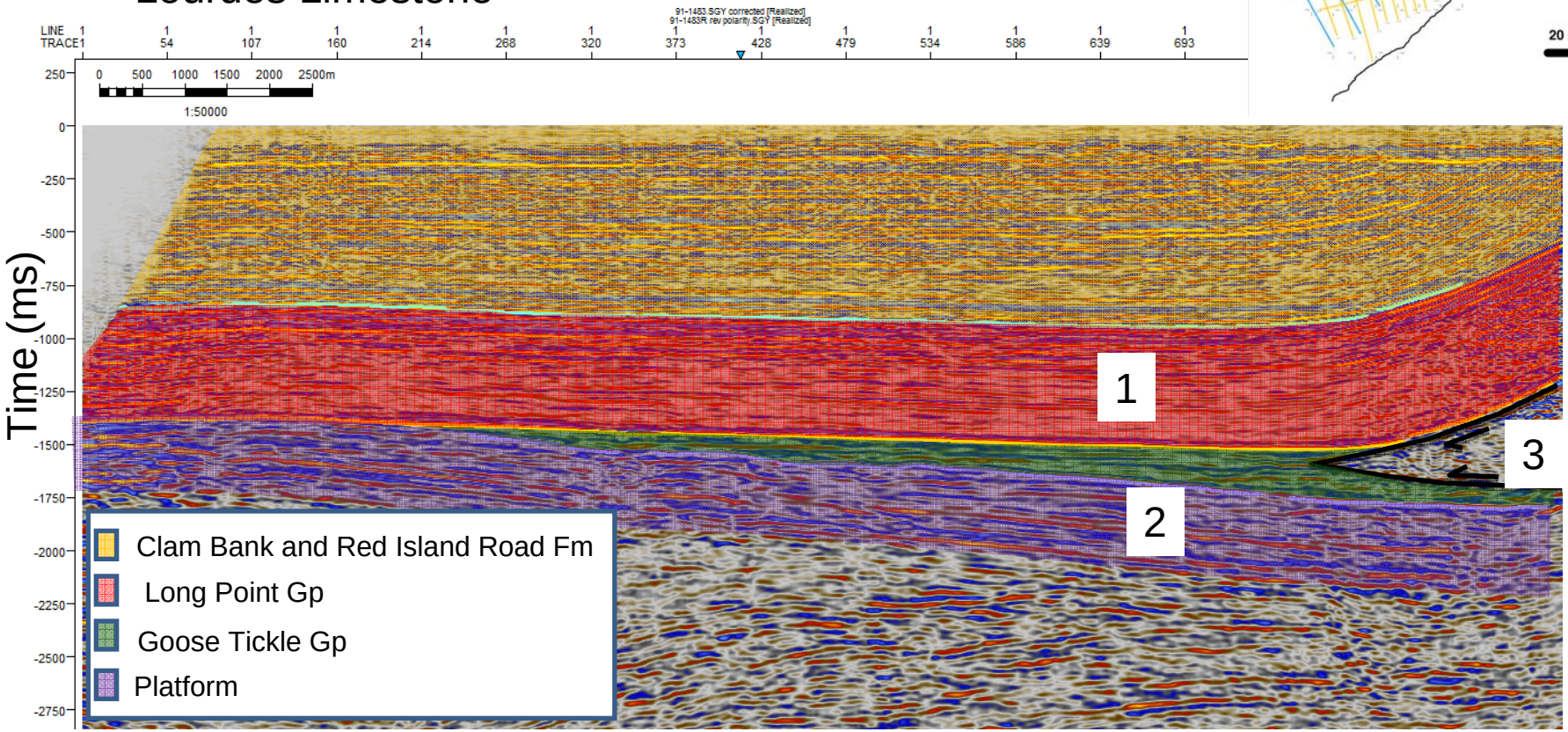

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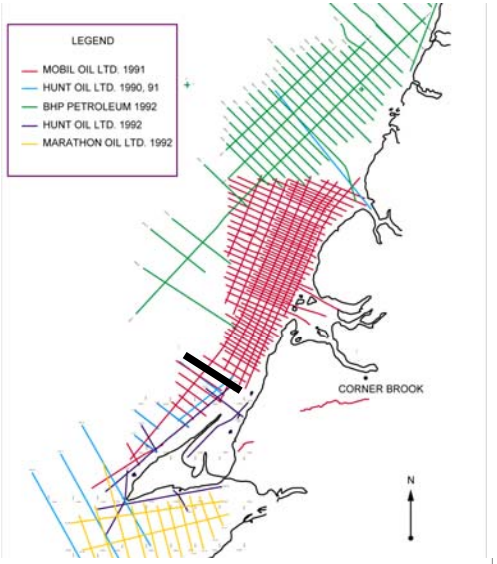
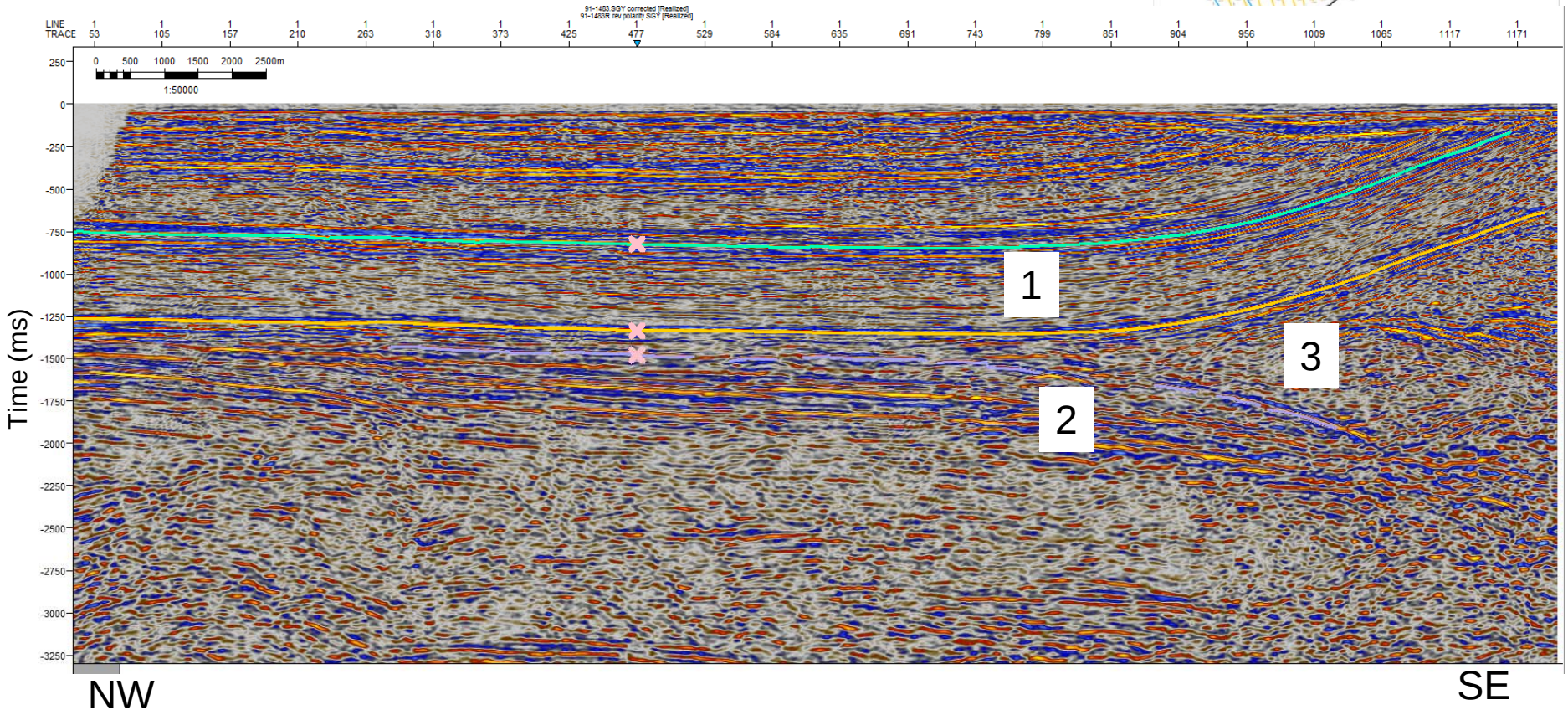
- Tea Cove Thrust along base of Lourdes Limestone
- Parallel reflectors in upper package “1”
- Wedge within Goose Tickle Group





