

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

Elliott Burden

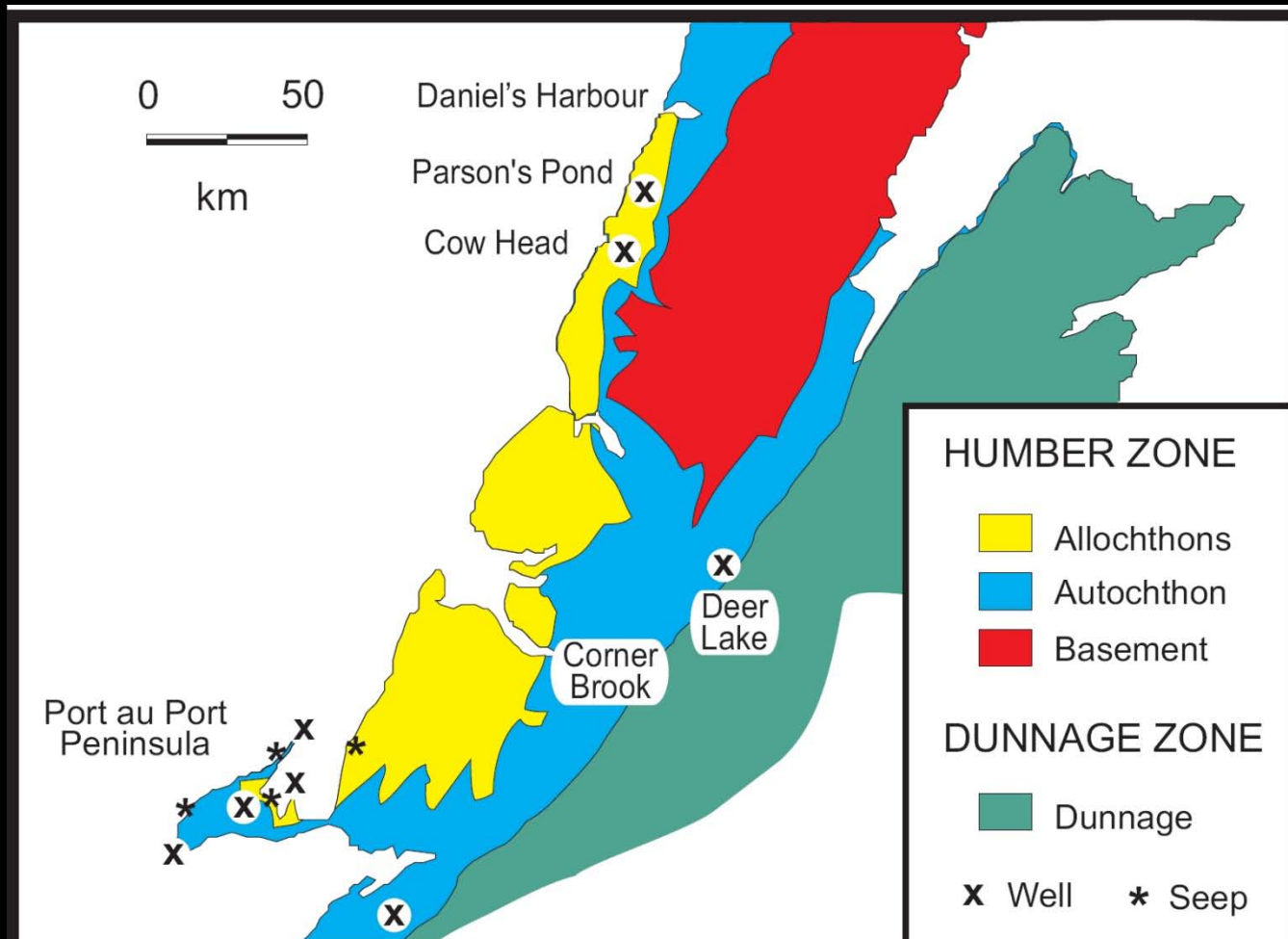
## **Applied Geoscience Research Philosophy:**

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

## 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.

## PEEP Programmes:



## 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

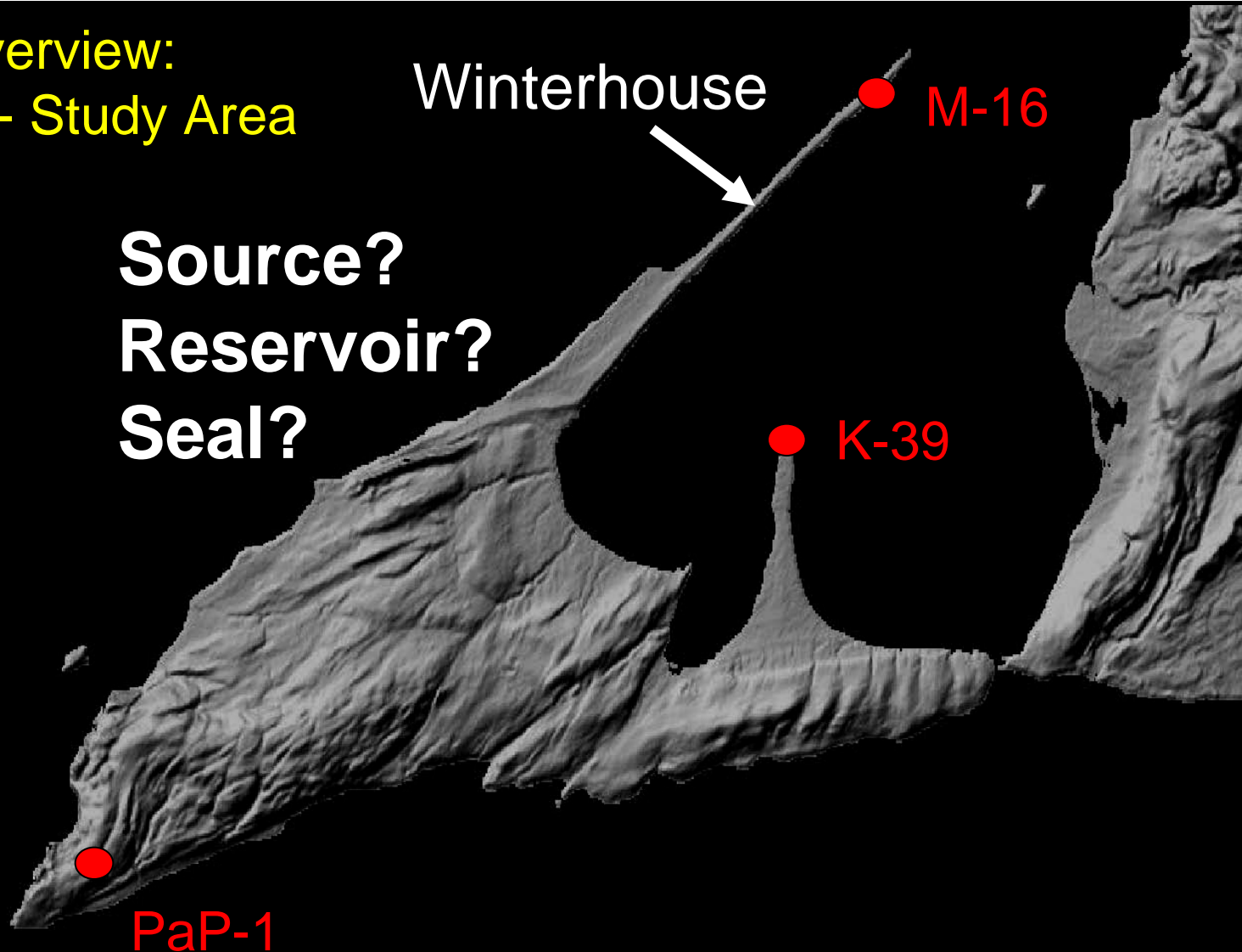
## Reports:

