

## *Geology of Lambton County*

*This monograph, one in a series of single issue documents dealing with Lambton County environment, has been prepared by the Sarnia-Lambton Environmental Association in co-operation with the School Boards of Lambton Kent.*

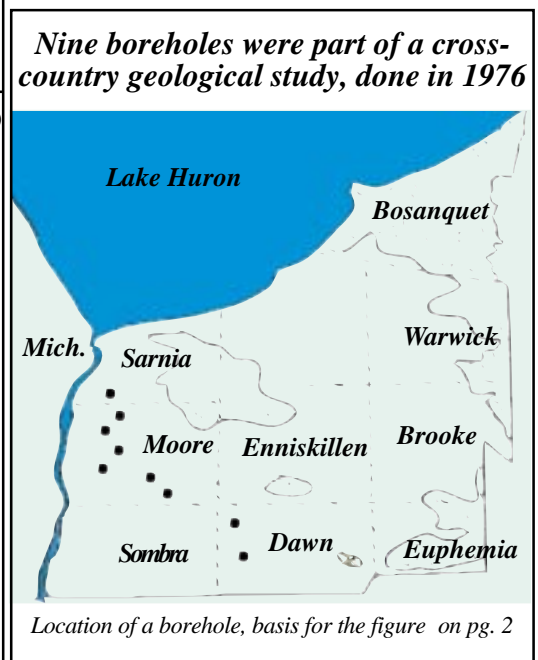
### *Introduction*

**Geology is the study of the earth, its history and its life as recorded in the rocks.** Extensive studies of the geology and hydrogeology of this area provide a valuable information base, an appreciation of which is necessary to have success in challenging areas such as:

- maintenance of safe drinking water
- disposal of municipal and industrial wastes
- deep subsurface storage of petroleum products

### *Facts*

<b>A Simplified Overview of the Geological Strata Underlying Lambton County</b>		
<b>Formation</b>	<b>Thickness (m)</b>	<b>Approx. Age (yrs)</b>
<i>Glacial Till</i> clay – particles are finer than 3 millionths of a metre	20 – 50	9,000 – 14, 000
<i>Sedimentary Rock</i> limestone – mainly calcium carbonate, dolomite	300 – 400	360 – 415 million
<i>Sedimentary Salt</i> e.g. sodium chloride	300 – 400	415 – 455 million
<i>Sedimentary Rock</i> dolomite – alternating layers of calcium and magnesium carbonates	500 – 700	455 – 490 million
<i>Metamorphic Rock</i> e.g. granite	Unknown	>590 million