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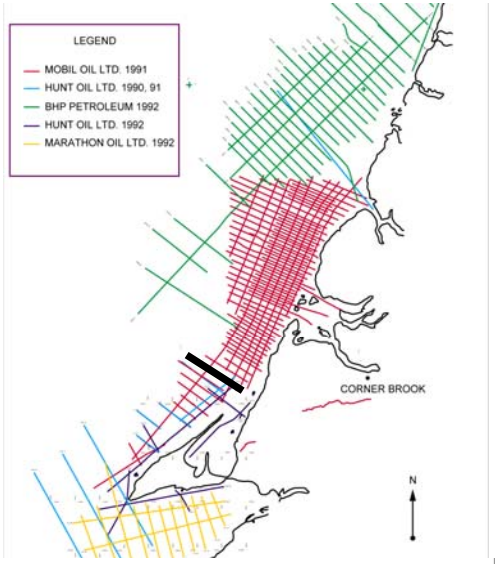
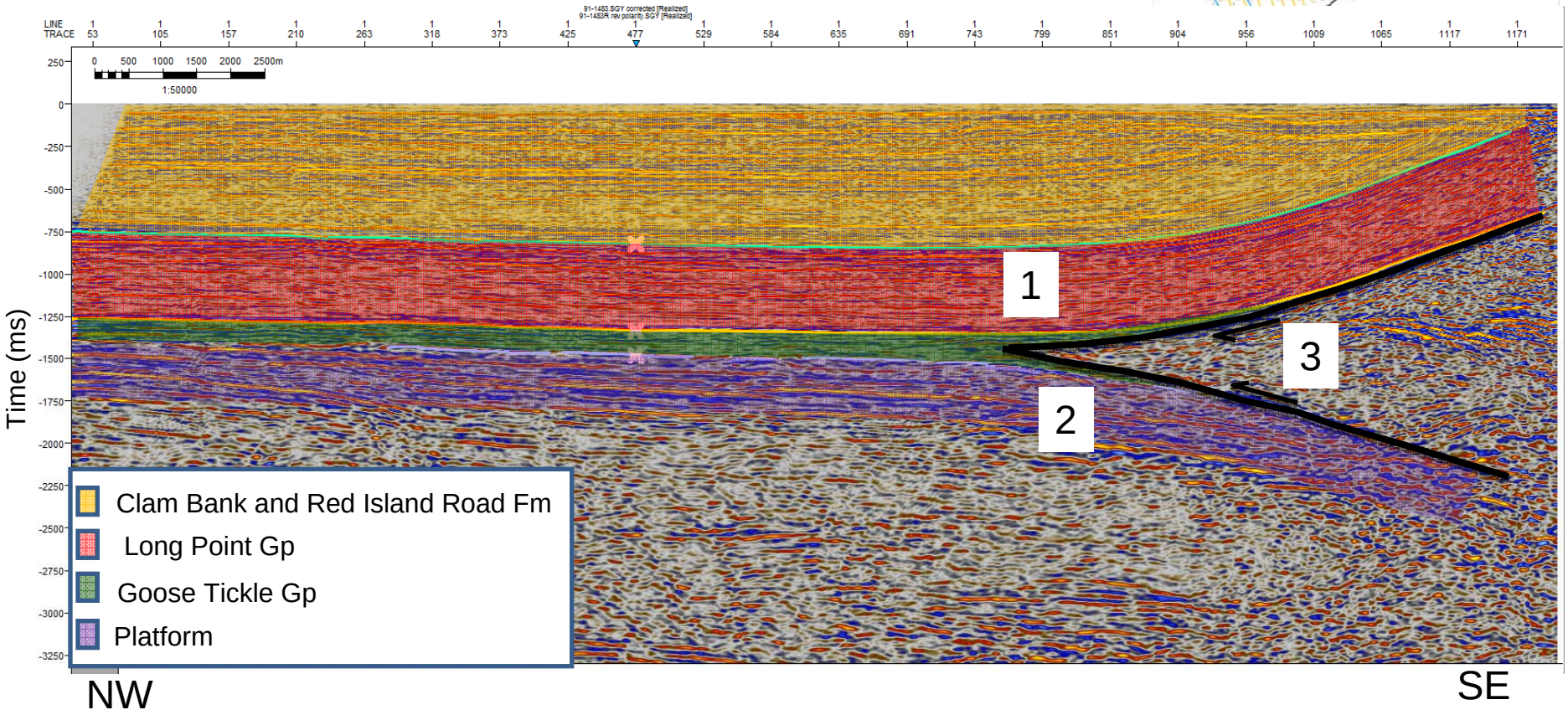
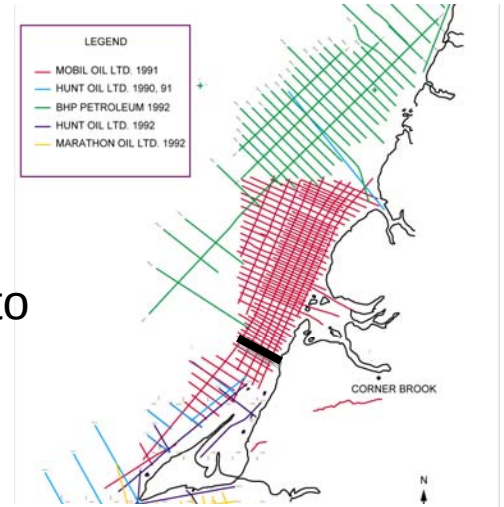
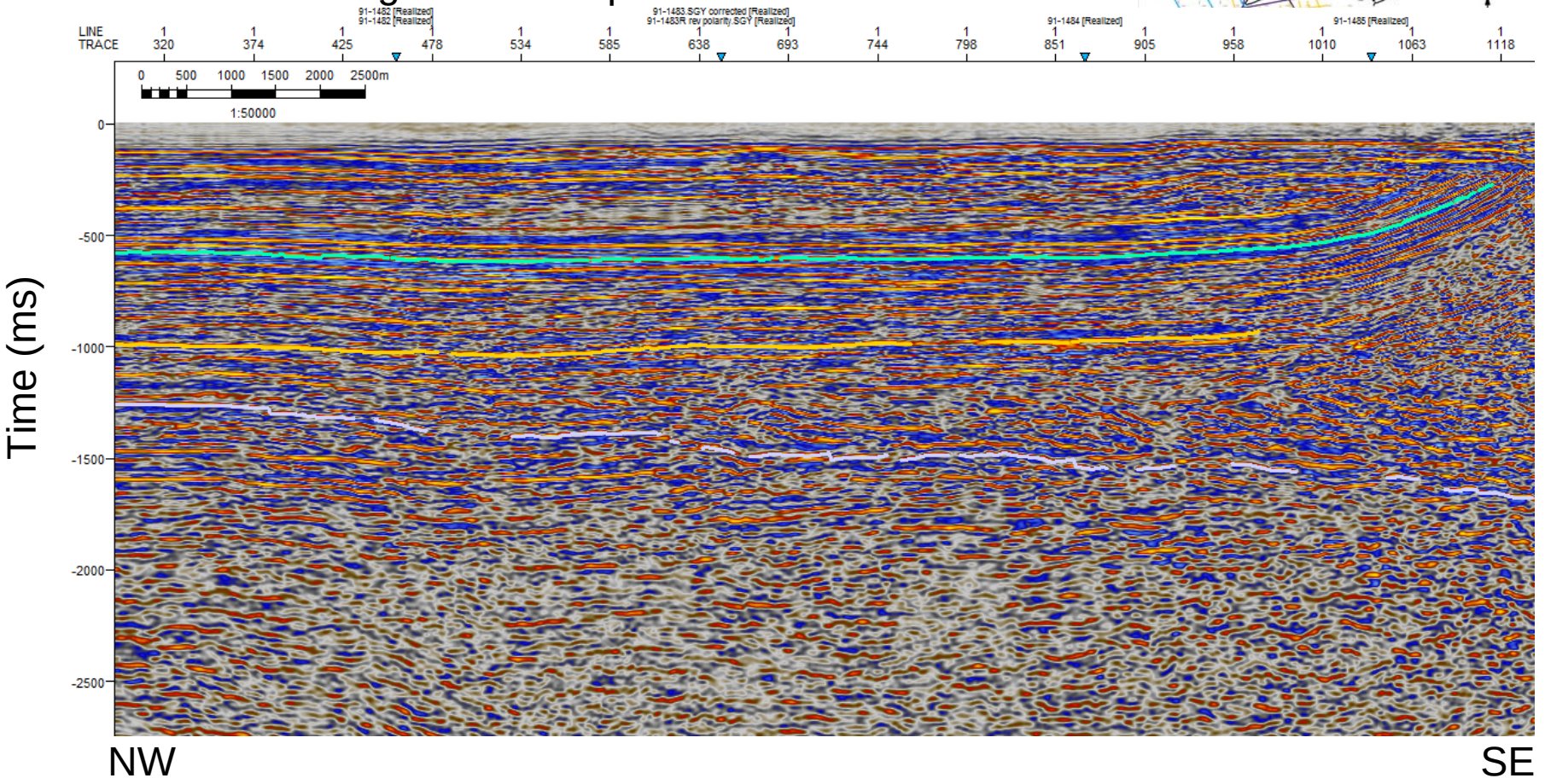