- 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

Project Overview:  
Concepts - Study Area

Source?  
Reservoir?  
Seal?



# Winterhouse Fm. - Port au Port Peninsula

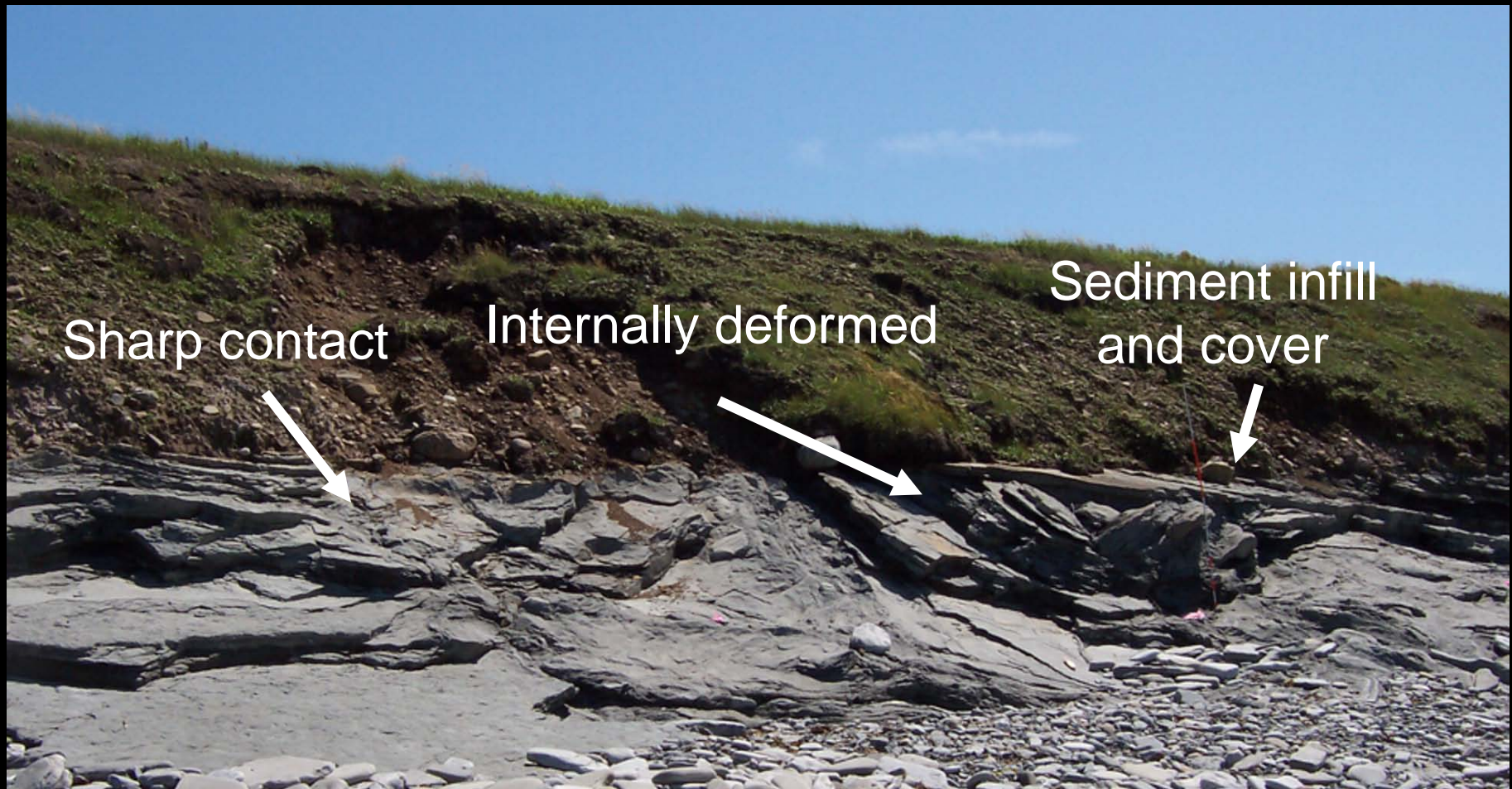
## Project Overview: Concepts - Study Area





# Winterhouse Fm. - Port au Port Peninsula

Bedding is disrupted and fractured in places



# Winterhouse Fm. - Port au Port Peninsula



Beds tend to be thin and with an obvious eroded base

Calcareenite 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

Oil stained siltstones



- 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.

