Source, Reservoir, Seal: Review and update on three PEEP projects in western Newfoundland

Elliott Burden

Department of Earth Sciences

MEMORIAL UNIVERSITY

Applied Geoscience Research Philosophy:

Identification of real world applied problems of mutual interest to industry and academia is the recipe for effective research synergy

Burden et al. – Petroleum Geoscience

MEMORIAL UNIVERSITY

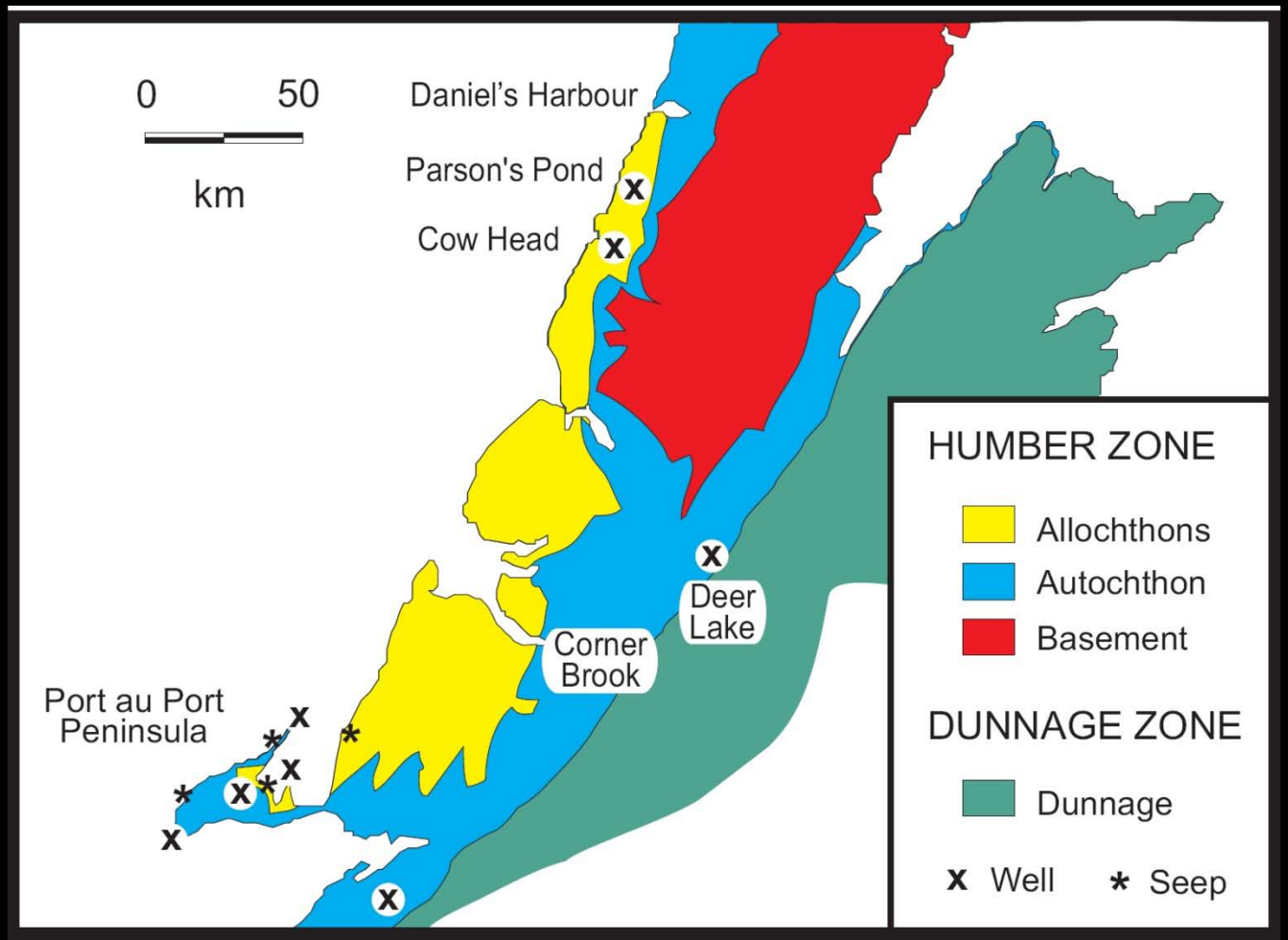
PEEP Programmes:

1. Strata, structures and fractures of the Winterhouse (Utica) Formation: ***background for unconventional plays***.
2. Strata, ***source rock distribution***, and depositional history of the Serpukhovian, Rocky Brook Formation.
3. Stratigraphy and structure of Cambro-Ordovician, Humber Arm "mélange"; ***new exploration models*** for exploring the Gulf of St Lawrence.
4. Geochemical and environmental parameters affecting lacustrine ***source rock properties*** of the Tournaisian, Anguille Group (Conche), White Bay Subbasin -Atlantic conjugate margin.

Burden et al. – Petroleum Geoscience

MEMORIAL UNIVERSITY

PEEP Programmes:



Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

Programme:

Strata, structures and fractures of the Winterhouse (Utica) Formation: ***background for unconventional plays***.

Personnel:

Elliott Burden - Principal Investigator

Informal Partnership - Dr. George Dix (Carleton).

Contributions towards training HQP

Jennifer Cunningham - Summer intern 2009

Brett Nwokeforo - Honours Thesis 2012

Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

Reports:

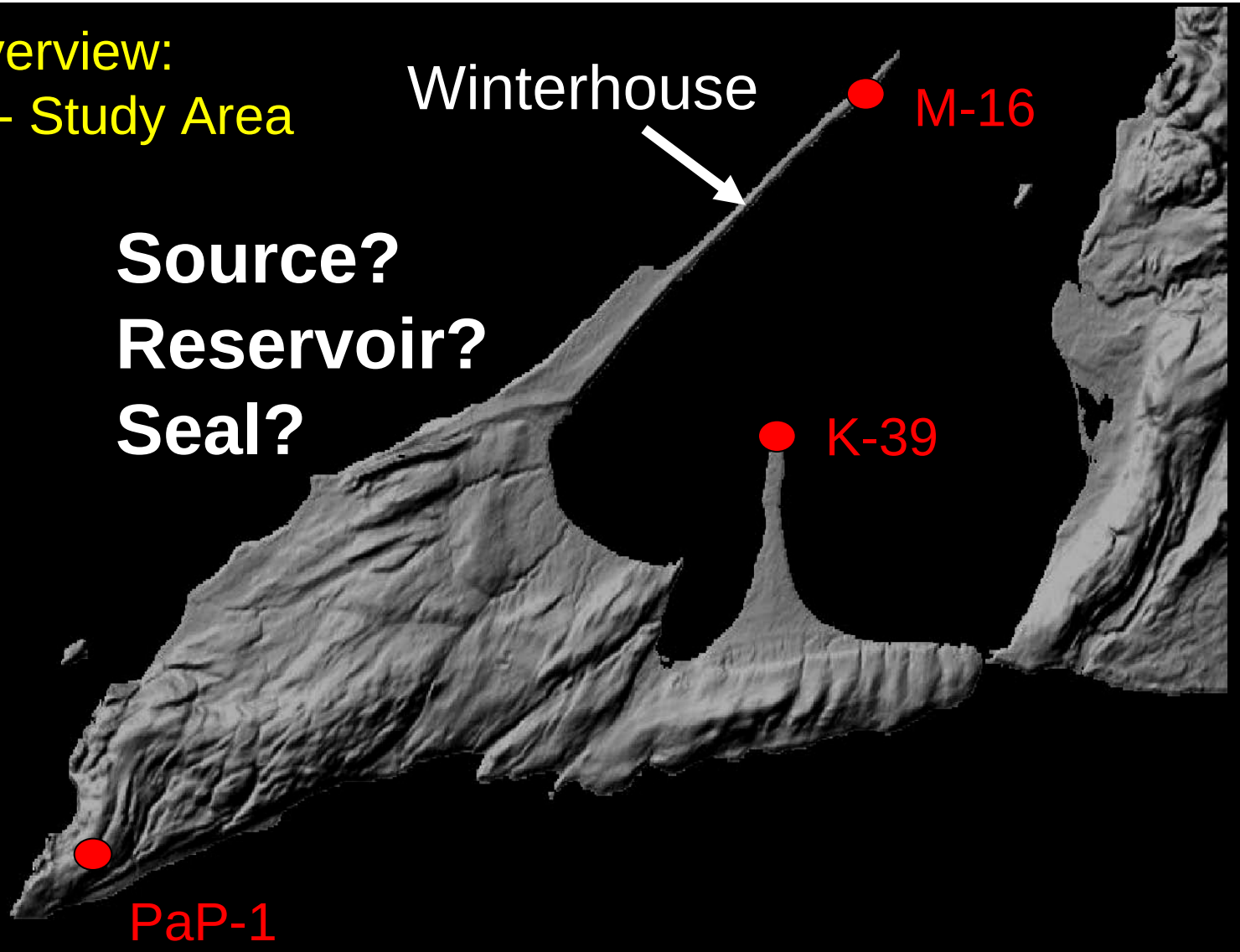
Burden, E., Gillespie, H. and Cunningham, J. 2010. Prospects for conventional and unconventional hydrocarbon plays for the Winterhouse Formation, Port Au Port Peninsula, Newfoundland. *Atlantic Geology* 46, p. 77 (GAC-NL talk, 2010).

Dix, G.R., Burden, E. and Nwokeforo, B., 2012. Outer-ramp carbonate production, transport, and deposition: Upper Ordovician Winterhouse Formation, Long Point Group, western Newfoundland. *GAC-MAC Abstracts*, 35, p. 37.

Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

Project Overview:
Concepts - Study Area



Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

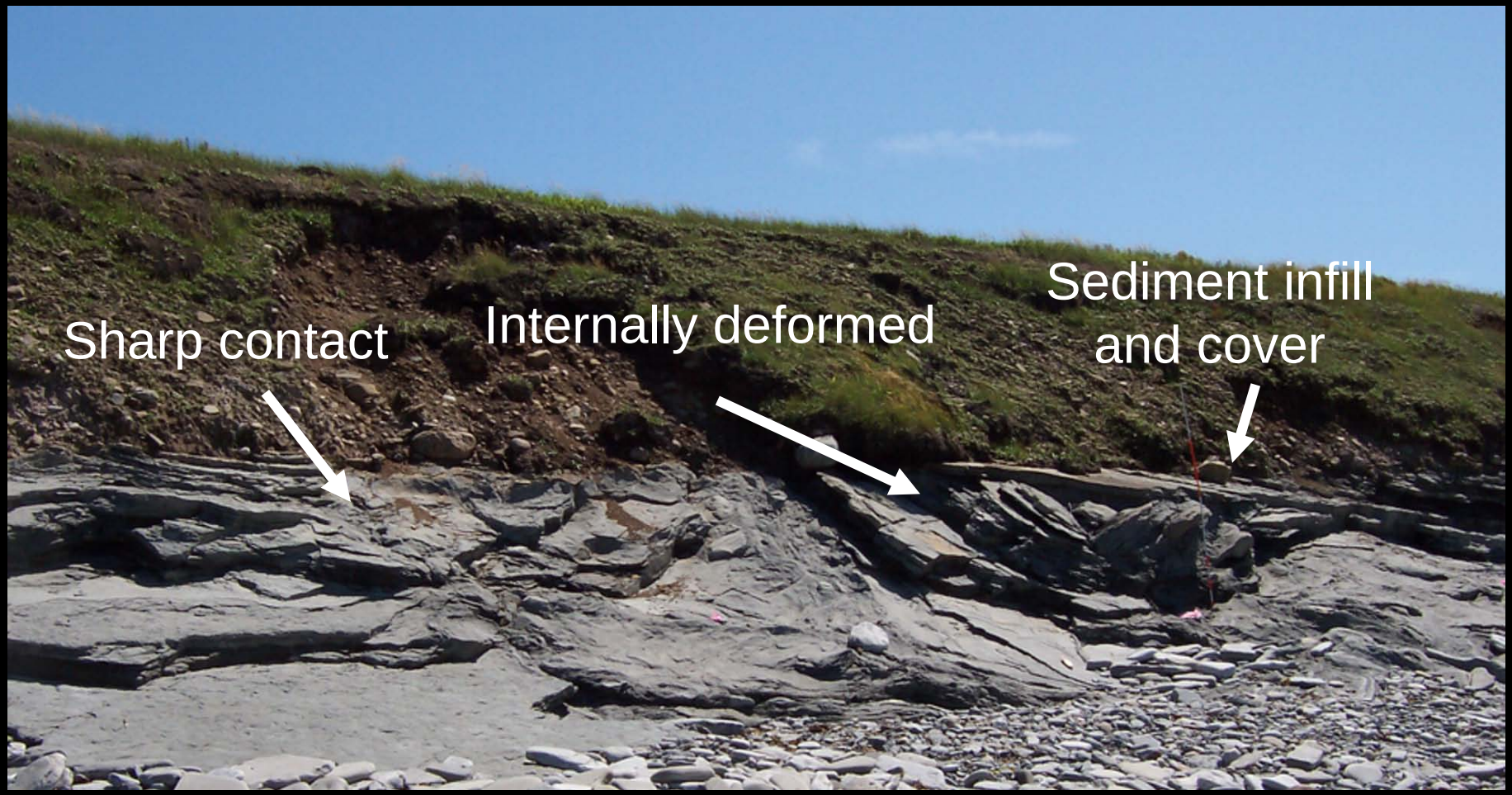
Project Overview:

Concepts - Study Area

Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

Bedding is disrupted and fractured in places



Winterhouse Fm. - Port au Port Peninsula

Beds tend to be thin and with an obvious eroded base

Calcarenite boulder conglomerate debris flows

Winterhouse Fm. - Port au Port Peninsula

Thicker, more frequent “sandstone” beds, including some with oil stain, occur higher in the section

Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

Oil stained siltstones

Winterhouse Fm. - Port au Port Peninsula

MEMORIAL UNIVERSITY

- Winterhouse offers a possibility that “Utica”-type source rocks may be nearby.