Appalachian Structural Front: South to North variation

- Top of tectonic wedge (Tea Cove Thrust) no longer coincides with Lourdes Limestone: wedge inserted into Goose Tickle Group?
- Thicker Goose Tickle Group
- Thinner Long Point Group





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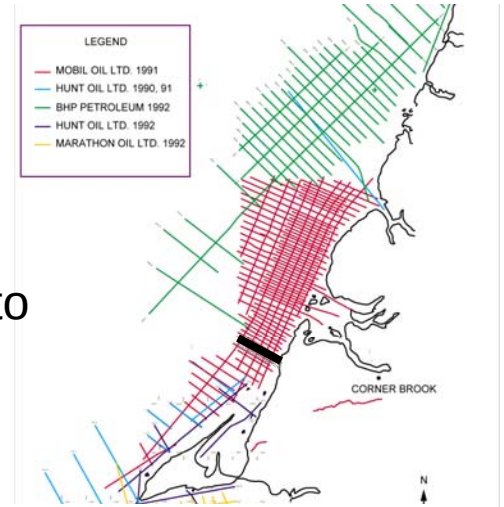
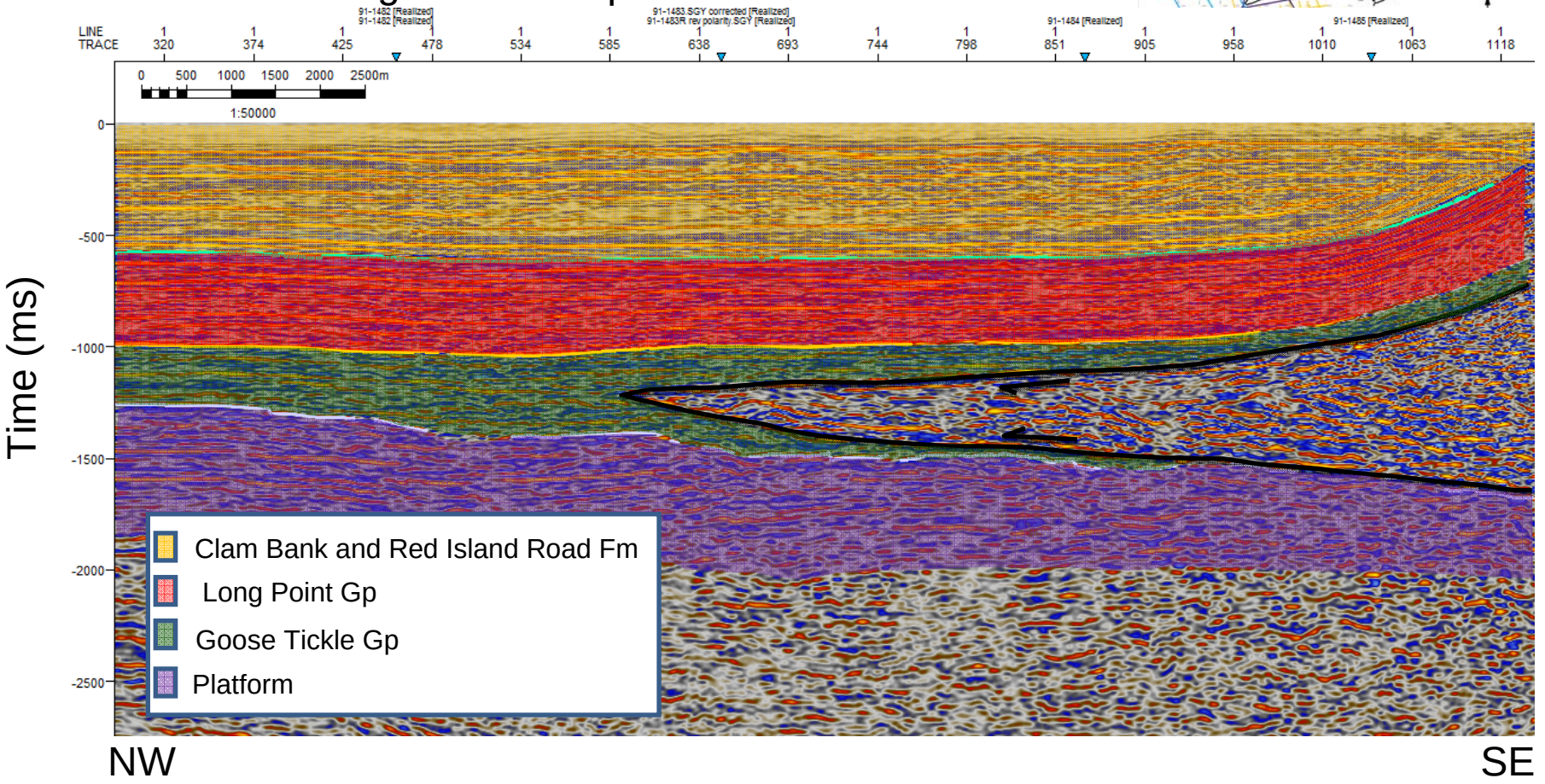
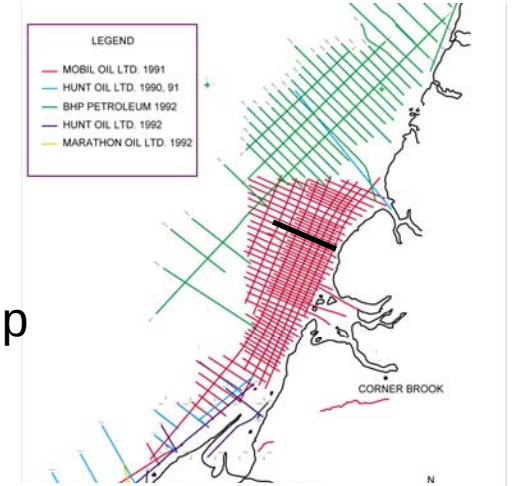
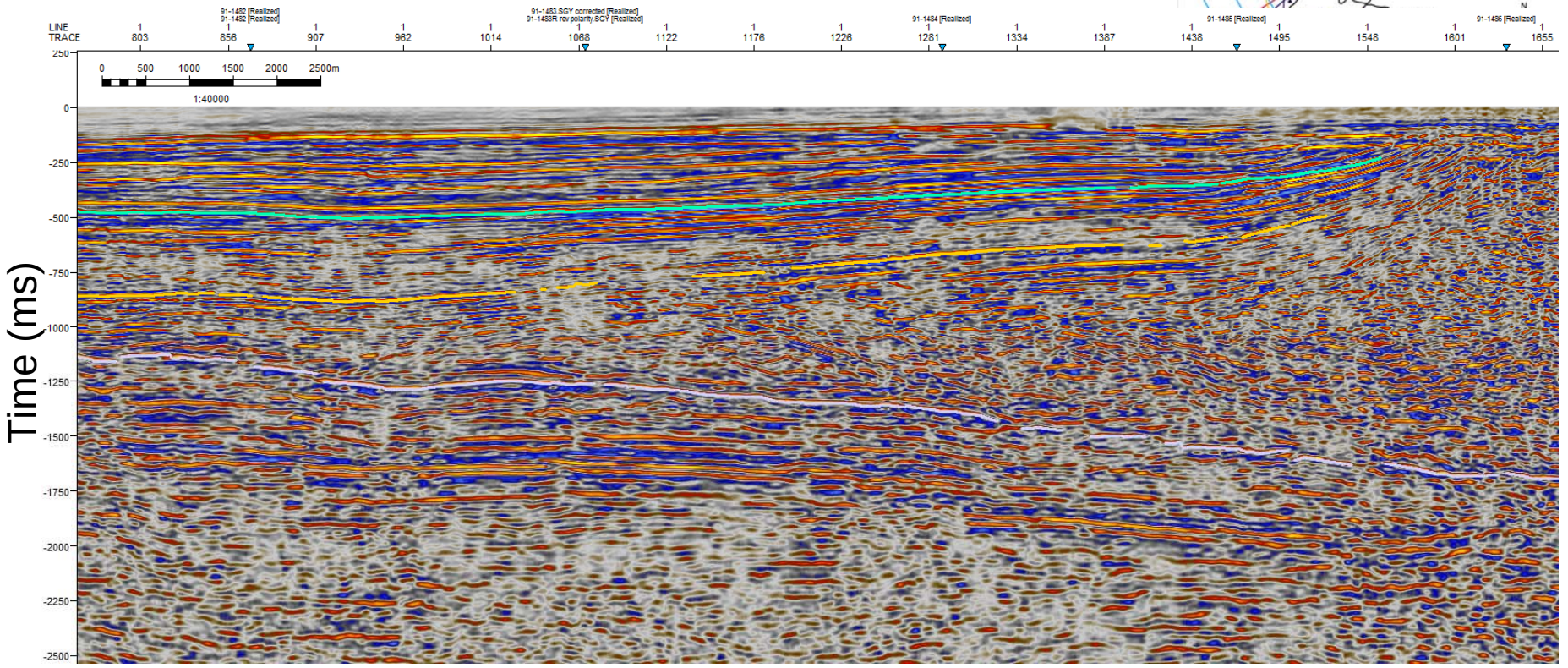