## Programme:

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

## Personnel:

Elliott Burden - Principal Investigator

## Contributions towards training HQP

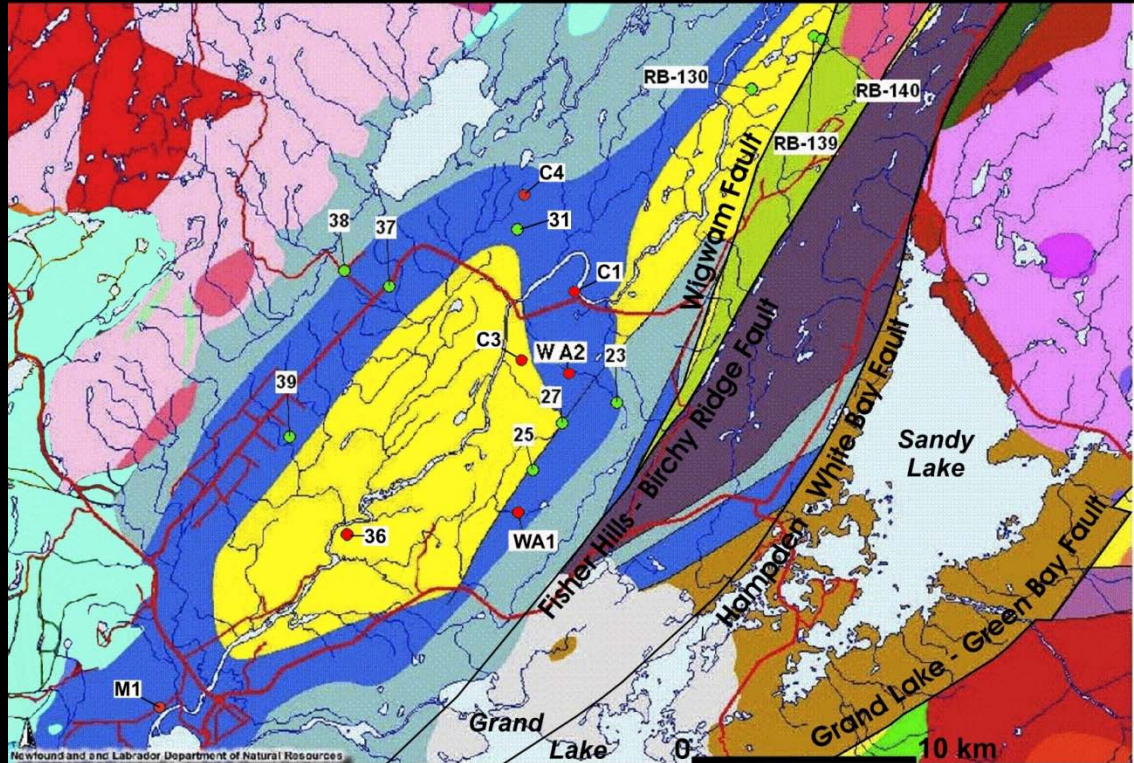
Michael Kelly - Summer intern 2009

## 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

## Project Overview: Concepts - Study Area



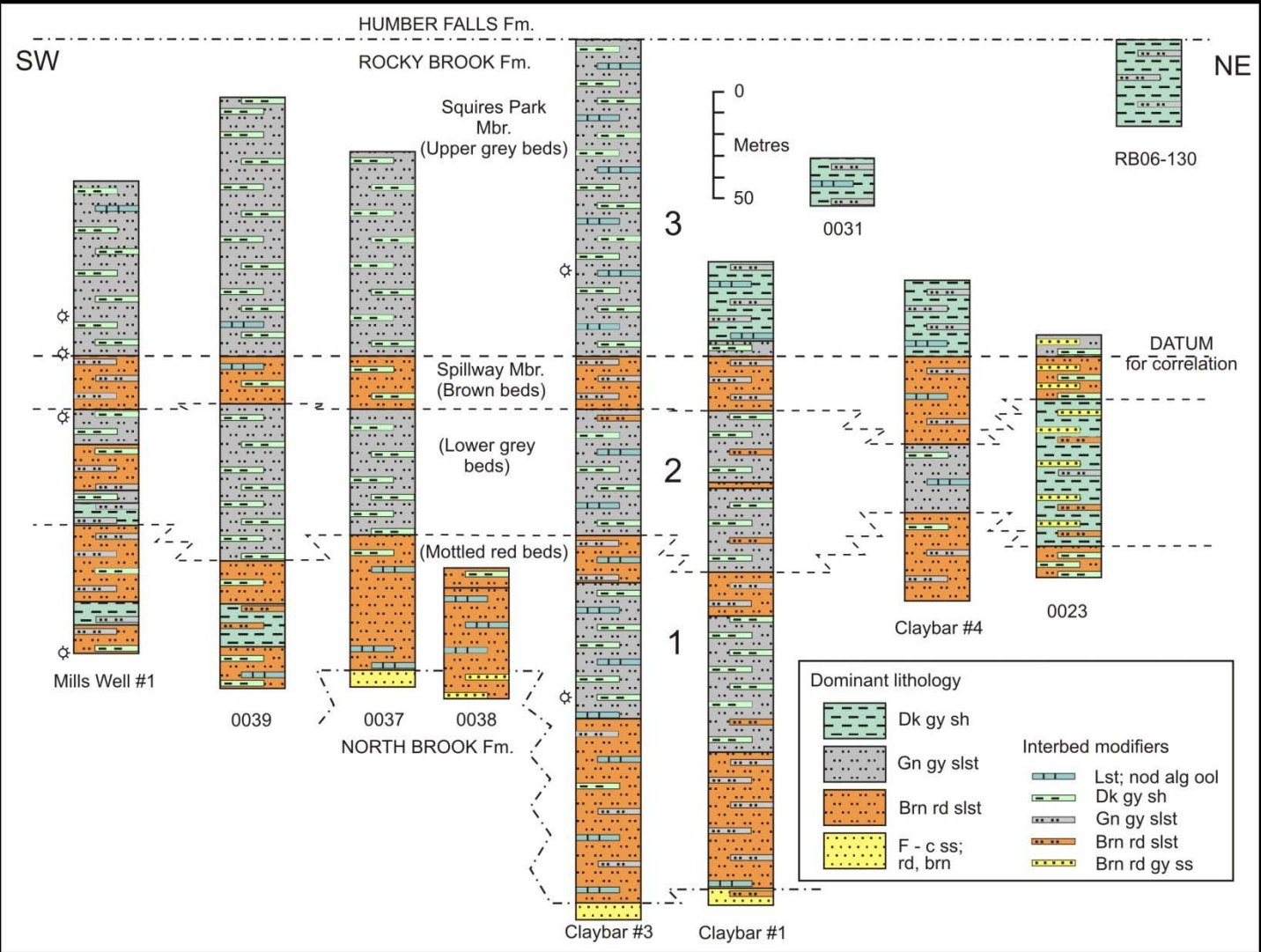
