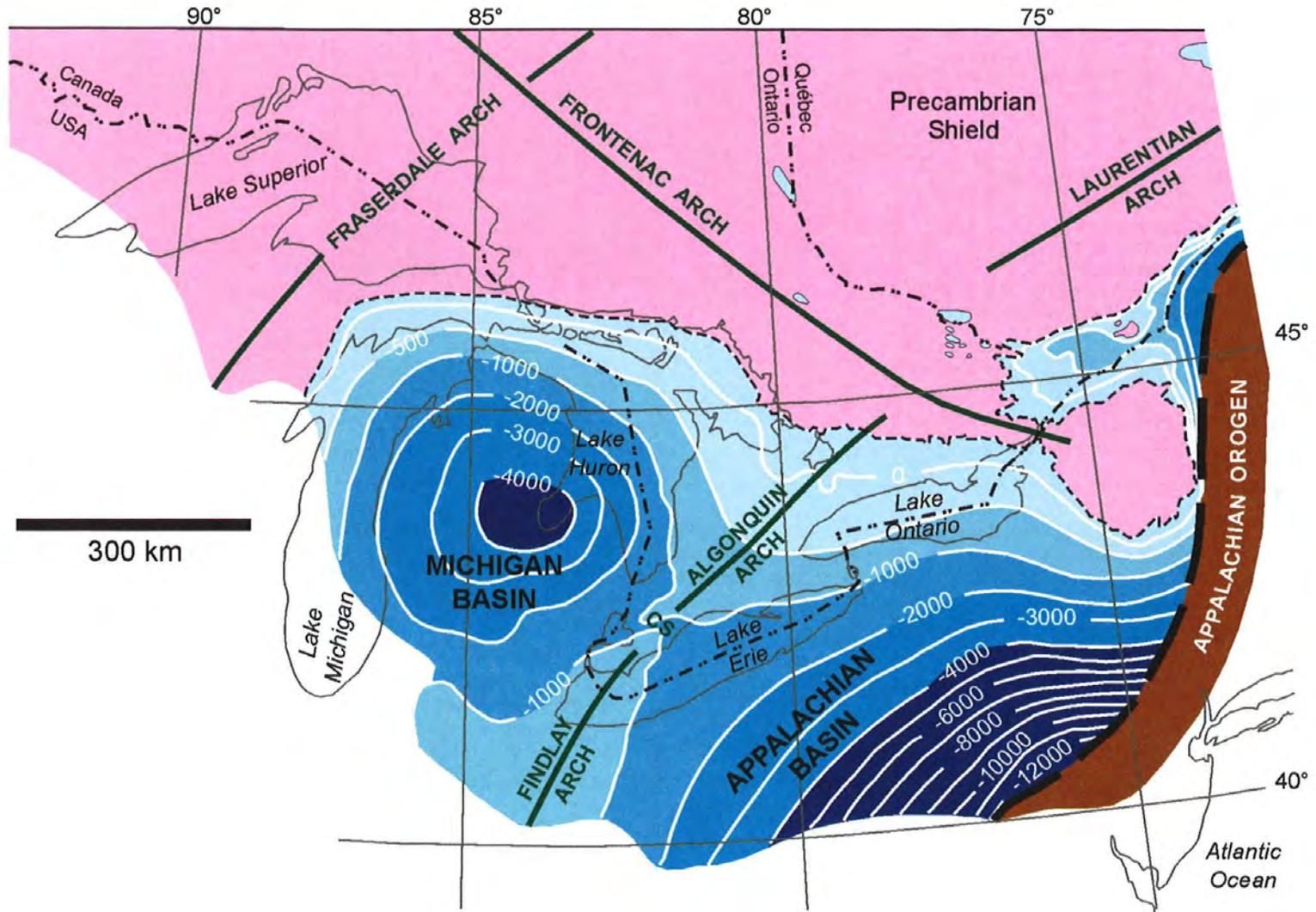




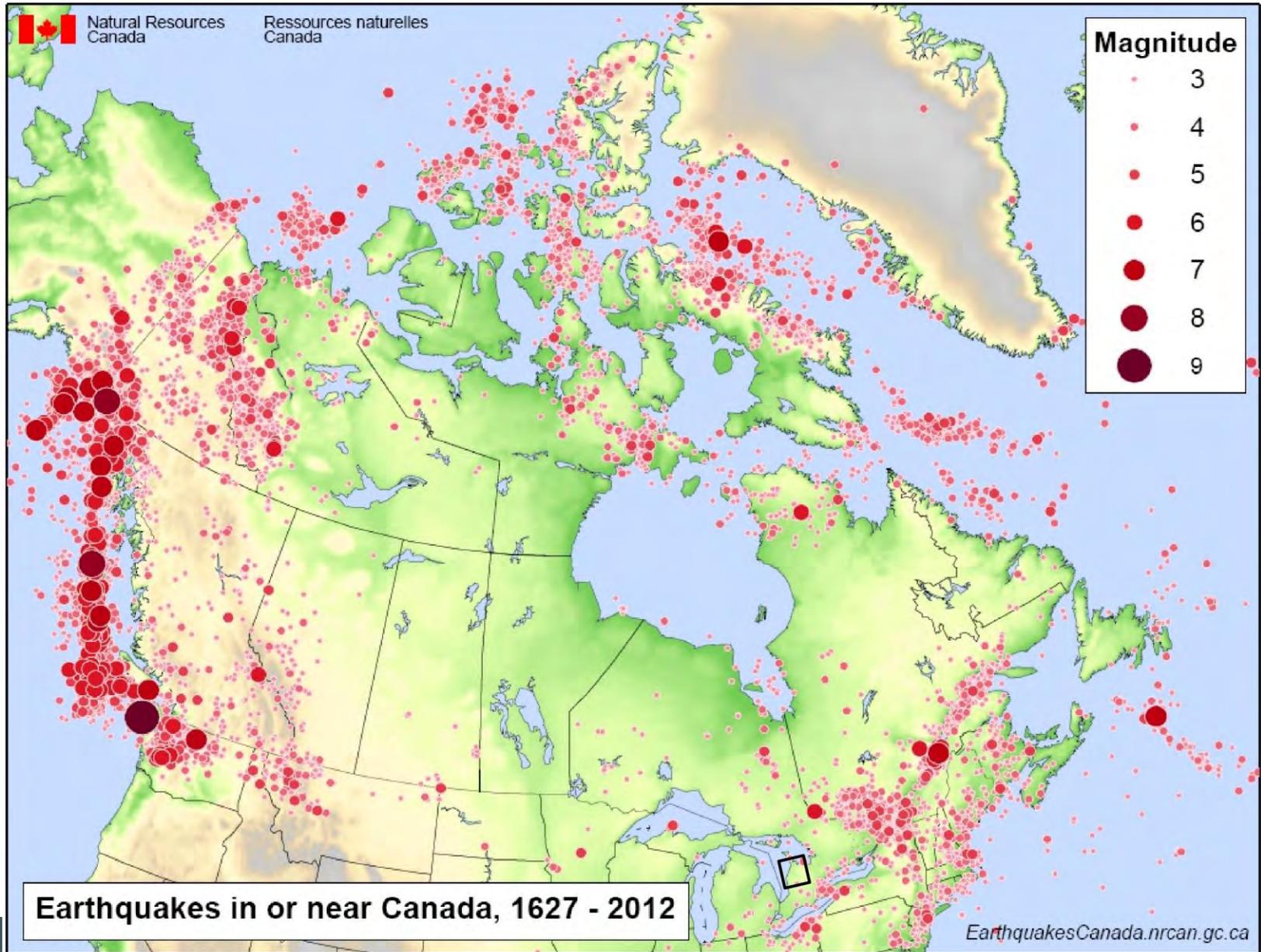
Overview of the Sub-Surface Geology in Southern Ontario

Geological Features of Southern Ontario



Contours represent thickness of the sedimentary sequence in metres

Earthquakes Map of Canada 1627-2012



Regional Surface Bedrock Geology

LEGEND

- The Communities
- Expressway
- Highway
- Canada - USA Boundary

Mapped Subsurface Faults

- Rochester (Silurian)
- Trenton (Ordovician)
- Shadow Lake/Precambrian
- Waterbody
- Regional Cross-Section

Bedrock Geology

Upper Devonian

- Port Lambton Group
- Kettle Point

Middle Devonian

- Hamilton Group
- Marcellus
- Dundee
- Lucas
- Amherstburg
- Onondaga

Lower Devonian

- Bois Blanc
- Oriskany

Upper Silurian

- Bass Islands
- Bertie
- Salina
- Guelph

Lower Silurian

- Amabel
- Lockport
- Clinton-Cataract Group

Upper Ordovician

- Queenston
- Georgian Bay
- Blue Mountain
- Lindsay (Cobourg)
- Verulam (Sherman Fall)
- Bobcaygeon (Coboconk & Kirkfield)
- Gull River
- Shadow Lake