Appalachian Structural Front: South to North variation

- Goose Tickle Group continues to thin northward
- Tectonic wedge inserted lower in ? Goose Tickle Group
- Long Point Group noticeably thinner
- E-W thickness variation within Long Point Group





NW

SE

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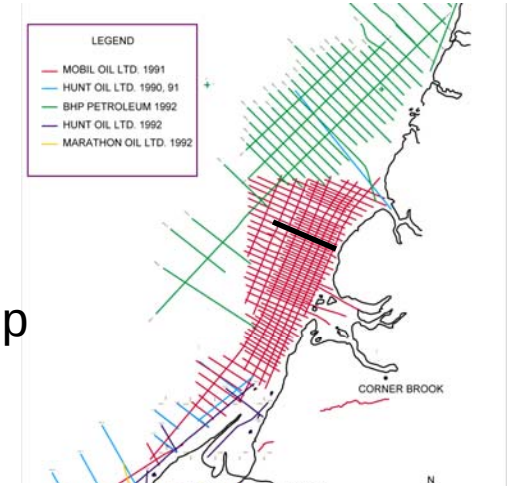
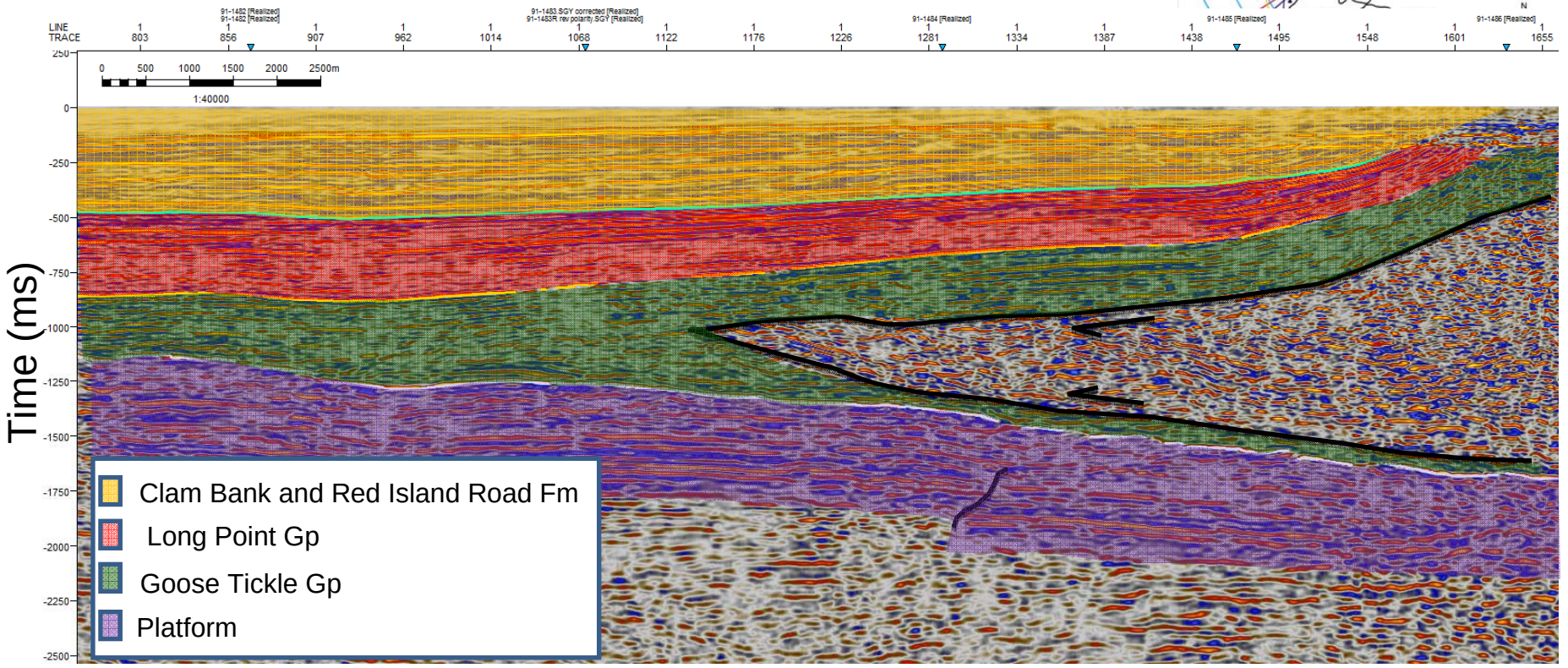
- W-E thinning of Long Point Group