### DEER LAKE GROUP

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

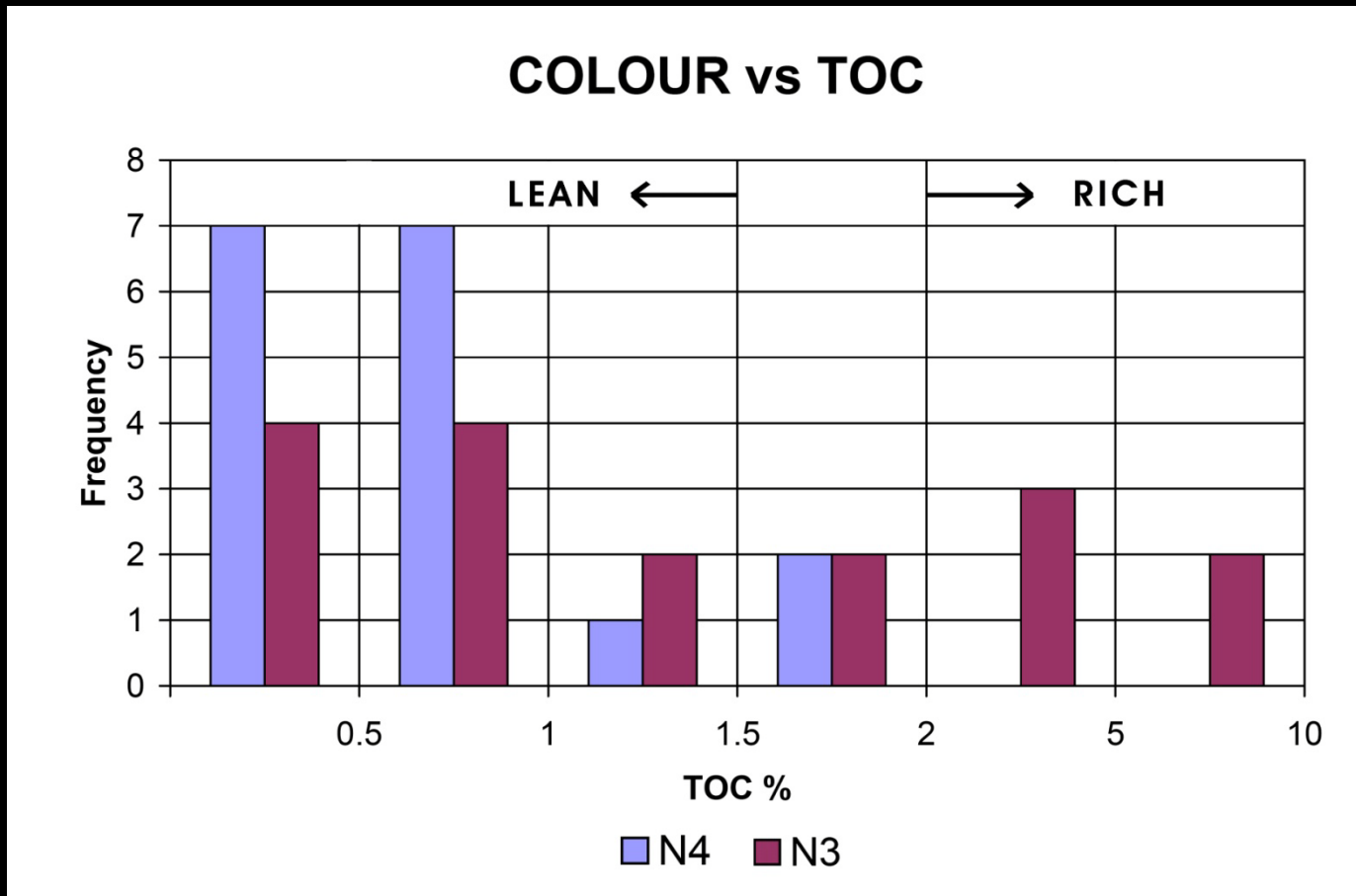


# Rocky Brook Fm. – Deer Lake Basin

Correlations are slightly modified to include a basal muddy succession

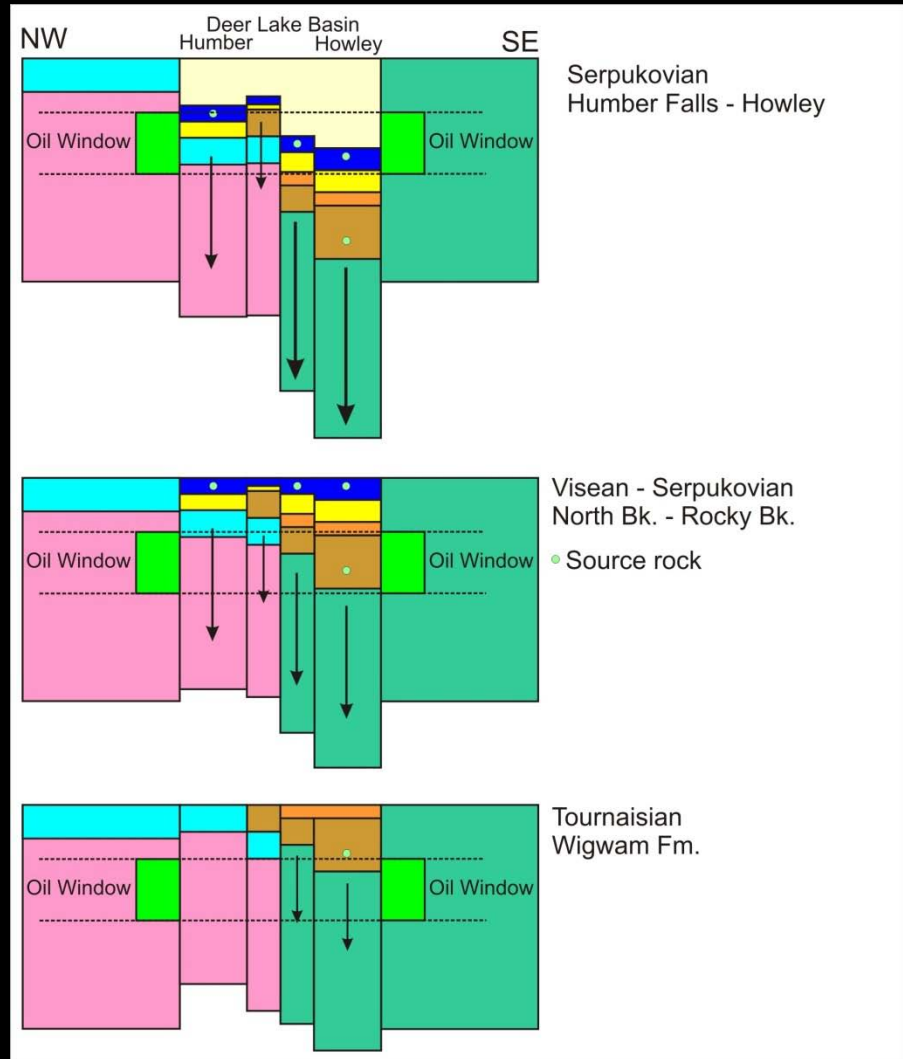