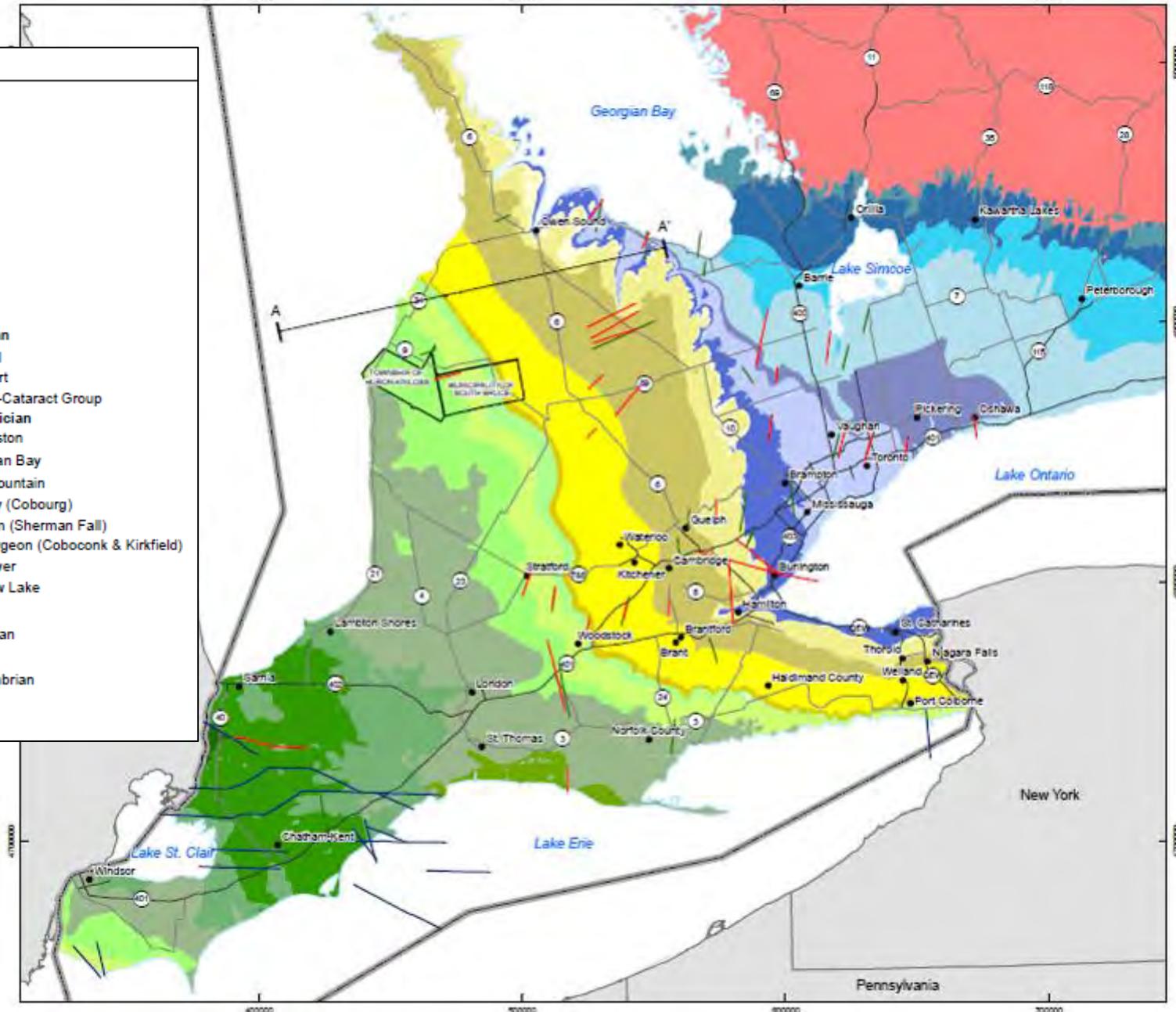
Cambrian

- Cambrian

Precambrian

- Precambrian

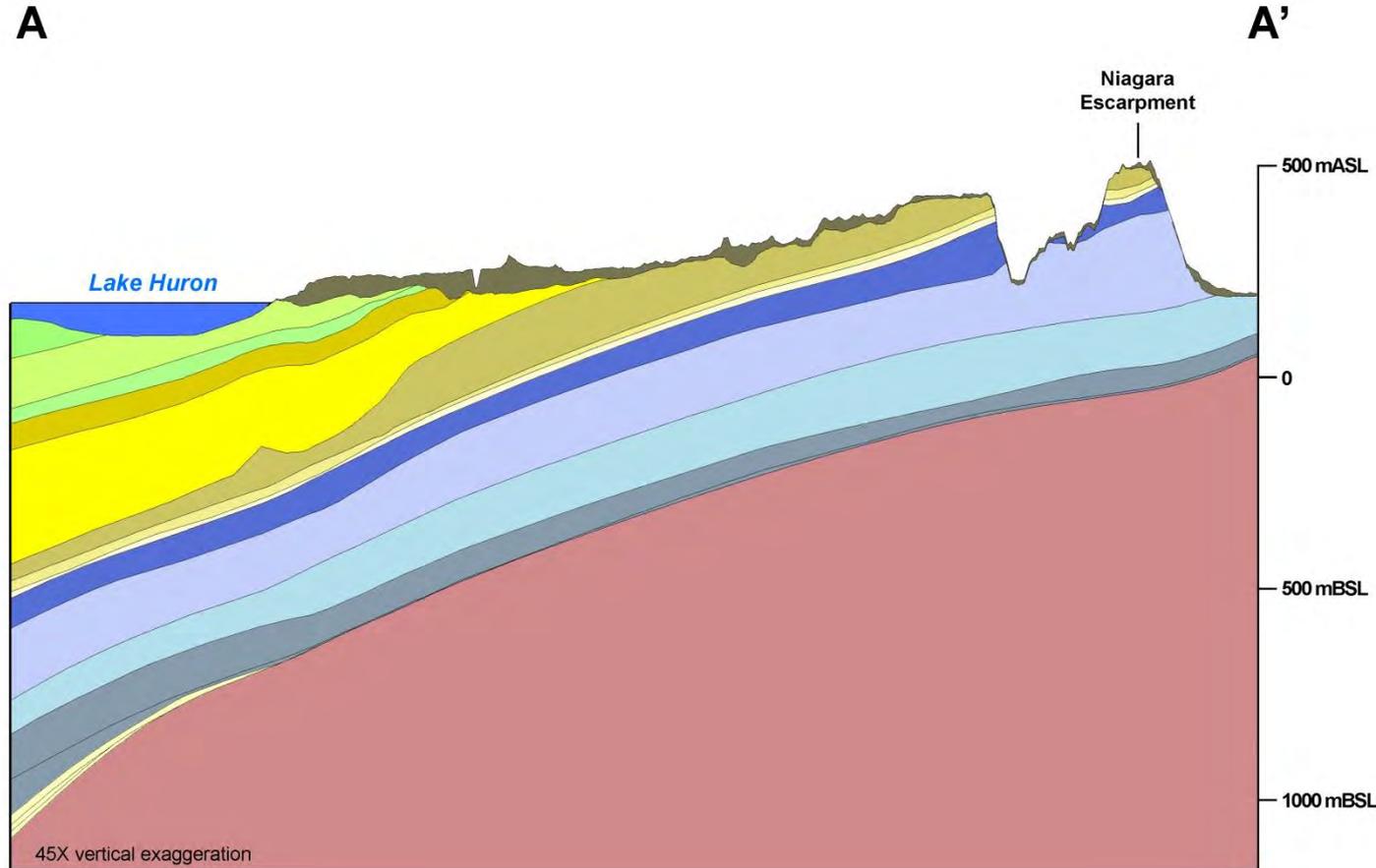
(Cobourg) = Subsurface Nomenclature



Regional Geological Cross-section - Eastern Section of Michigan Basin

Legend

- Overburden
- Bedrock Geology**
- Middle Devonian**
 - Lucas
 - Amherstburg
- Lower Devonian**
 - Bois Blanc
- Upper Silurian**
 - Bass Islands
 - Salina
 - Guelph
- Lower Silurian**
 - Lockport (Goat Island, Gasport)
 - Clinton-Cataract Group (Fossil Hill, Cabot Head, Manitoulin)
- Upper Ordovician**
 - Queenston
 - Georgian Bay/Blue Mountain
 - Trenton (Cobourg, Sherman Fall, Kirkfield)
 - Black River (Cobocok, Gull River, Shadow Lake)
- Cambrian**
 - Cambrian
- Precambrian**
 - Precambrian