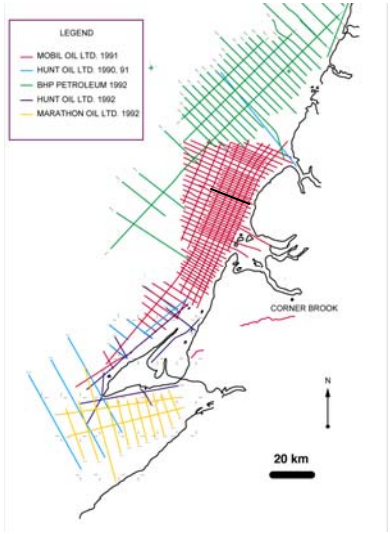


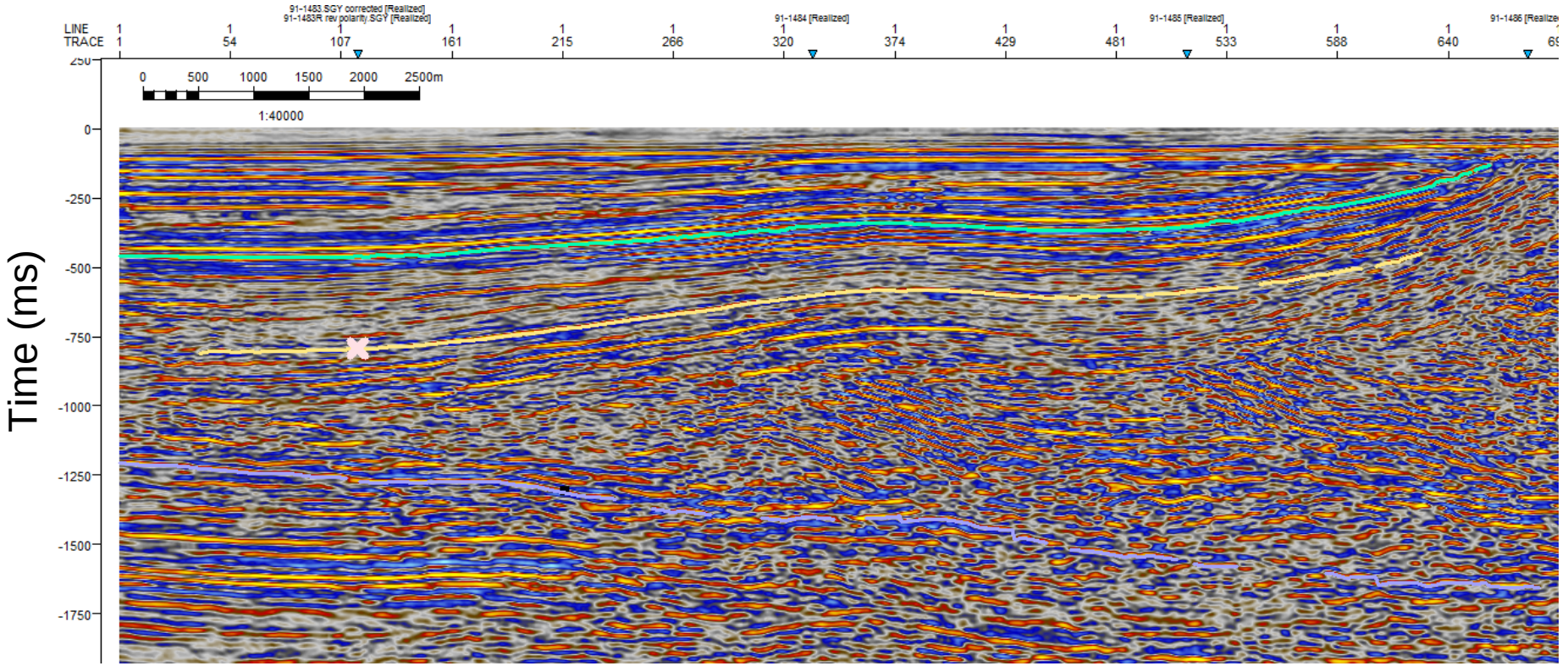


NW SE

Appalachian Structural Front: South to North variation

- Antiformal structure formed above wedge





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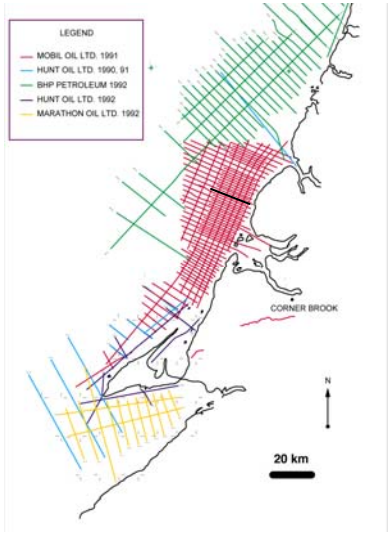
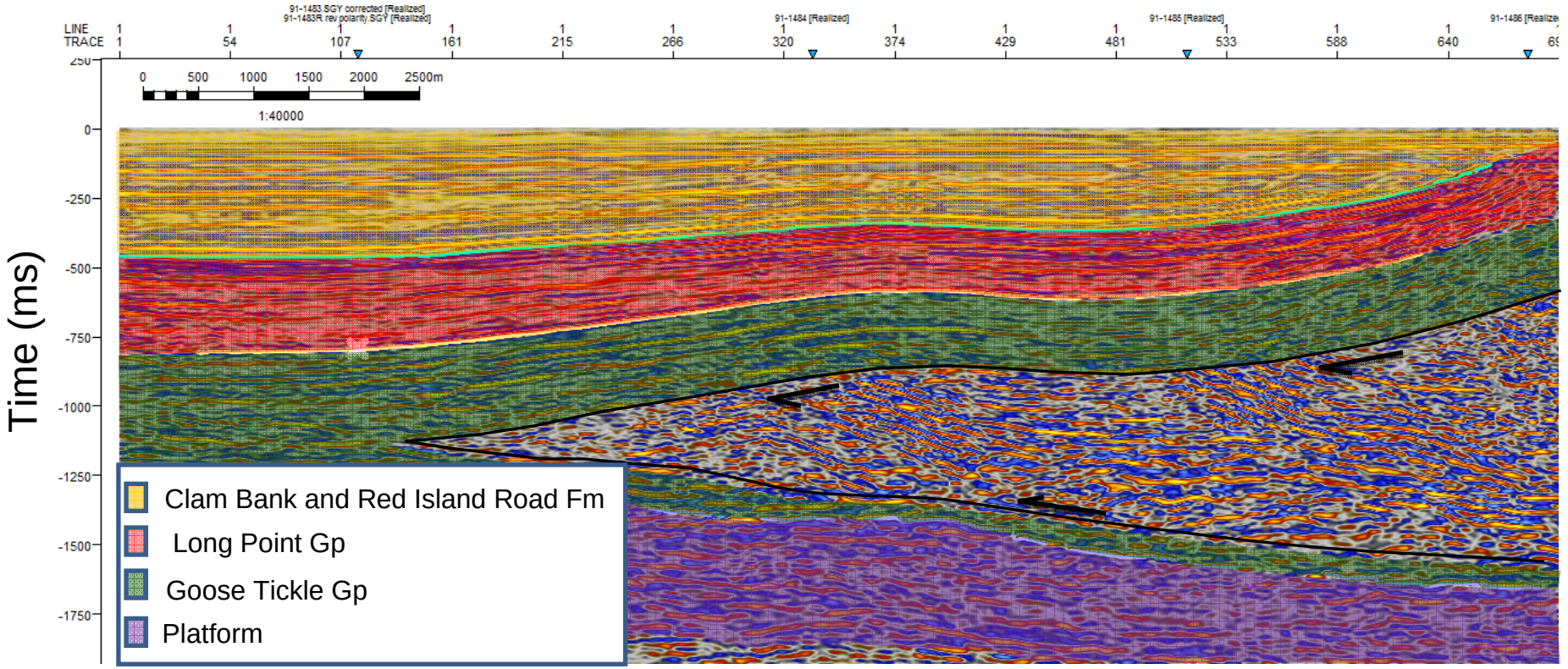
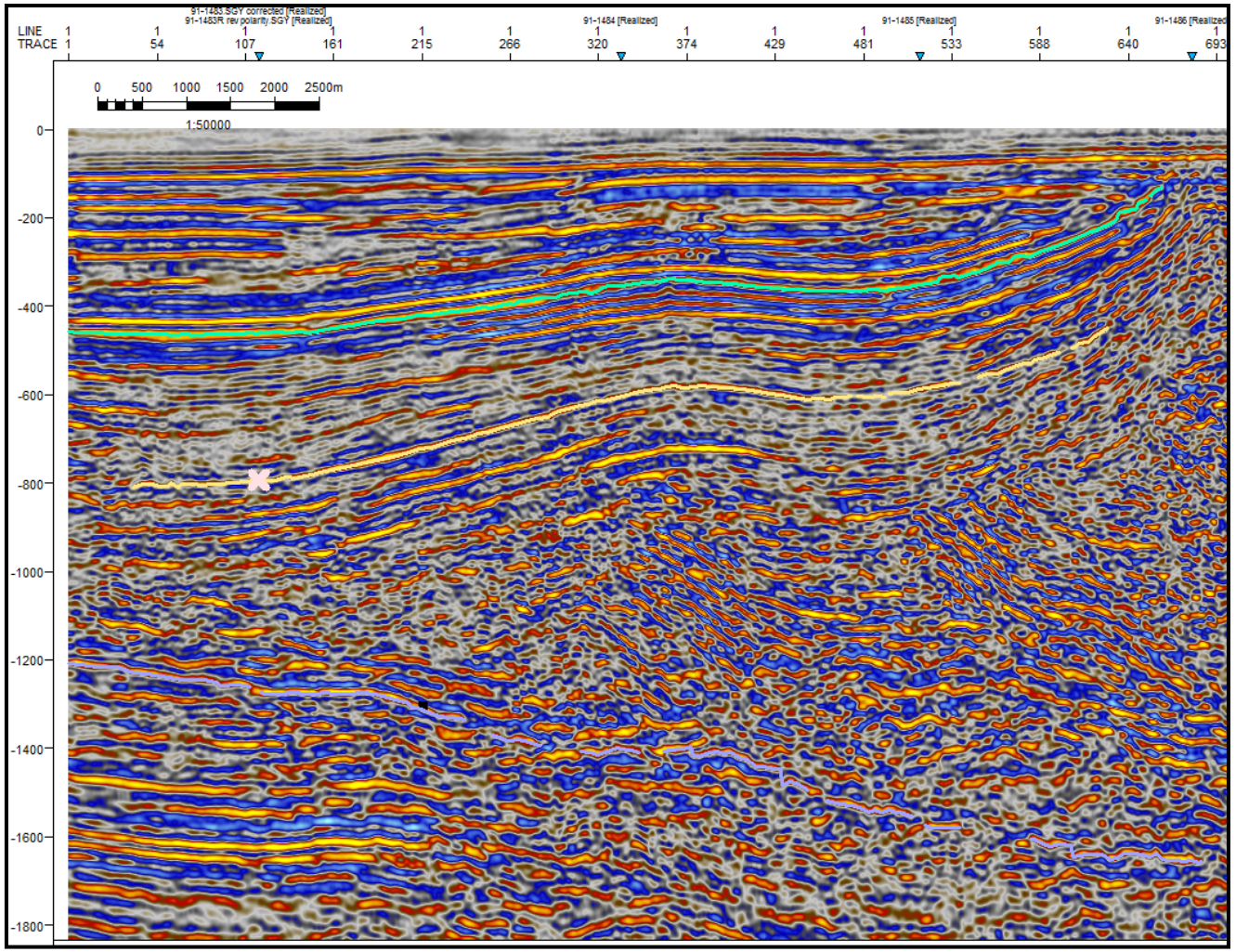