## Source rock richness and volumetrics addressed



# Rocky Brook Fm. – Deer Lake Basin

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

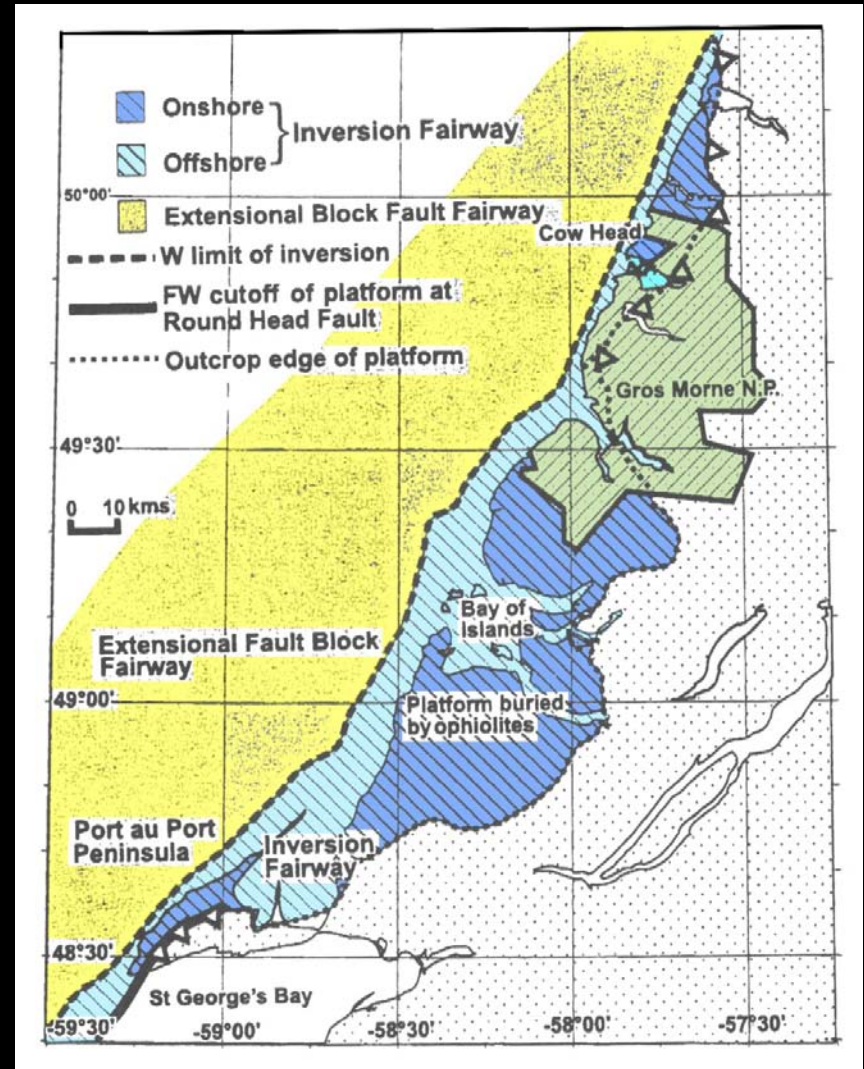
Stratigraphy and structure of Cambro-Ordovician, Humber Arm “mélange”; ***new exploration models*** for the Gulf of St Lawrence.

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”