- Winterhouse shelf sandstones and conglomeratic slump and debris flows may be porous and permeable reservoirs.

- Diagenetic cements, structural relationships, and in particular broken seals, remain a contentious issue hindering any successful outcomes.

Rocky Brook Fm. – Deer Lake Basin

MEMORIAL UNIVERSITY

Programme:

Strata, ***source rock distribution***, and depositional history of the Serpukhovian, Rocky Brook Formation.

Personnel:

Elliott Burden - Principal Investigator

Contributions towards training HQP

Michael Kelly - Summer intern 2009

Rocky Brook Fm. – Deer Lake Basin

MEMORIAL UNIVERSITY

Reports:

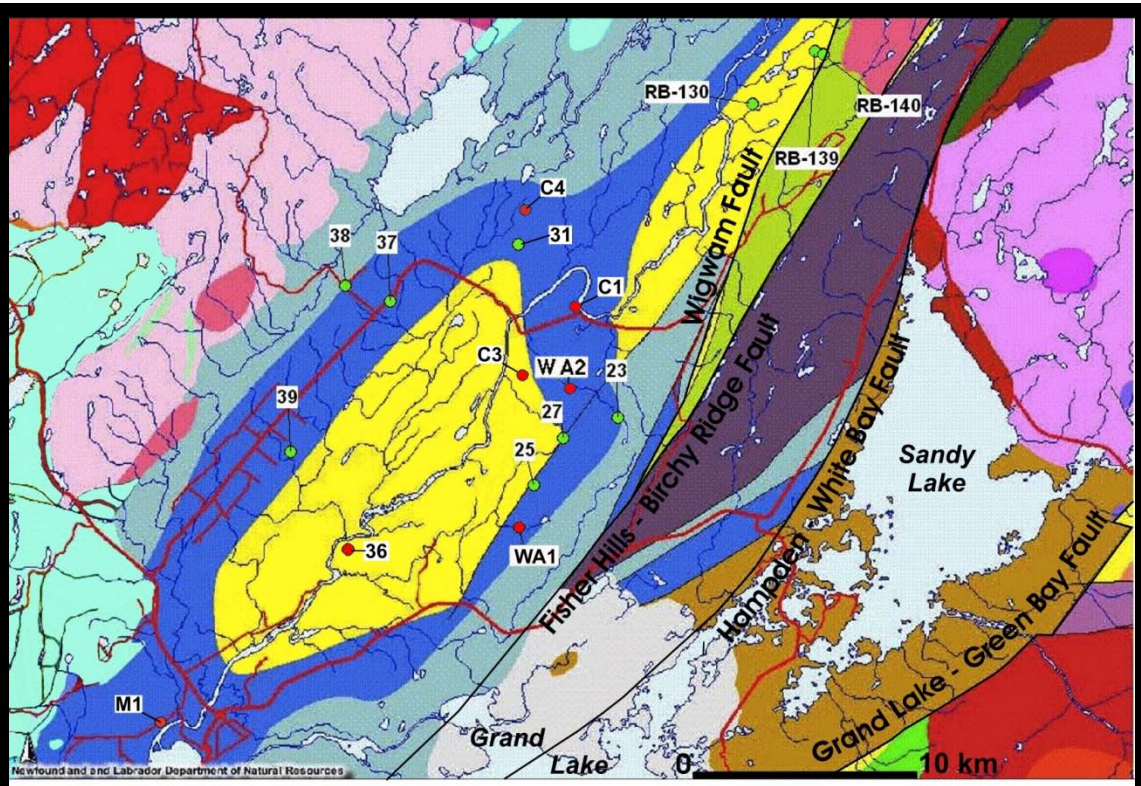
Kelly, M., and Burden, E., 2011. Atlas of strata and source rock characteristics for the Rocky Brook Formation, Deer Lake Group, Newfoundland and Labrador. NL Government, Open File, 144 p.

Burden, E., and Kelly, M., 2011. The Rocky Brook Formation: Facies distribution and cycles. *GAC-MAC Abstracts* 34.