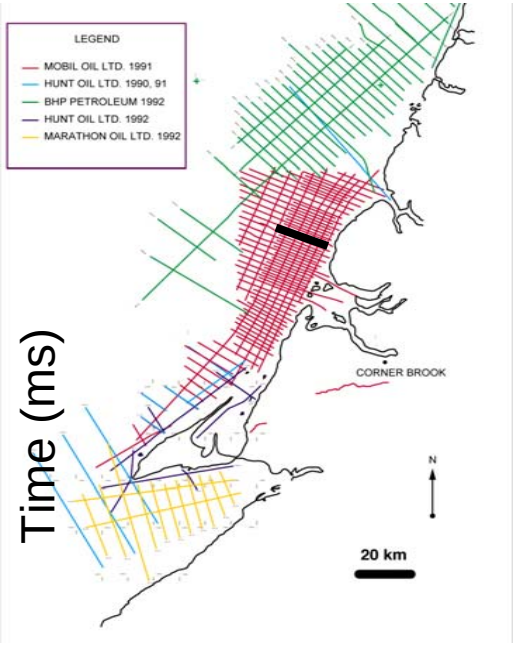


Appalachian Structural Front: South to North variation

Antiformal Structure Above Wedge

NW SE





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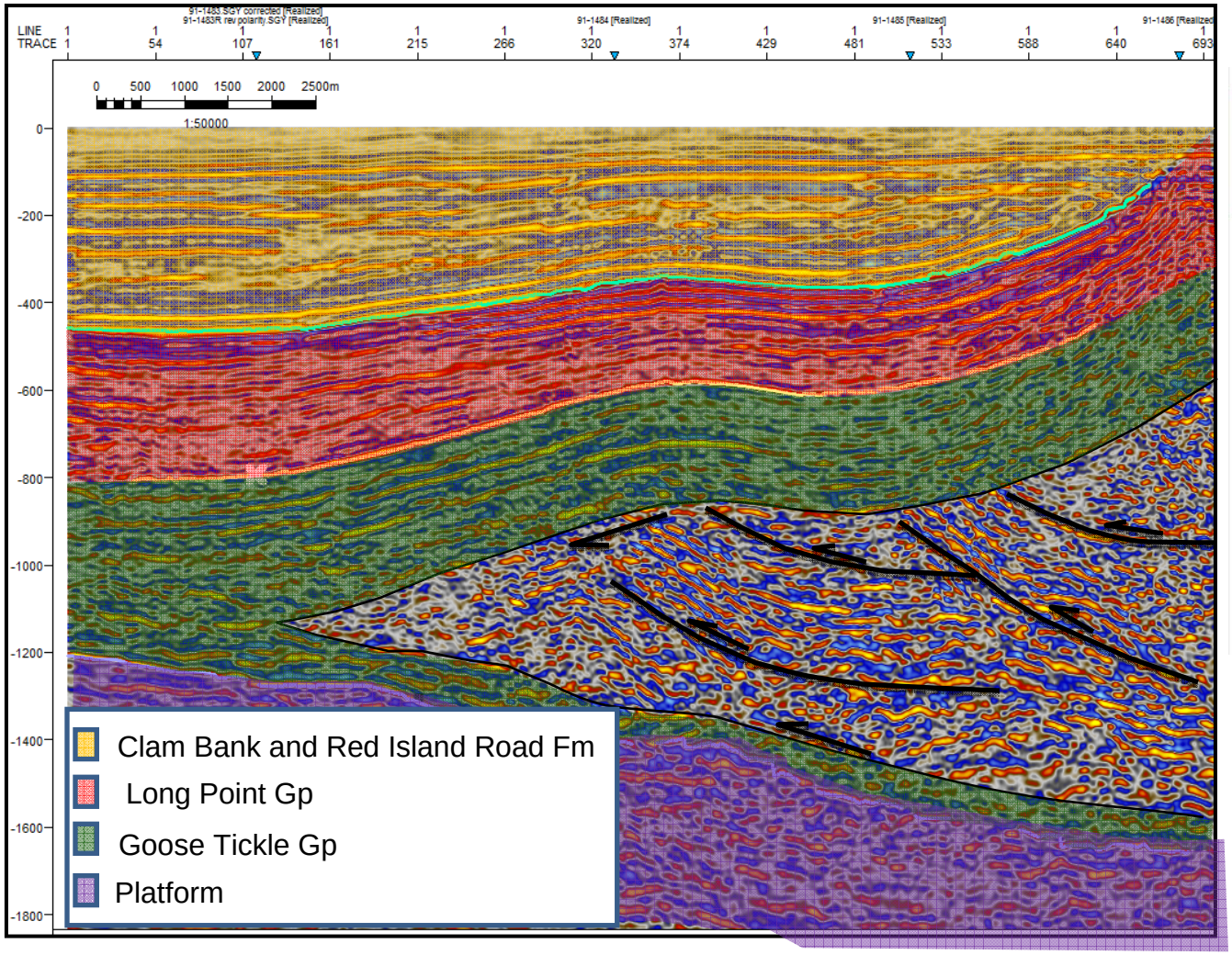