## Project Overview: Concepts - Study Area



# Humber Arm Allochthon – “mélange”

## Project Overview: Concepts - Study Area

**Reduce  
Risk  
Offshore**



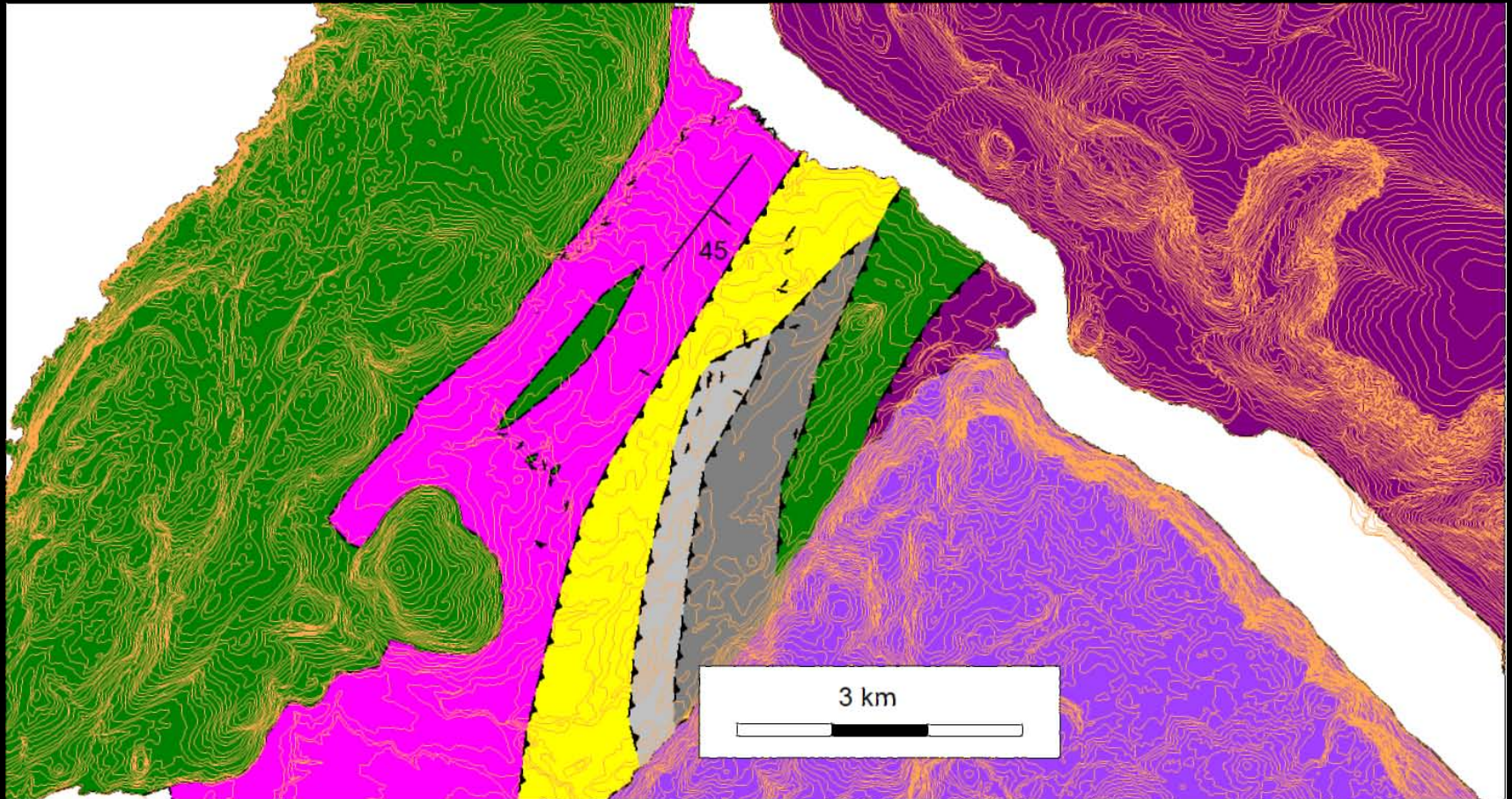
(Williams and Cawood, 1989)