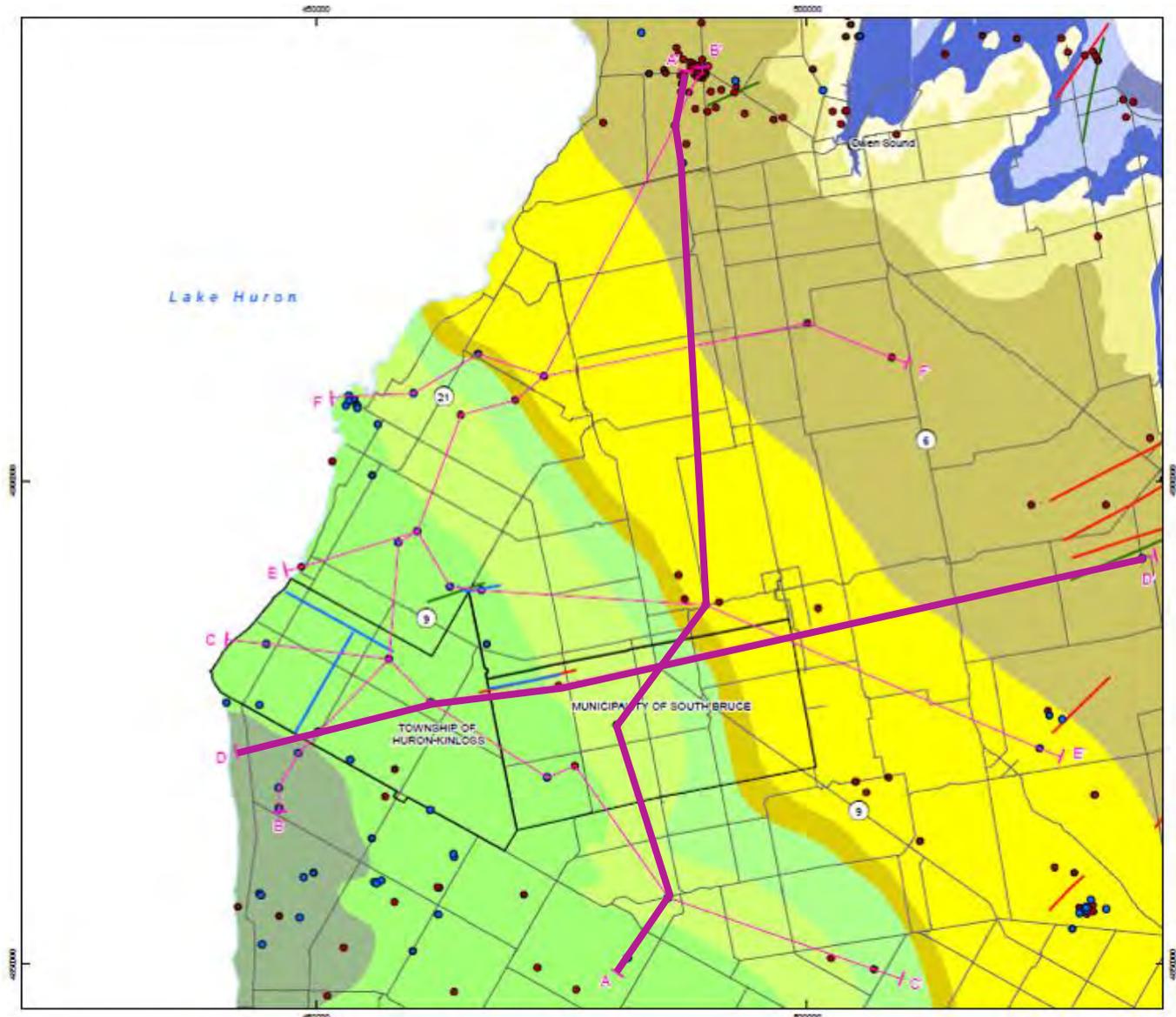


Section is about 150 km long with a 45x vertical exaggeration

OGSRL Wells and Cross Sections

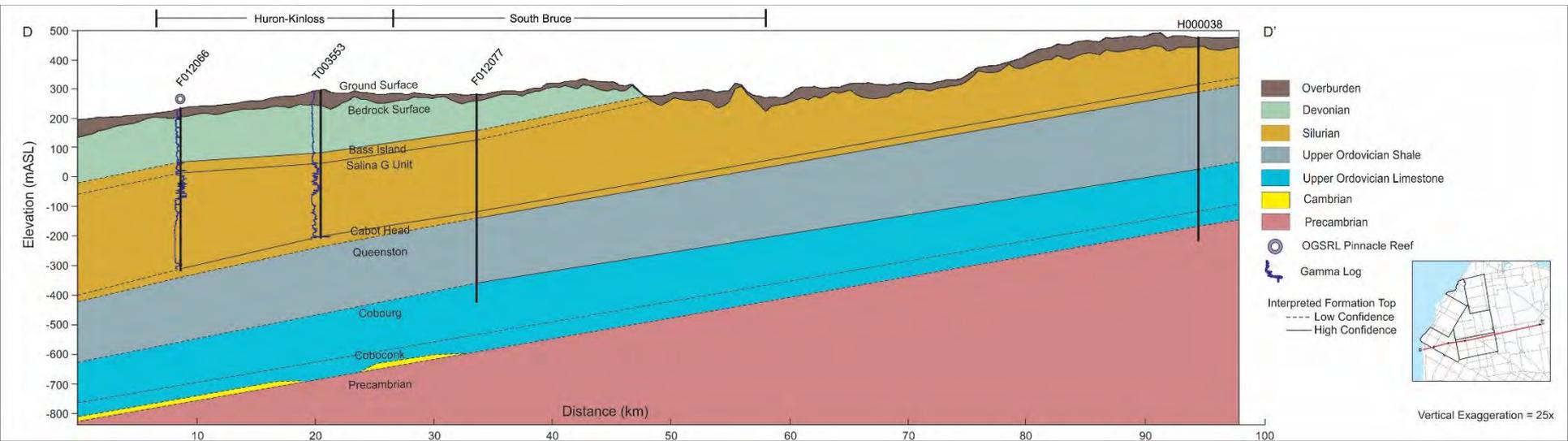
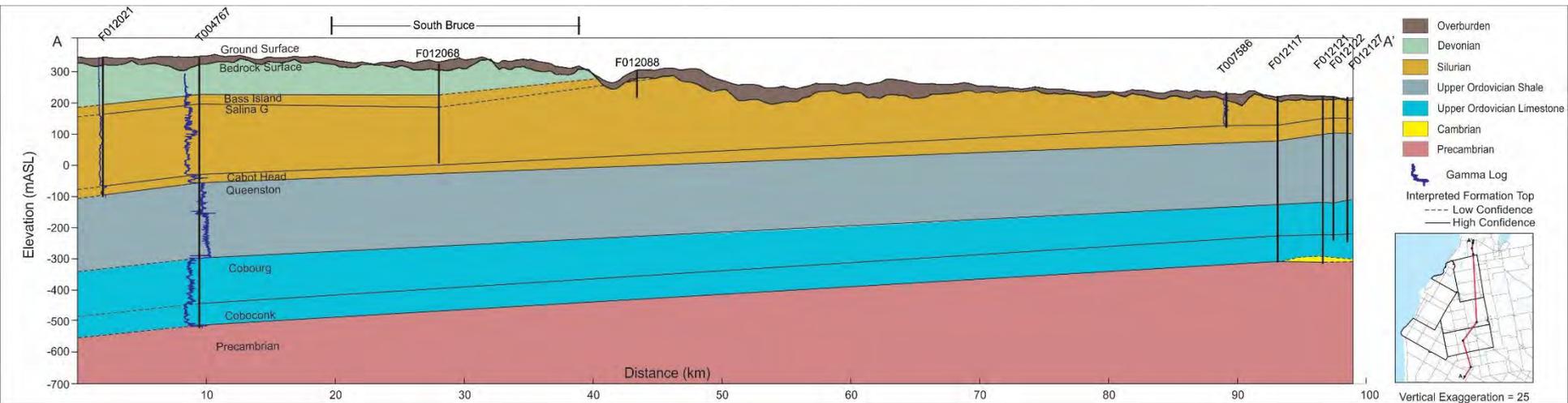
LEGEND

-  The Communities
-  Highway/Major Road
-  Waterbody
- Mapped Subsurface Faults**
-  Shadow Lake/Precambrian
-  Trenton (Ordovician)
-  Acquired 2D Seismic Data
-  OGSRL Well