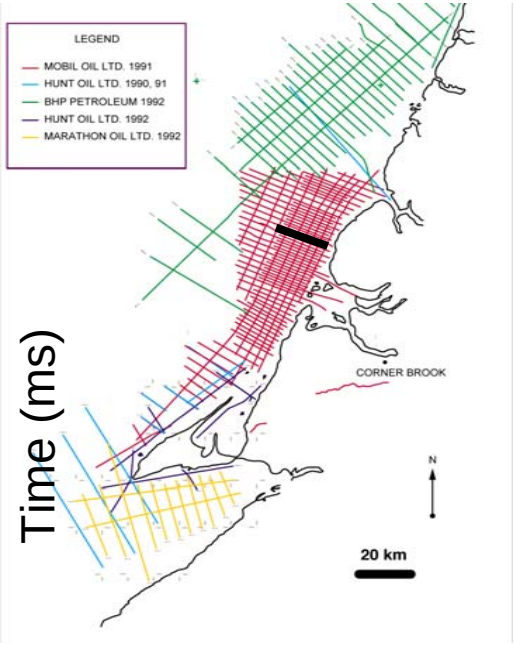

Along-strike variations

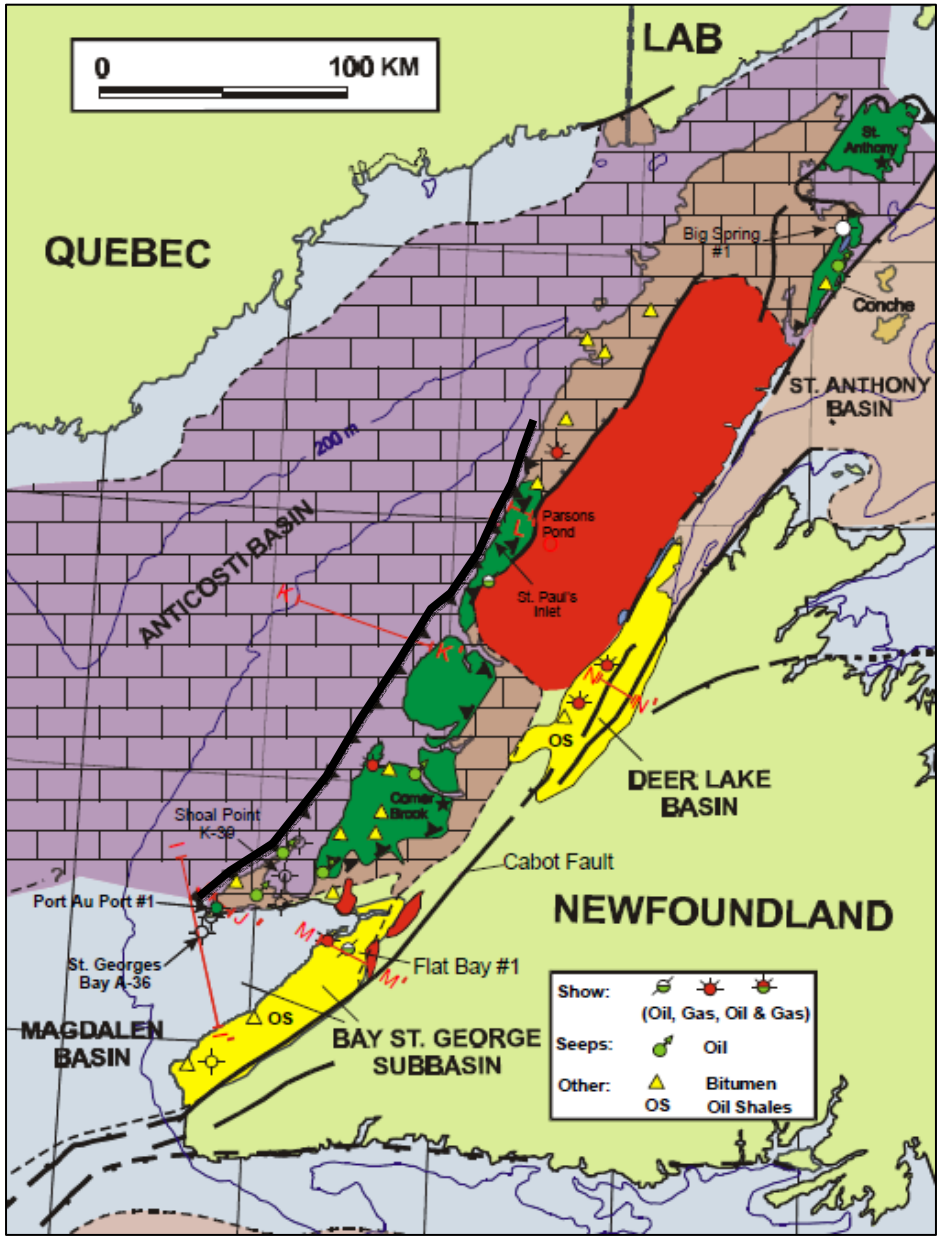

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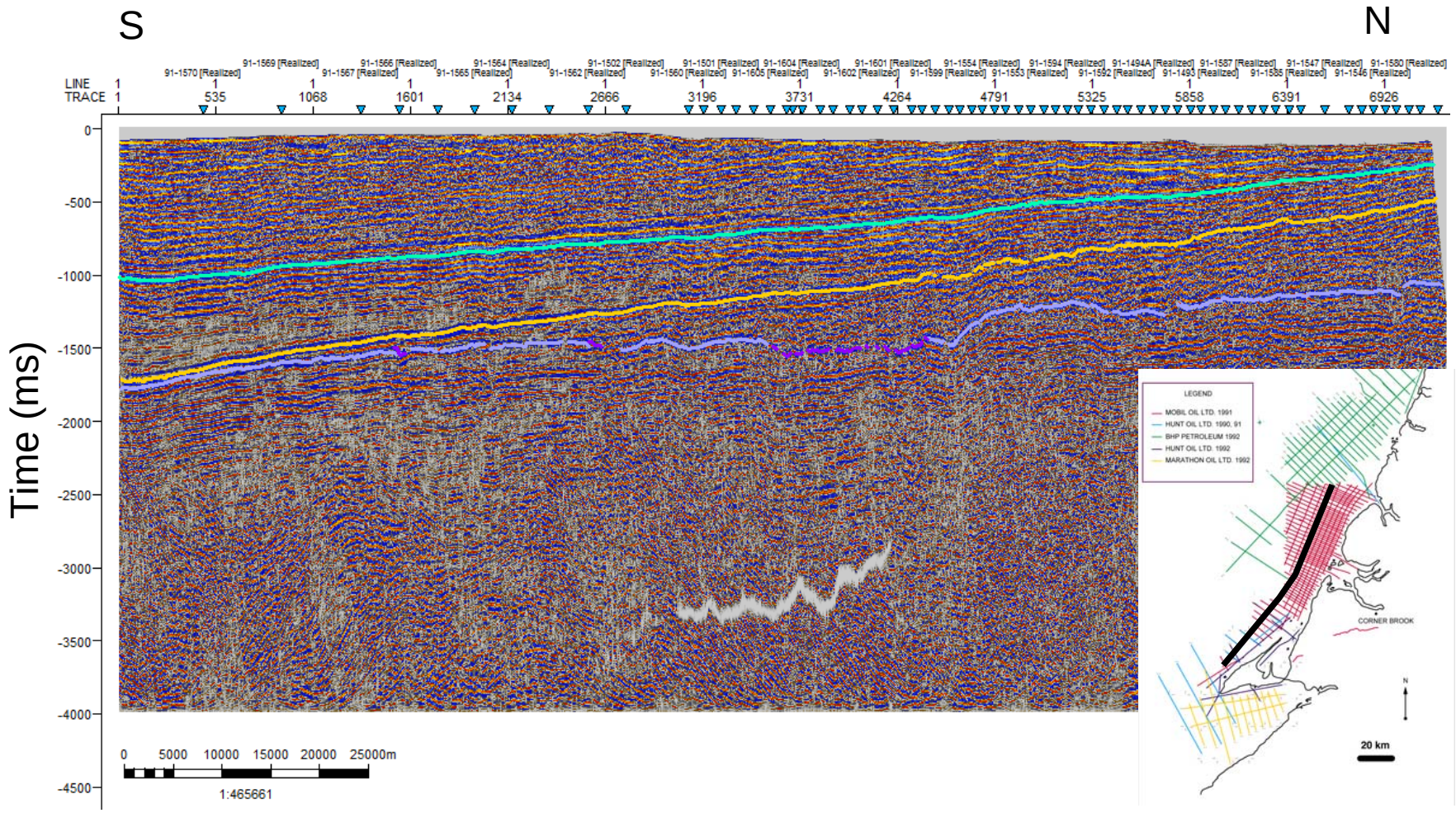
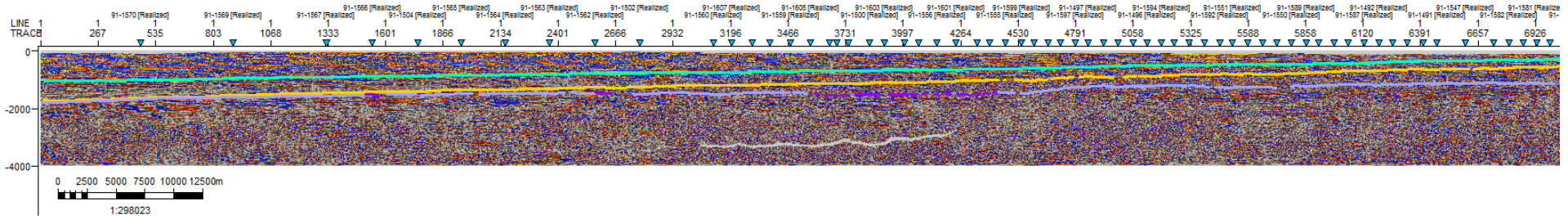
Figure shows approximate surface trace of Tea Cove thrust.