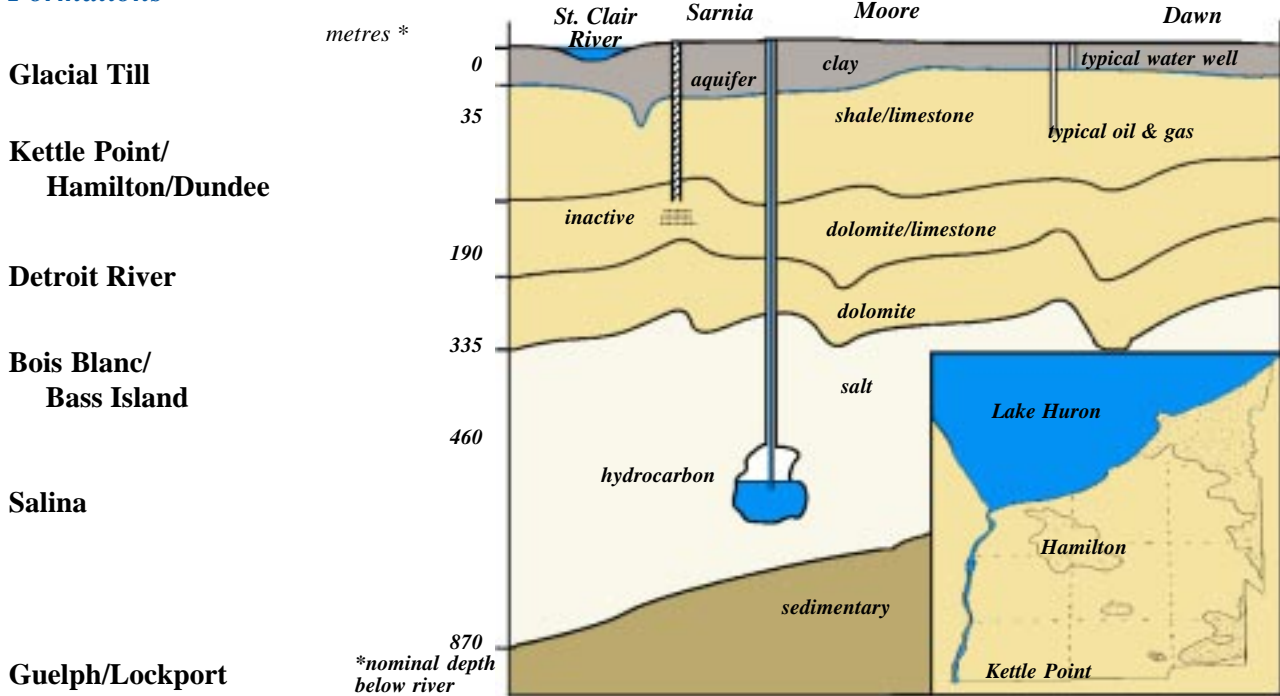


### *Key Words*

- aquifer* -locally, a thin discontinuous layer of water-bearing gravel/sand, 30 to 35 meters below ground level
- bedrock* -the solid rock underlying surface deposits
- hydrocarbon* -a compound composed of hydrogen and carbon eg. methane (the main component of natural gas)
- metamorphic* -rock that has been formed by the action of great heat and pressure within the earth
- paleozoic* -denoting the lowest fossil - containing strata and thus the earliest complex forms of life
- sedimentary* -rock formed by consolidation of sediment that was deposited in layers

# A Geological Cross-section of Lambton County

## Formations



The inset shows a plan view of the bedrock geology of Lambton County. The bedrock existing below the glacial till in Lambton County is primarily Kettle Point strata with some occurrences of the Hamilton Group (carbonates shales)

*Vandenberg, A. et al, 1977, figure 30*

### Glacial Till

probably deposited during the recession period of the Wisconsin glacier (beginning about 80,000 years ago and ending about 5000 B.C.). Hydraulic conductivity of unweathered clay averages 0.003 metres/year. Landfills can be suitably located in areas of clay deposits.

*Middleton, T.A. et al, p 21*

### Interface Aquifer

the upper bedrock (one to two metres) is weathered and fractured; this area forms an **Aquifer** which is a source of potable water for much of Lambton County.

### Kettle Point/ Hamilton/ Dundee

oil and gas-bearing; interbedded shales and limestones of the **Hamilton Group** and the overlying black, bituminous shales of the **Kettle Point** formation provide a thick, low-permeability cap to the **Dundee** formation. The Dundee Formation, mainly limestone and dolomite, bears gas and oil in Lambton County.

### Detroit River Group

composed of limestones and dolomites with some interbedded gypsum and anhydrite; liquid wastes have been injected into this area; Ont. reg. 341 permits injections of brine only.

*see Monograph L4*

### Bois Blanc/ Bass Island

a relatively impermeable barrier between the **Salina** formation and the **Detroit River** formation.

### Salina

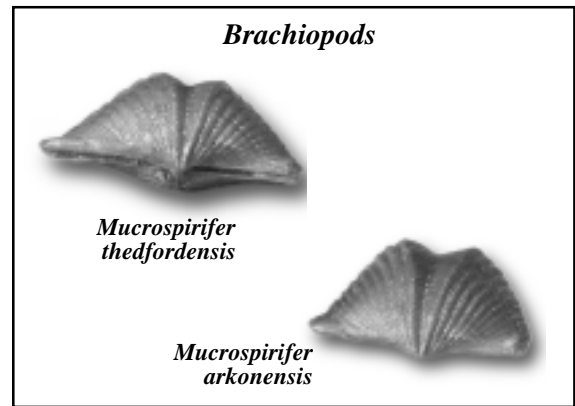
composed of alternating beds of salt, dolomite, shale, and gypsum. The largest salt beds, at a depth of approximately 600 metres, contain man-made caverns which are used for storage of hydrocarbons.

*Middleton, T.A. et al, p 5-7*

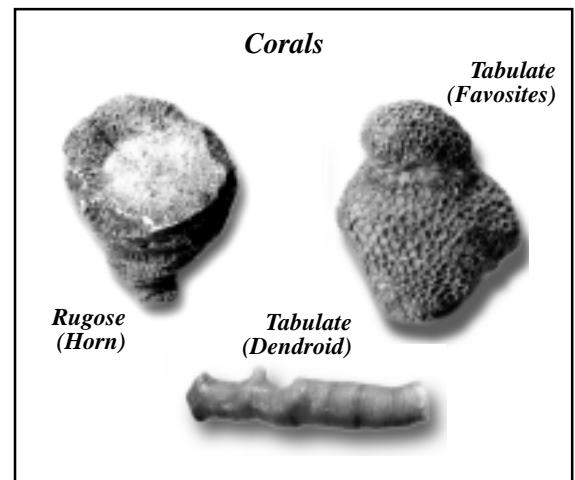
## Generalized Geological Section Southwestern Ontario