# Humber Arm Allochthon – “mélange”



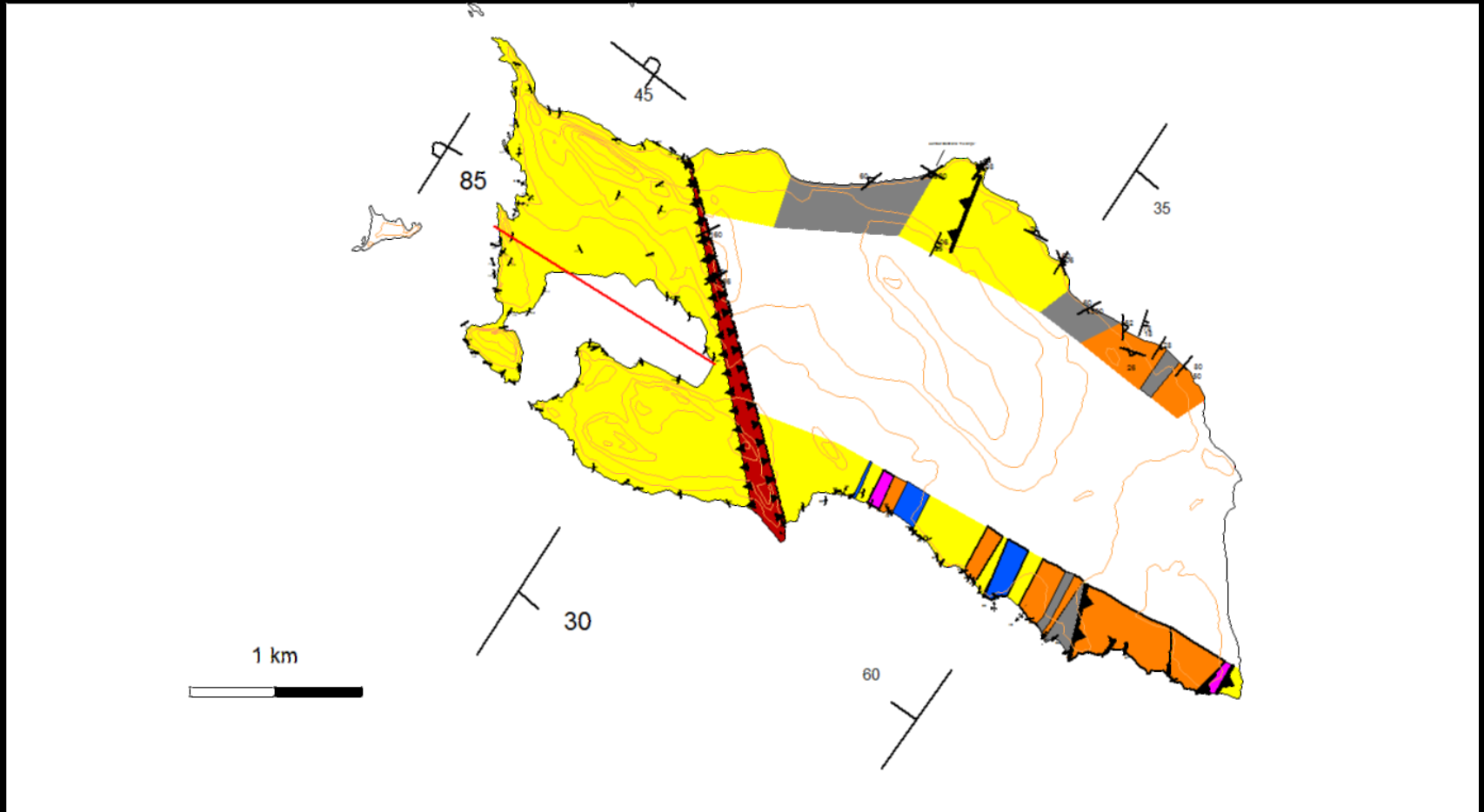


# Humber Arm Allochthon – “mélange”



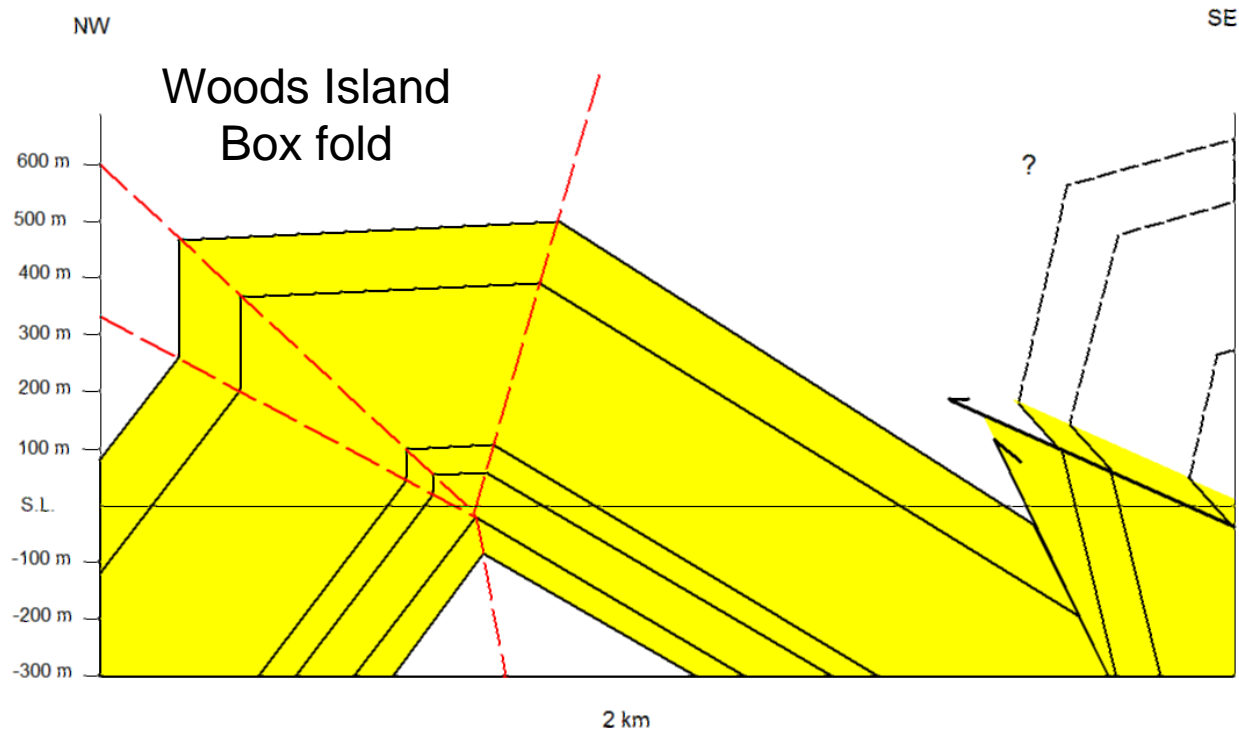
# Humber Arm Allochthon – “mélange”