Rocky Brook Fm. – Deer Lake Basin

MEMORIAL UNIVERSITY

Project Overview:
Concepts - Study Area



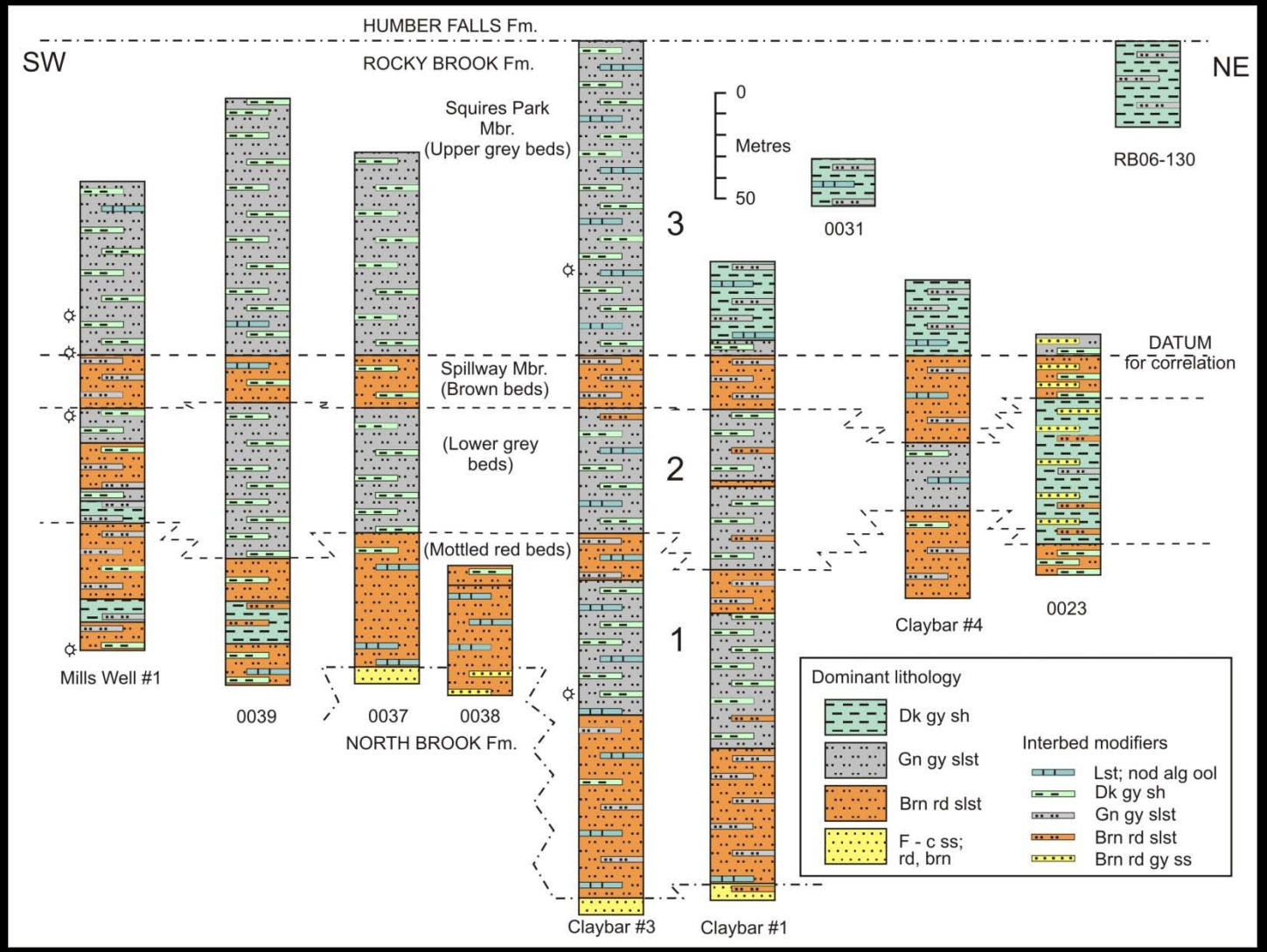
DEER LAKE GROUP

- Humber Falls Formation
- Rocky Brook Formation
- North Brook Formation
- Howley Formation
- Boreholes Examined
- Boreholes Reported
  - W - Western Adventure
  - C - Claybar
  - M - Mills

Rocky Brook Fm. – Deer Lake Basin

MEMORIAL UNIVERSITY

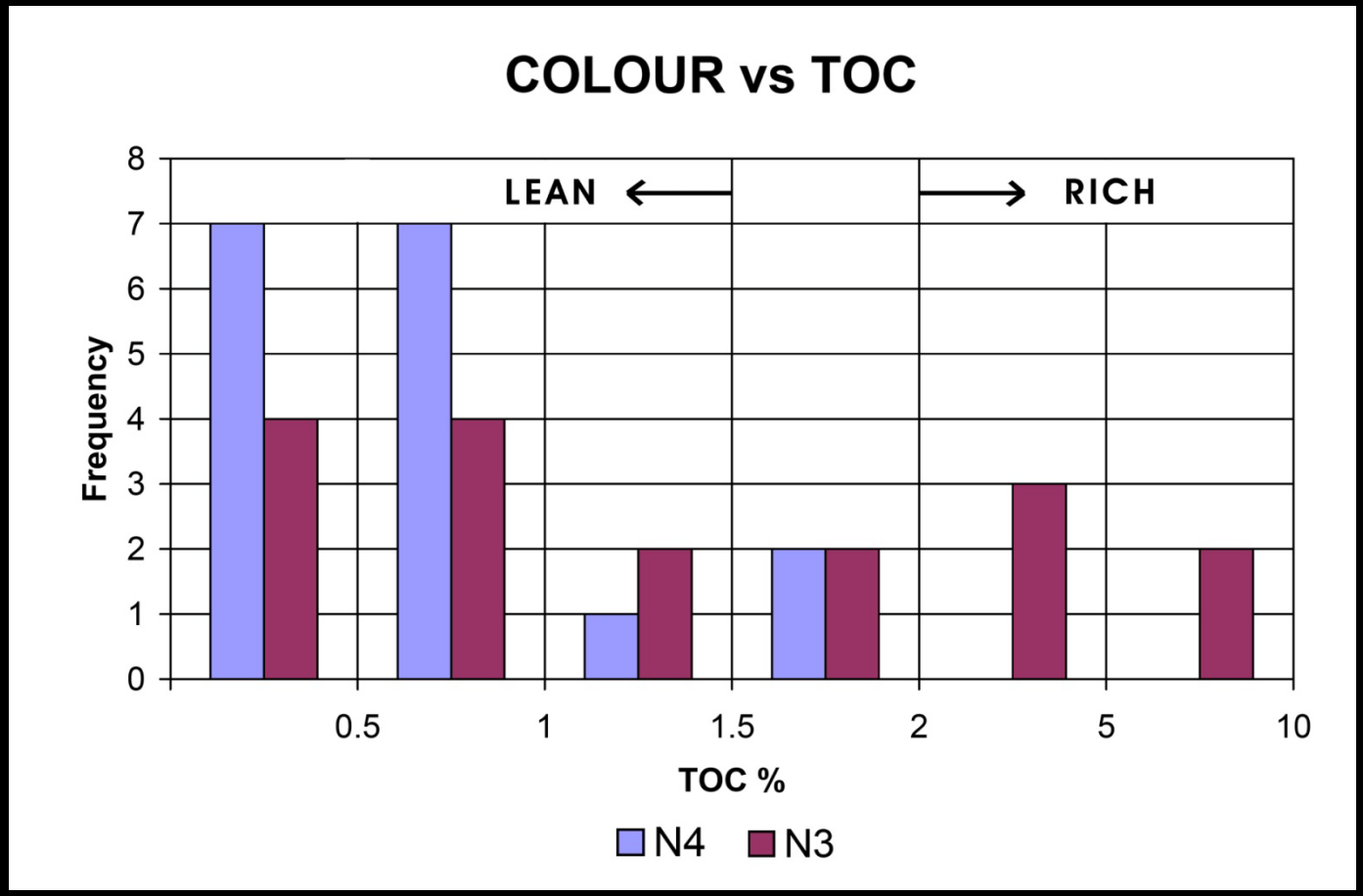
Correlations are slightly modified to include a basal muddy succession