-  OGSRL Well with Geophysics Log
-  Cross-Section
- Bedrock Geology**
- Middle Devonian**
-  Dundee
-  Lucas
-  Amherstburg
- Lower Devonian**
-  Bois Blanc
- Upper Silurian**
-  Bass Islands
-  Salina
-  Guelph
- Lower Silurian**
-  Amabel
-  Clinton-Cataract Group
- Upper Ordovician**
-  Queenston
-  Georgian Bay
-  Blue Mountain

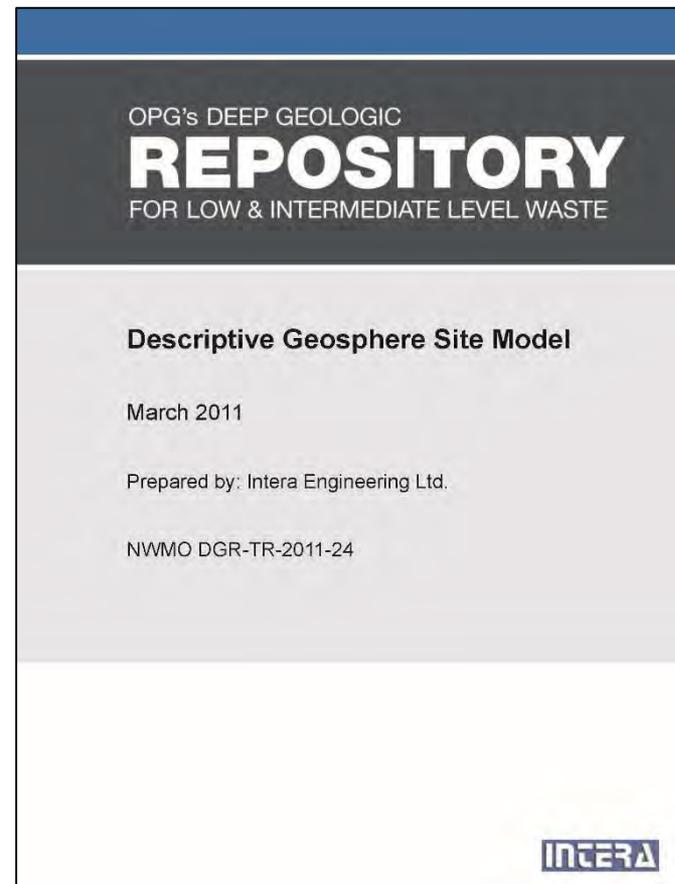
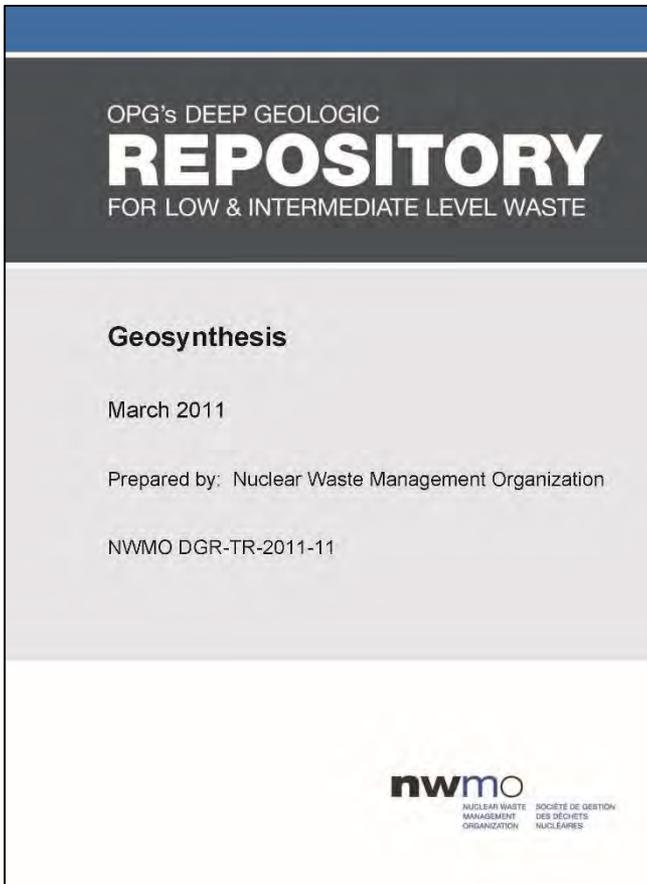