Approx. Depths (metres)	Period	Era	Group or Formation	Section	Lithology		
50	Miss.		Drift		clays, gravels		
400	Devonian	upper	Port Lambton		sandstone, shale		
			Kettle Point		shale		
					limestone, shaly limestone		
		middle	Dundee		limestone		
			Detroit River	Lucas		dolomite	
			Amherstburg			cherty limestone	
		lower		Bois Blanc		cherty limestone	
		1000	Silurian	upper	Bass Islands		dolomite with shale interbeds
					Salina	G	
F						shaly dolomite, anhydrite, salt	
E						dolomite with shaly interbeds	
D						anhydrite, salt	
C						shale, dolomitic shale	
B						anhydrite, salt	
A-2						dolomite, anhydrite, salt	
A-1						limestone, dolomite, anhydrite	
middle	Guelph-Lockport					dolomite	
	Clinton				dolomite, silty shale		
	lower			Cataract		sandstone, shale, dolomite	
1450	Ordovician			upper	Queenston		silty, shaly dolomite
		Meaford Dundas			shale, dolomitic interbeds		
		Collingwood			shale		
		middle	Trenton		limestone		
			Black-River		dolomite, limestone, shaly and silty limestone		
	Cambrian			sandstone			
	Precambrian			igneous rocks			

## Fossils - Visible Traces of Organisms That Lived in the Geological Past

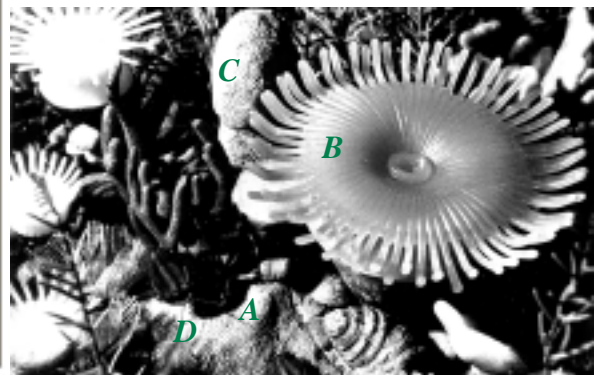


Fossils are often named after the areas in which they have been found. Arkona and Thedford are sources of Devonian fossils.



Dating systems indicate that some 400-350 million years ago, what is now Ontario was probably covered by warm salt seas. These seas contained a rich variety of creatures which included:

- A- brachiopods
- B- rugosan corals
- C- tabulate corals
- D- trilobites

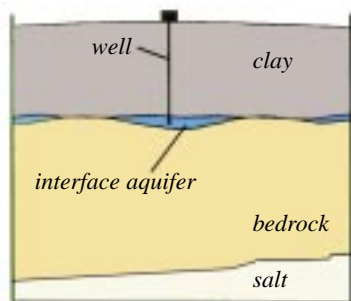


Vandenberg, A. et al...1977, page 61

Photograph provided by: Biology - Earth Science Museum,  
University of Waterloo  
page 3

## Local Geology Relative to Environmental Concerns

### Potable Groundwater



Approximately 90% of the water wells in Lambton County are drilled into the interface aquifer, the remainder intersect local sandy deposits at shallower depths within the glacial till.

*Vandenberg, A. et al, 1977, page 9*

The aquifer is the water source for some 15,000 people in Lambton County. In general, restoration of contaminated groundwater quality is difficult and extremely expensive; protection of groundwater quality is therefore essential.

*see Monograph L2*

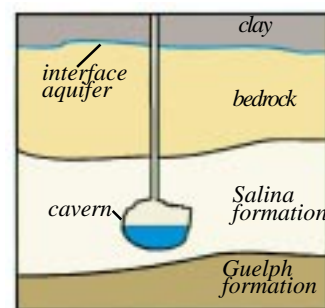
### Hazardous Waste Disposal

Because groundwater flow through clay is either very slow or absent, the St. Clair Clay Plain is considered suitable for containment of wastes. Lambton County has a licenced commercial hazardous waste disposal site which is recognized as one of the best in the country. Along with other regions of Ontario, this area is faced with the growing need to reduce the generation of waste. *see Monograph L4*

### Underground Storage

The safety associated with underground storage has led to widespread use of caverns by petrochemical and processing industries for storage of products and intermediate feedstocks such as propane, butane and ethylene. The underground caverns in the Sarnia-Windsor area, which range in size from 92,000 to 250,000 cubic metres, are located in the Salina formation. Caverns are constructed in the salt formation(s) by a solution-mining process. The rock salt has extremely low permeability and porosity; these properties make it a good storage medium.

*see Monograph L3*



### Conclusion

This monograph simply opens the door to the fascinating world of the ground beneath our feet and to some of the challenges that must be met in order to maintain a healthy environment. More information is readily available in the references listed below.

### Resources

Brigham, Robert J., 1971, Structural Geology of S. W. Ontario and S. E. Michigan

Freeze/Cherry, 1979, Groundwater

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Ontario Ministry of Environment, 1992, Hydrogeologic Study of the Freshwater Aquifer and Deep Geologic Formations, Sarnia, Ontario

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*\* materials from this monograph may be reprinted*

*\* references are available in our Resource Centre*

*\* additional copies of this monograph are available from the*

*Sarnia-Lambton Environmental Association or on-line at*

*www.sarniaenvironment.com*

**Monograph L1**