Rocky Brook Fm. – Deer Lake Basin

MEMORIAL UNIVERSITY

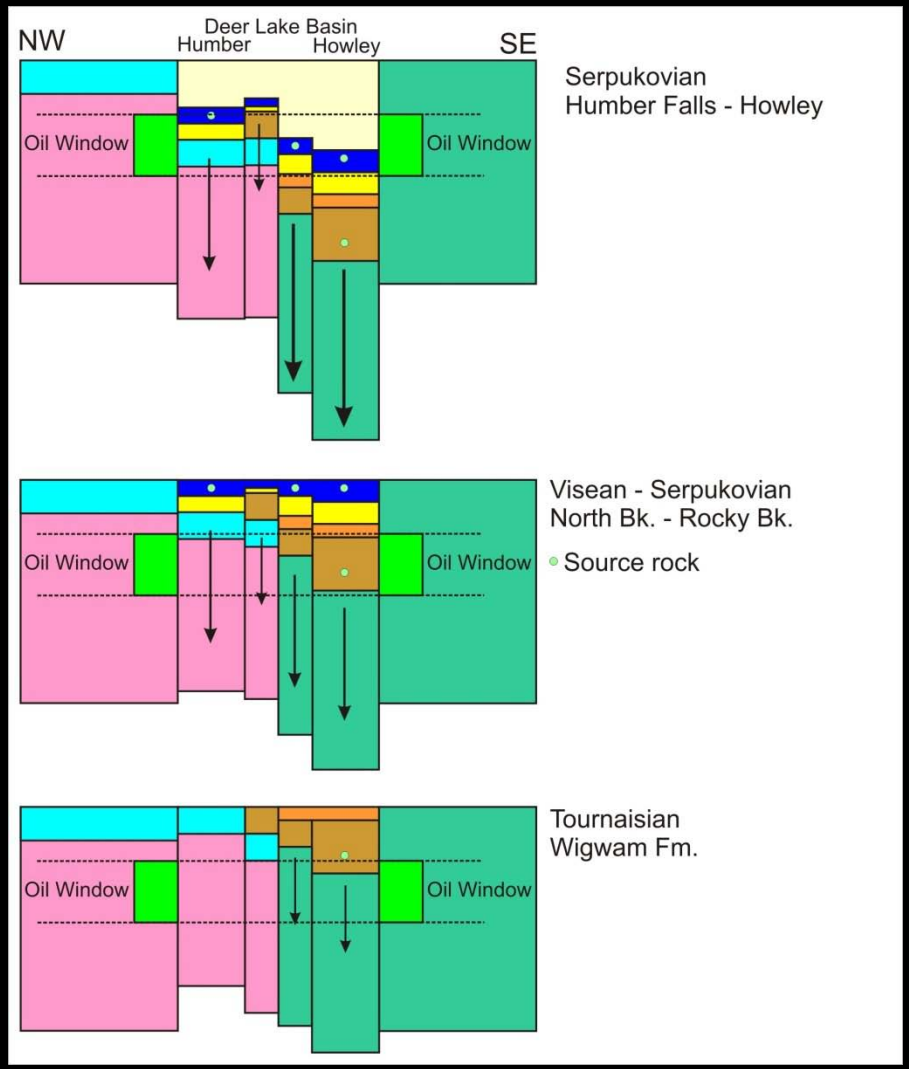
Source rock richness and volumetrics addressed



Rocky Brook Fm. – Deer Lake Basin

MEMORIAL UNIVERSITY

Burial history model predicting North Brook Fm as a possible reservoir and Howley Subbasin as the more prospective target.



Humber Arm Allochthon – “mélange”

Stratigraphy and structure of Cambro-Ordovician, Humber Arm “mélange”; ***new exploration models*** for the Gulf of St Lawrence.

Personnel:

Elliott Burden - Principal Investigator

Contributions towards training HQP:

Michael Kelly - M.Sc. Candidate 2010

Brad Coombs – Honours Thesis Fall 2011

Chris Corcoran - Honours Thesis Fall 2012

Mark Cooper - Summer intern 2010

Chris Corcoran - Summer intern 2011

Jillian Evans - Summer intern 2011

Matthew Scott - Summer intern 2011

Humber Arm Allochthon – “mélange”

Stratigraphy and structure of Cambro-Ordovician, Humber Arm “mélange”; ***new exploration models*** for the Gulf of St Lawrence.

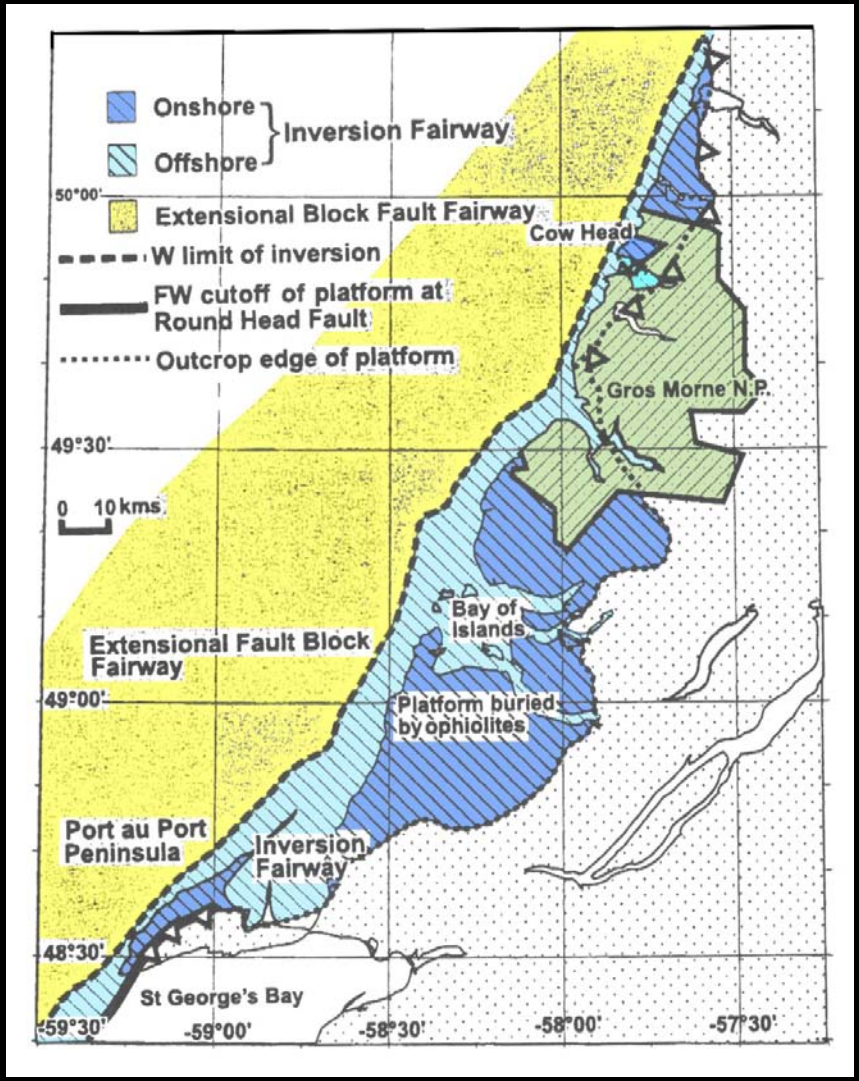
Reports:

Kelly, M.L. and Burden, E.T., 2012. Strata and structure of dismembered Humber Arm Allochthon between Bonne Bay and Bay of Islands: Implications for regional petroleum exploration. *GAC-MAC Abstracts*, 35, p. 66.