OGSRL: Ontario's Oil,
Gas and Salt
Resources Library

Cross Sections N-S and E-W

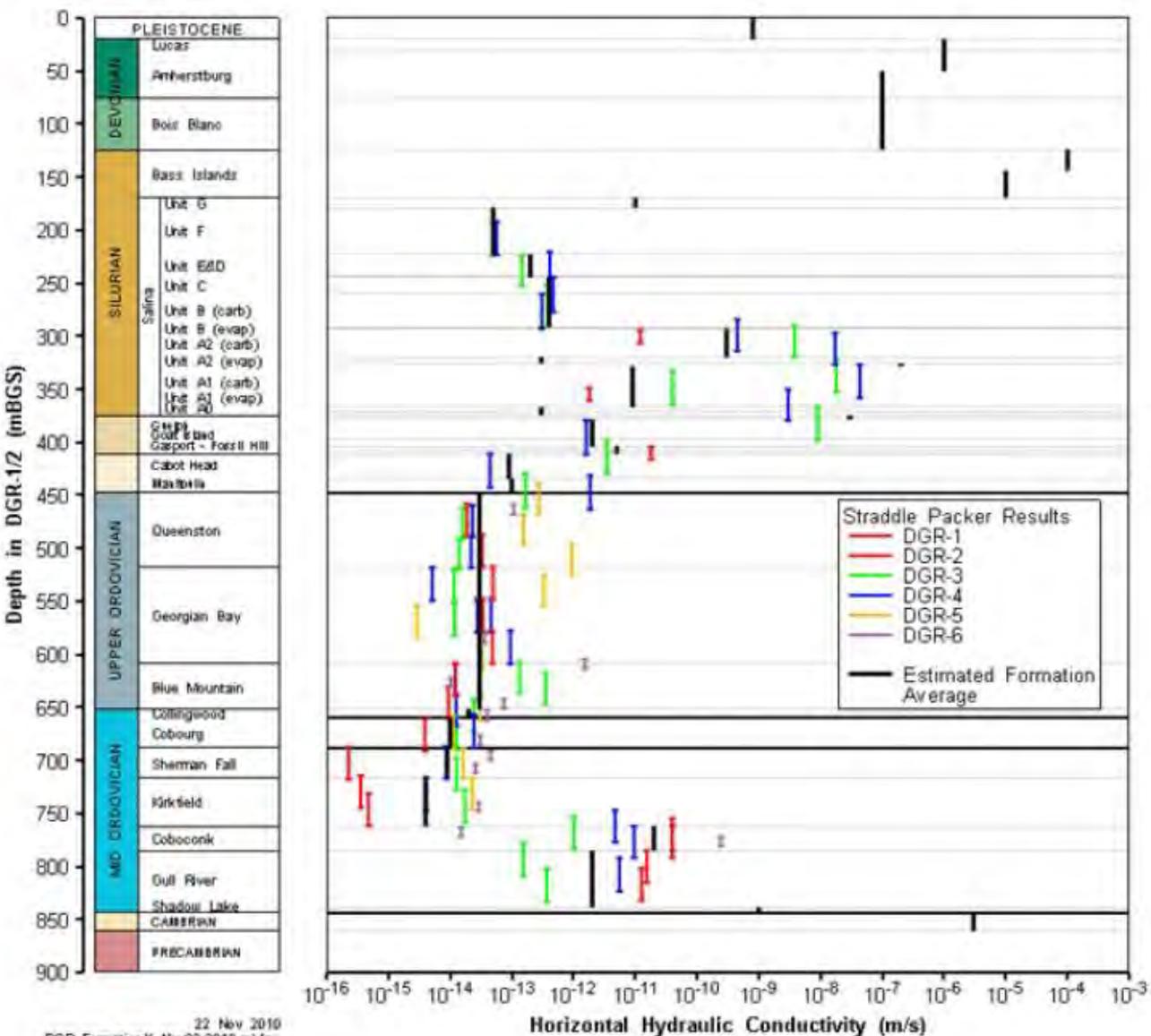


Characterization of the bedrock geology at the Bruce nuclear site



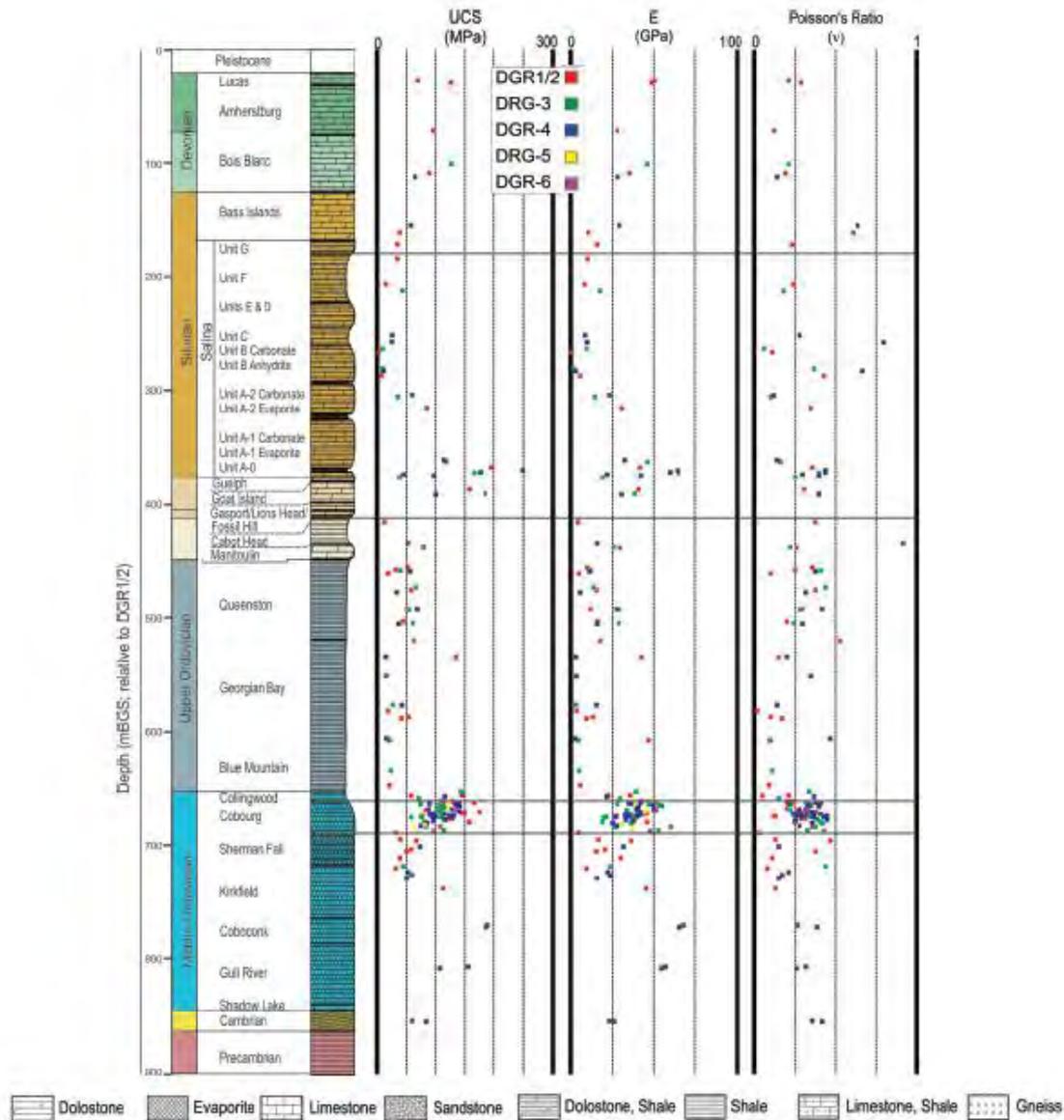
Hydraulic Testing at the Bruce Nuclear Site