Along-strike variations





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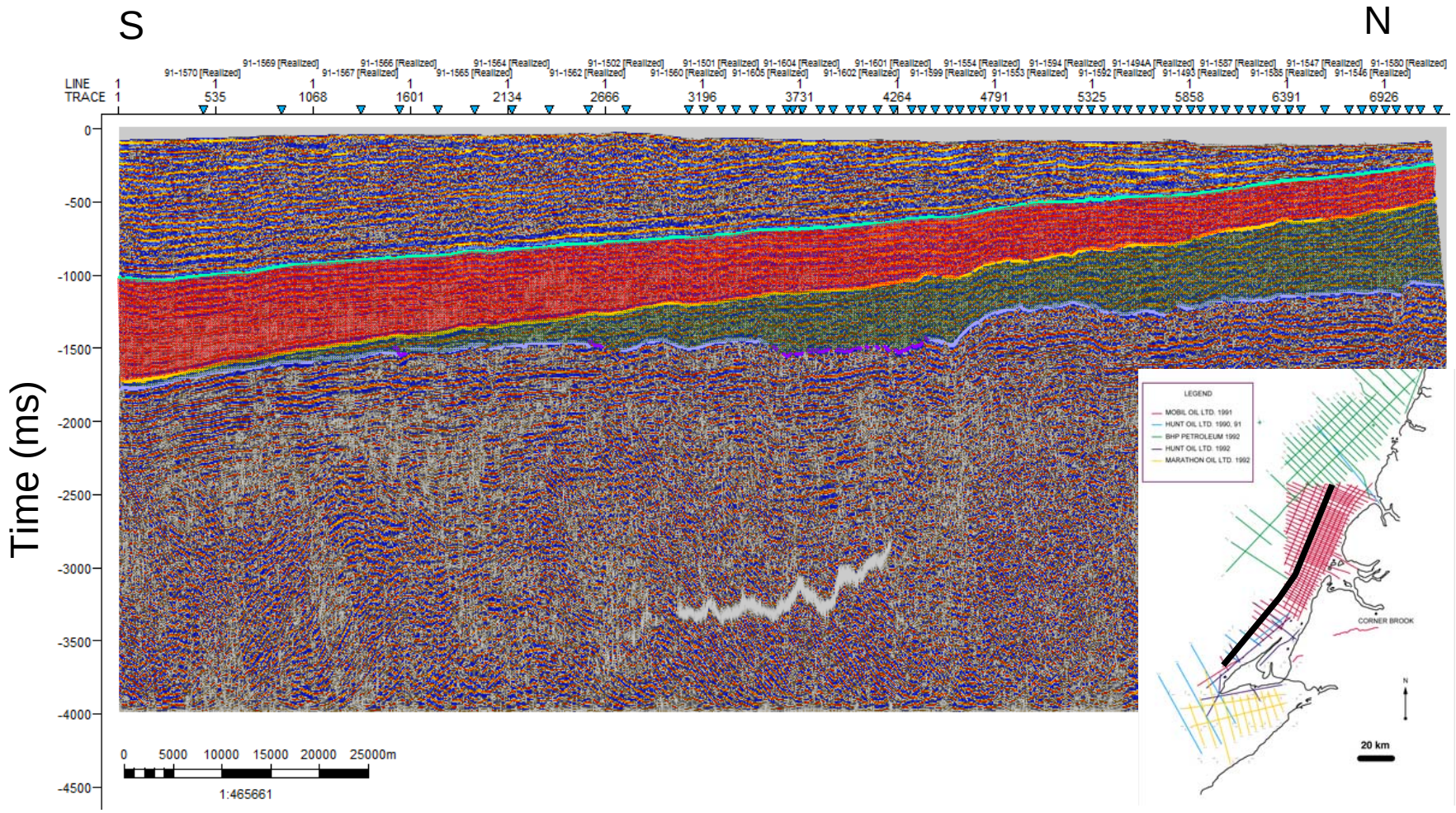

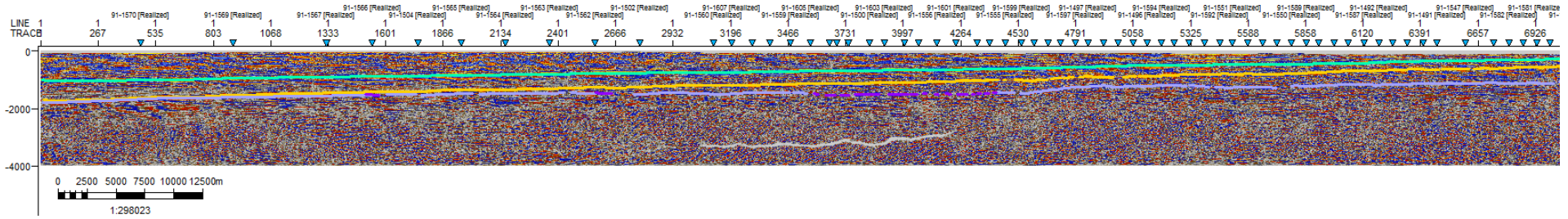

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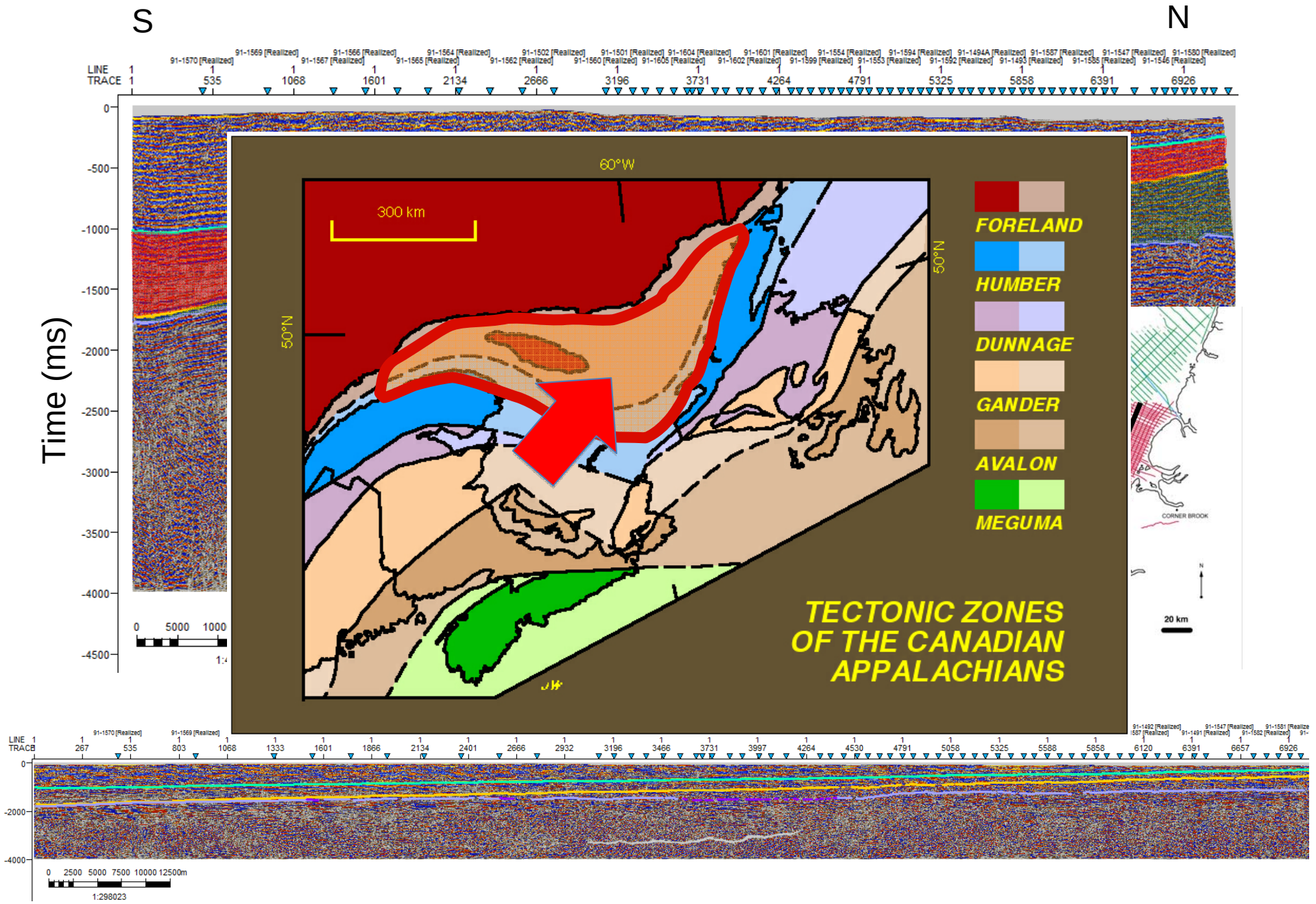

Conclusions

- Seismic profiles across the Appalachian deformation front image a tectonic wedge emplaced into sediments of the Taconian Foreland basin.
- The upper, east-verging thrust of the tectonic wedge (Tea Cove thrust) cuts down through stratigraphy towards the north, indicating a progressively lower insertion of the wedge (lateral ramp).
- In the south: constant thickness demonstrated by parallel reflectors, suggesting Acadian emplacement.
- In the north: thinning of the Late Ordovician Long Point Group atop the wedge suggests syn-tectonic deposition, implying earlier wedge movement.
- Movement along the deformation front was diachronous.
- Thickening of the Long Point Group towards the south may be related to a loading event in Québec reentrant.

Leprechaun Resources

Newfoundland Labrador

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PETROLEUM EXPLORATION ENHANCEMENT PROGRAM

Acknowledgments

- University of Alberta
- Petroleum Exploration Enhancement Program / NALCOR
- Leprechaun Resources

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