Humber Arm Allochthon – “mélange”

MEMORIAL UNIVERSITY

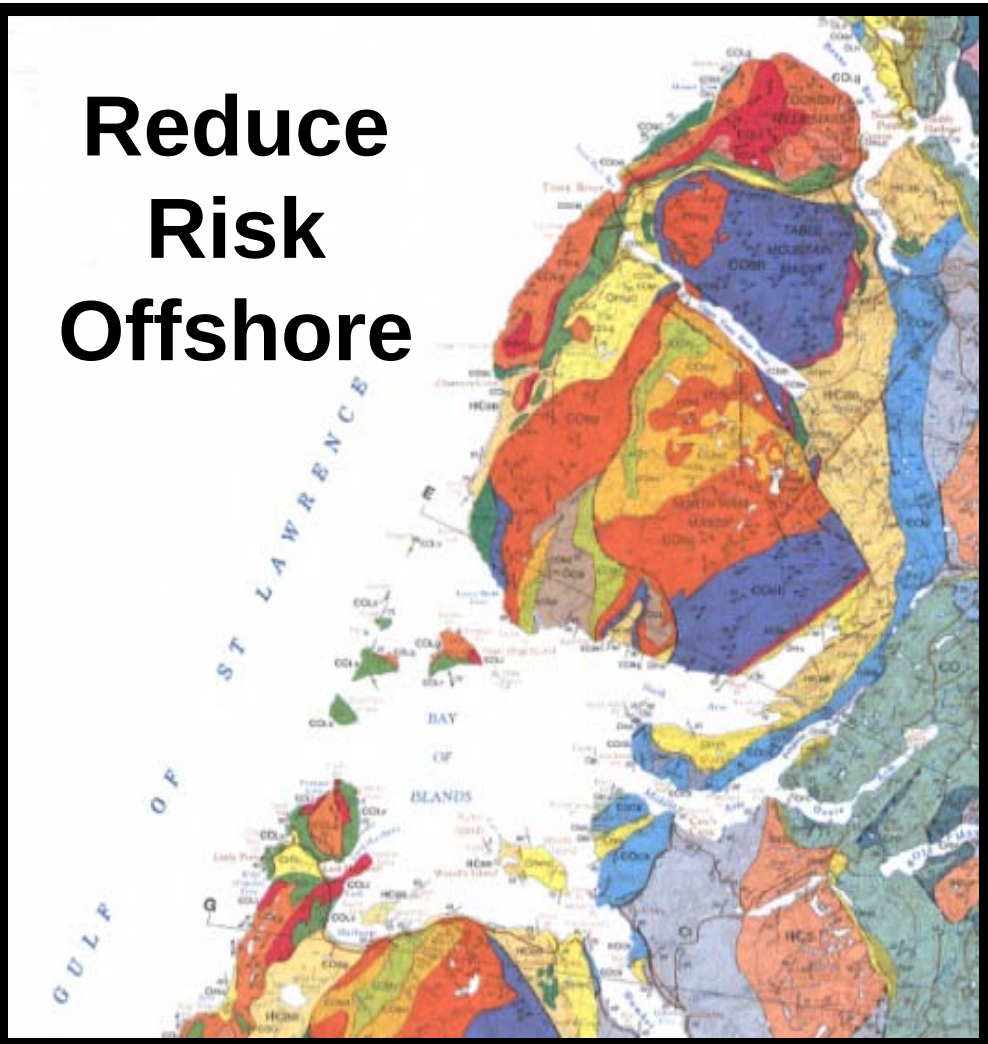
Project Overview:
Concepts - Study Area



Humber Arm Allochthon – “mélange”

MEMORIAL UNIVERSITY

Project Overview:
Concepts - Study Area



(Williams and Cawood, 1989)

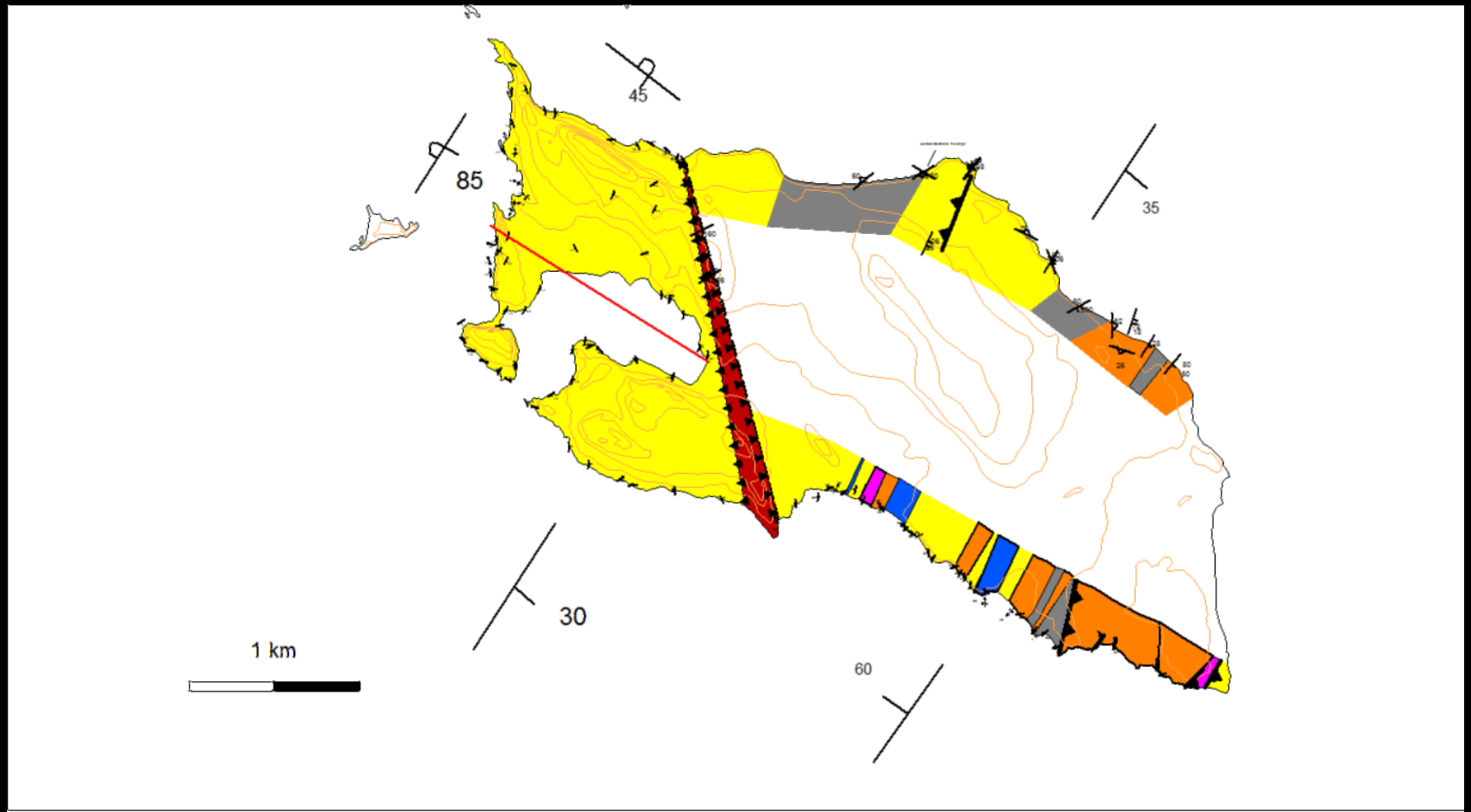
Humber Arm Allochthon – “mélange”