Hydrogeological studies seek to understand groundwater migration and mass transport of through the subsurface



22 Nov 2010
DGR_FormationK_Nov22-2010 mVlem

Rock Strength Testing from Bruce Nuclear Site



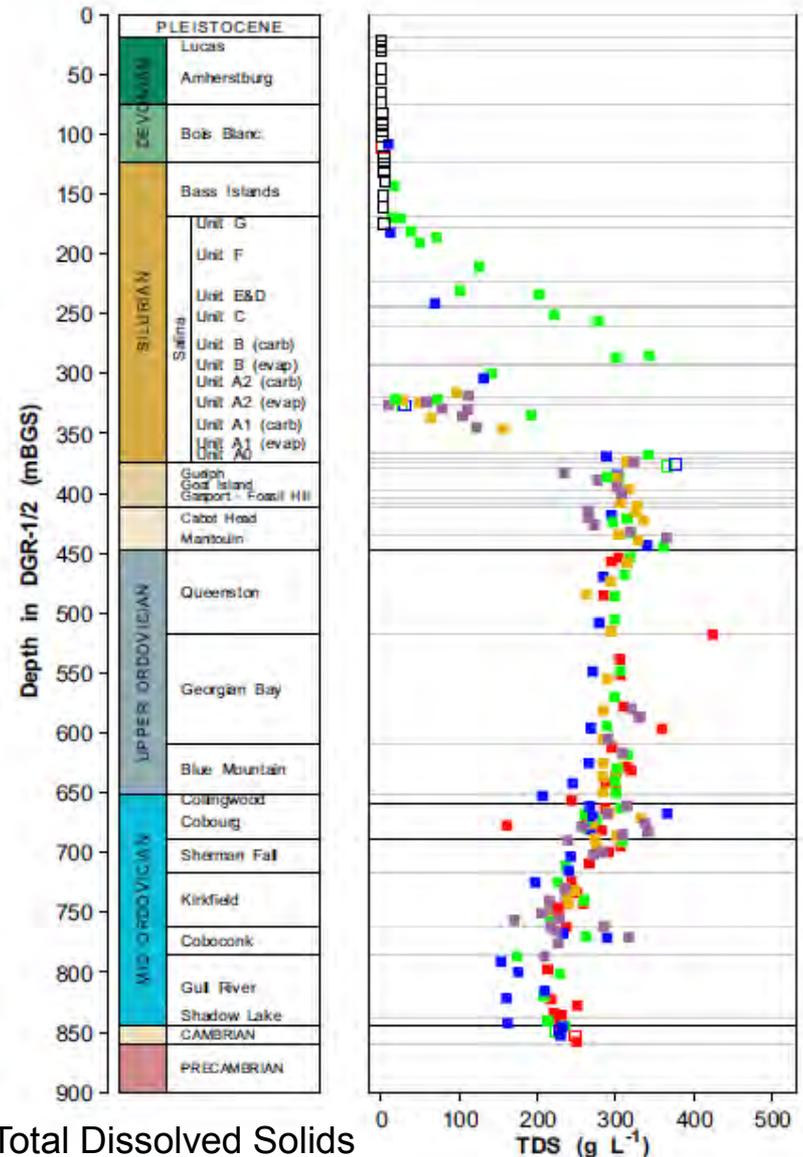
Laboratory tests reveal the high strength of the Cobourg argillaceous limestone