Large regional scale antiforms are mapped over the area



# Humber Arm Allochthon – “mélange”

## Traps or seals?



# Humber Arm Allochthon – “mélange”



Woods Island  
Box fold

## 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

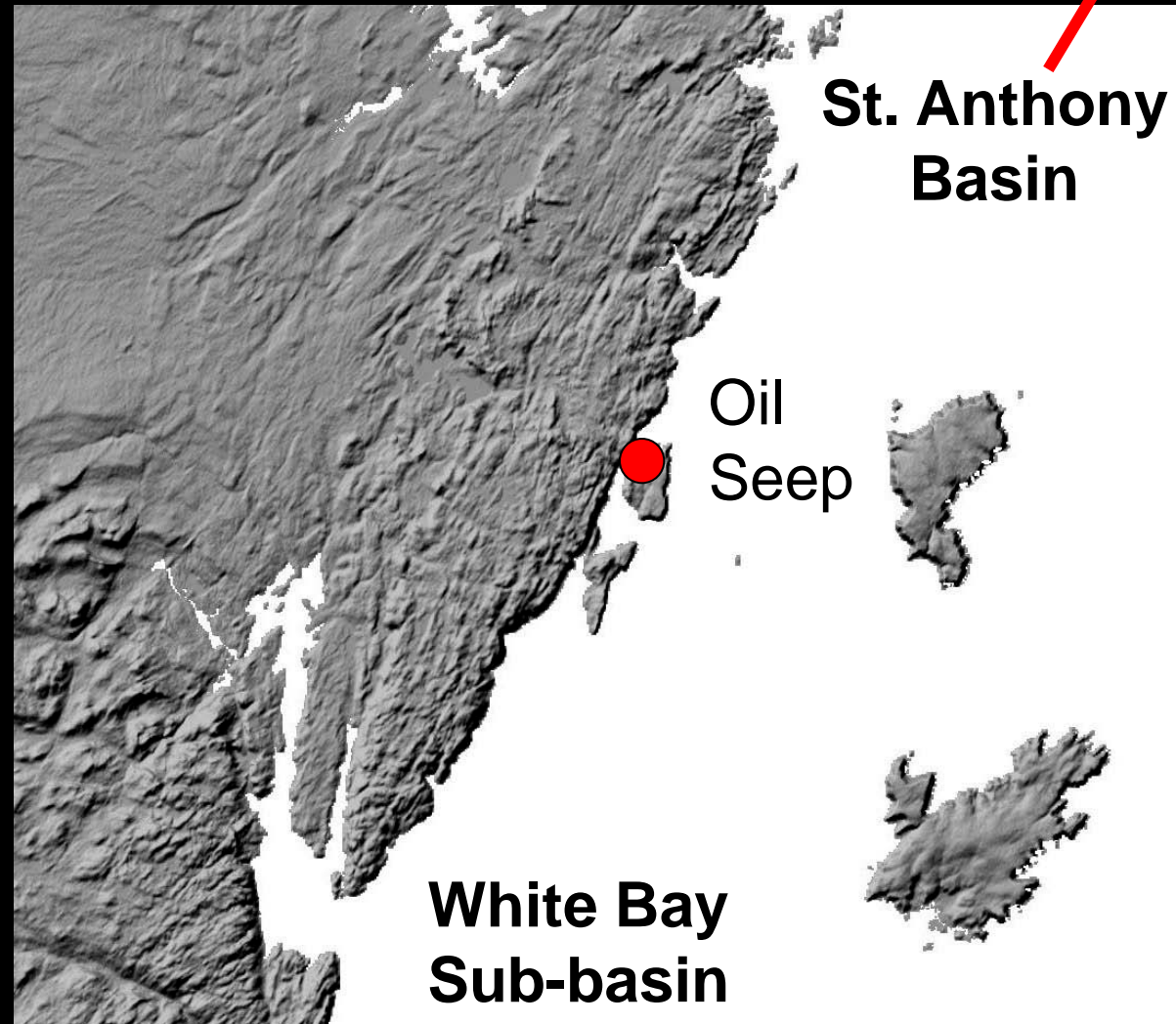
Danielle House - Honours Thesis 2011

Greg Froude - Honours Thesis 2012

Kevin Jordan - Summer intern 2012

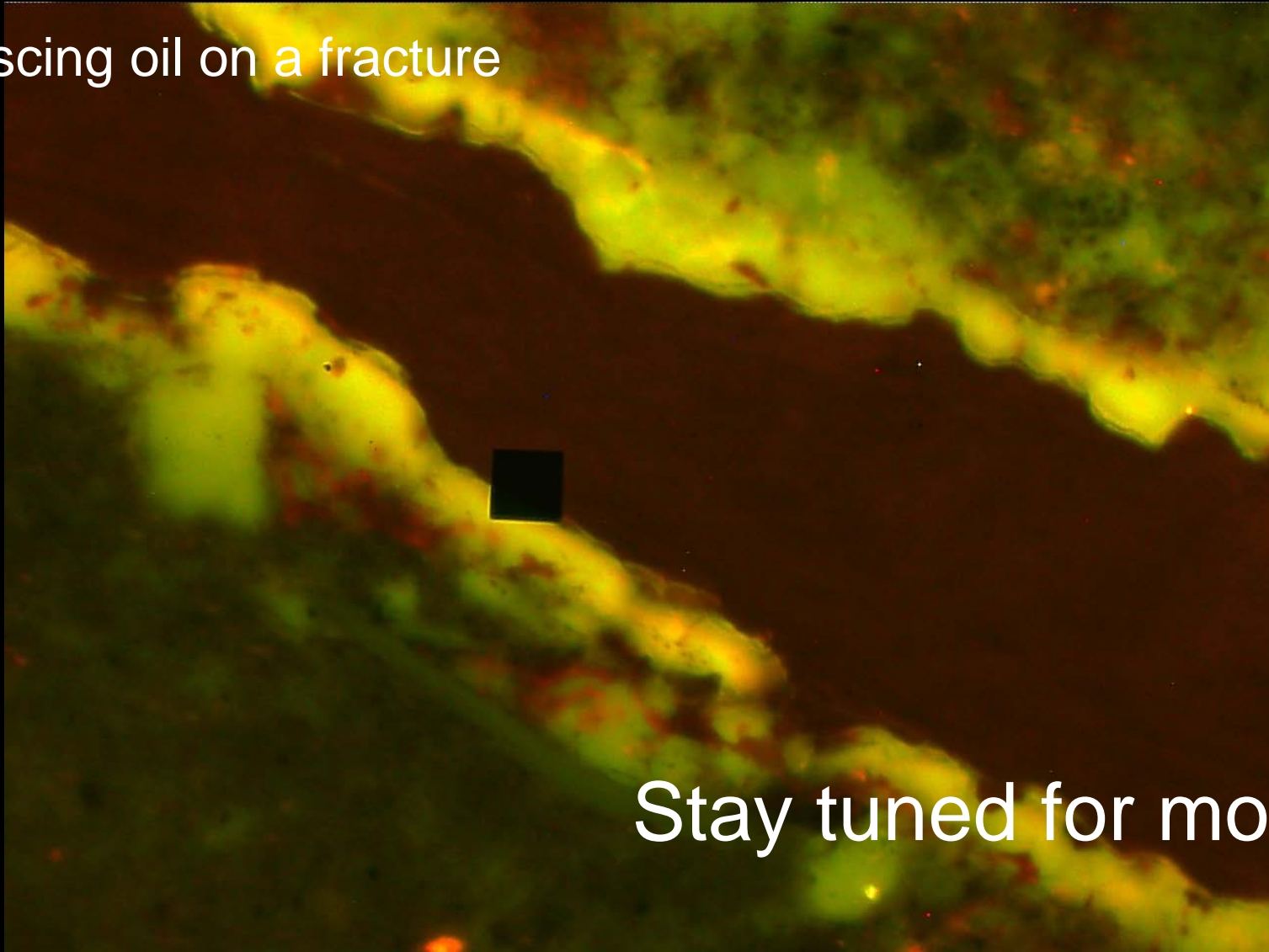
# Anguille Gp. - White Bay Subbasin

## Project Overview: Concepts - Study Area



# Anguille Gp. - White Bay Subbasin

Fluorescing oil on a fracture



Stay tuned for more

# Acknowledgments

MEMORIAL  
UNIVERSITY



Joe MacQuaker, Tom Calon, Ian Atkinson, Larry Hicks, and  
Ian Knight for places to mull ideas.  
Kris Oravec, and Mary and Ted Kelly