Humber Arm Allochthon – “mélange”

Humber Arm Allochthon – “mélange”

MEMORIAL UNIVERSITY

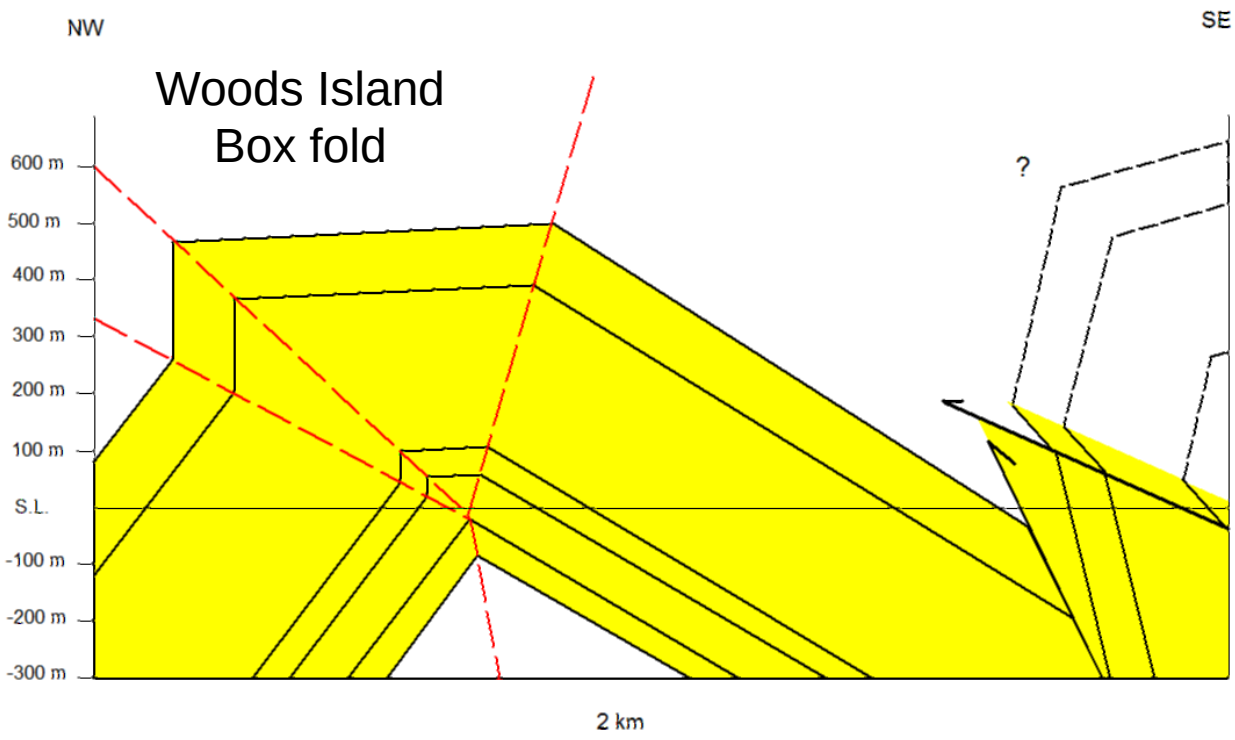
Large regional scale antiforms are mapped over the area



Humber Arm Allochthon – “mélange”

MEMORIAL UNIVERSITY

Traps or seals?



Humber Arm Allochthon – “mélange”

Anguille Gp. - White Bay Subbasin

MEMORIAL UNIVERSITY

Programme:

Geochemical and environmental parameters affecting lacustrine ***source rock properties*** of the Tournaisian, Anguille Group (Conche), White Bay Subbasin -Atlantic conjugate margin.

Personnel:

Elliott Burden, Joe MacQuaker, Geoff Clayton (Trinity College, Dublin) - Co-Investigators

Contributions towards training HQP:

Lucy Newton - M.Sc. Candidate 2014

Eimear McDonald (Trinity College) - Summer intern 2010

Eimear McDonald - Honours Thesis 2011

Danielle House - Honours Thesis 2011

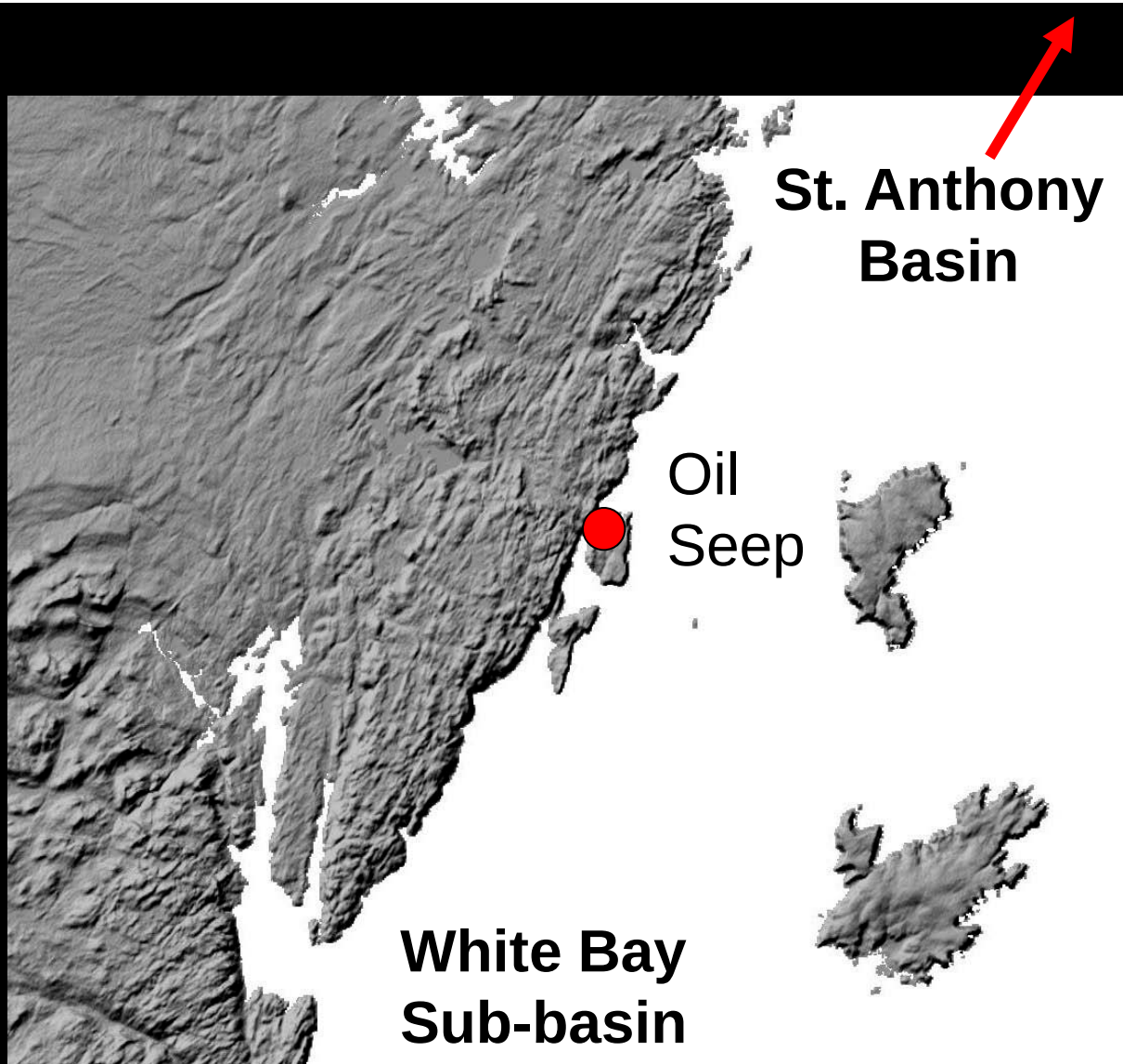
Greg Froude - Honours Thesis 2012

Kevin Jordan - Summer intern 2012

Anguille Gp. - White Bay Subbasin

MEMORIAL UNIVERSITY

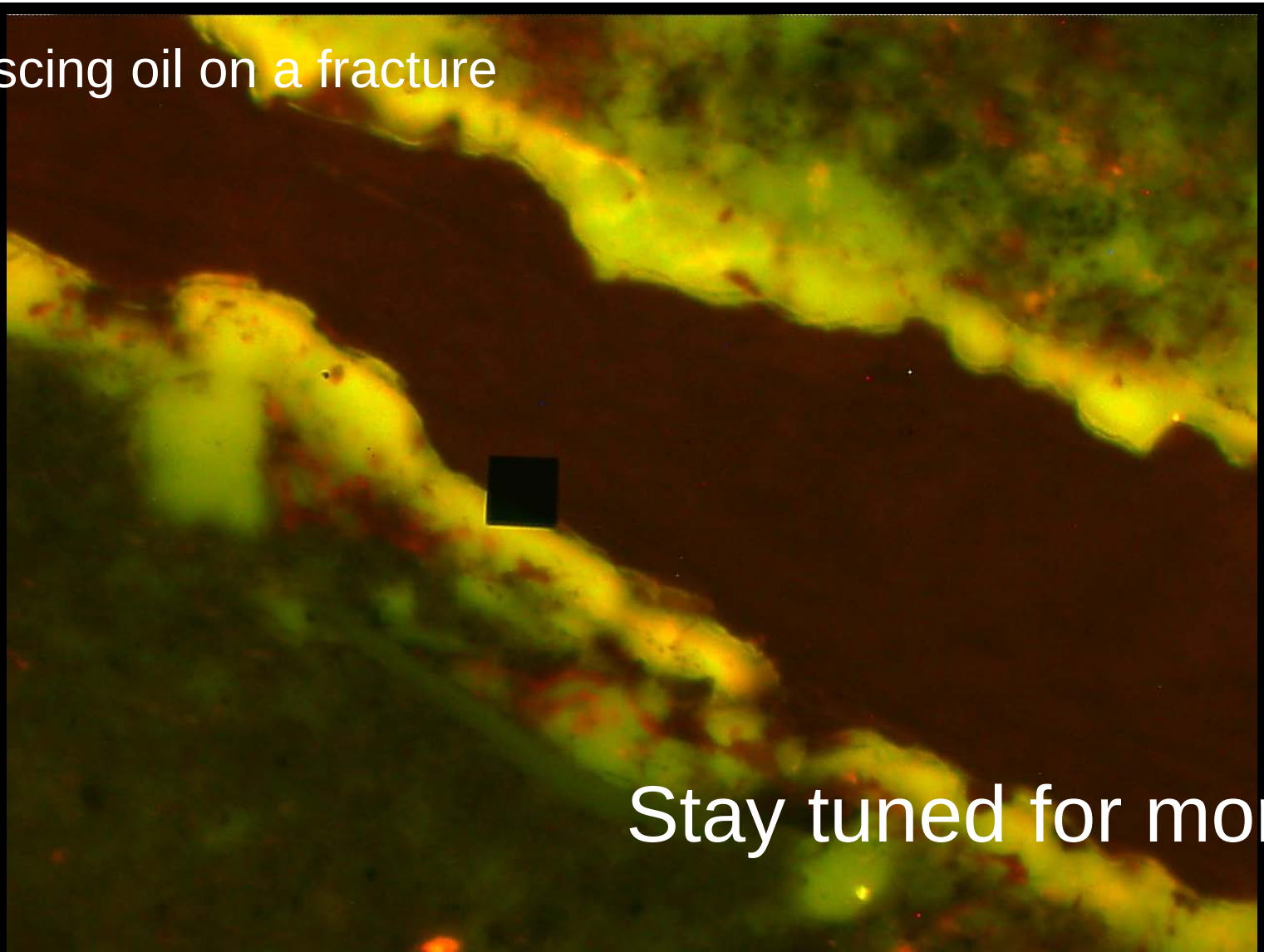
Project Overview:
Concepts - Study Area



Anguille Gp. - White Bay Subbasin

MEMORIAL UNIVERSITY

Fluorescing oil on a fracture



Stay tuned for more

Acknowledgments

Joe MacQuaker, Tom Calon, Ian Atkinson, Larry Hicks, and Ian Knight for places to mull ideas.

Kris Oravec, and Mary and Ted Kelly