Groundwater and Porewater at the Bruce Nuclear Site

Consistent with Regional Hydrogeochemistry for S. Ontario (NWMO-DGR-TR-2011-12)

A shallow system (<200 mBGS) with fresh through brackish waters. Waters in this system have stable isotopic compositions consistent with mixing of dilute, recent or cold-climate (glacial) waters with more saline waters.

An intermediate to deep system (>200 mBGS) containing brines with elevated TDS values (200-400 g/L). The stable isotopic compositions of these waters are typical of sedimentary basin brines.



TDS = Total Dissolved Solids

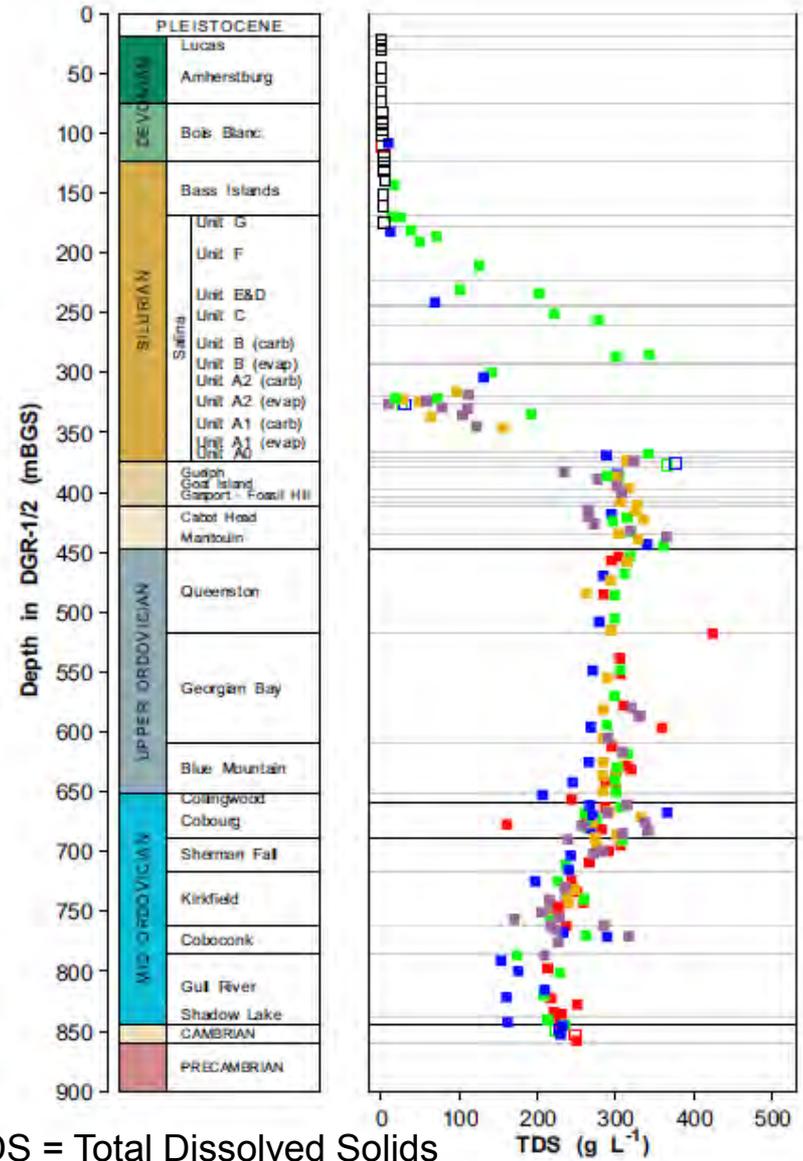
Groundwater and Porewater at the Bruce Nuclear Site

Groundwater Age Estimates

The ages of shallow Devonian and Upper Silurian groundwater have been investigated by ^{14}C dating. Although uncertainties exist, the ages range between about 4000 and 8000 years BP, suggesting the groundwater is relatively old Holocene groundwater.

Based on isotope analyses (^{129}I , He) from porewaters in Ordovician shales and the Cobourg Formation, groundwater ages are greater than 80 million years.

**Adapted from NWMO, 2011.
Descriptive Geosphere Site Model,
NWMO DGR-TR-2011-24.**



Potentially Suitable Host Rock Formation

- Data from the OGSRL well database indicates that the bedrock geology beneath this part of southern Ontario consists of a laterally extensive and predictable Paleozoic sequence.
- The initial screening reports (2012) identified the Upper Ordovician shale and limestone units as potentially suitable host rock formations.
- Based on available geoscientific information, the Ordovician Cobourg Formation (argillaceous limestone) would be the preferred host rock as it has sufficient thickness and volume and favourable characteristics of very low hydraulic conductivity and high geomechanical strength.
- The approximately 200 m thickness of Upper Ordovician shale formations overlying the Cobourg Formation, would act as an additional hydraulic barrier.



Thank you