Sarnia • Lambton Environmental Association
Industries Working Together

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

A Simplified Overview of the Geological Strata Underlying Lambton County

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

Nine boreholes were part of a cross-country geological study, done in 1976

Location of a borehole, basis for the figure *on pg. 2*

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

Glacial Till

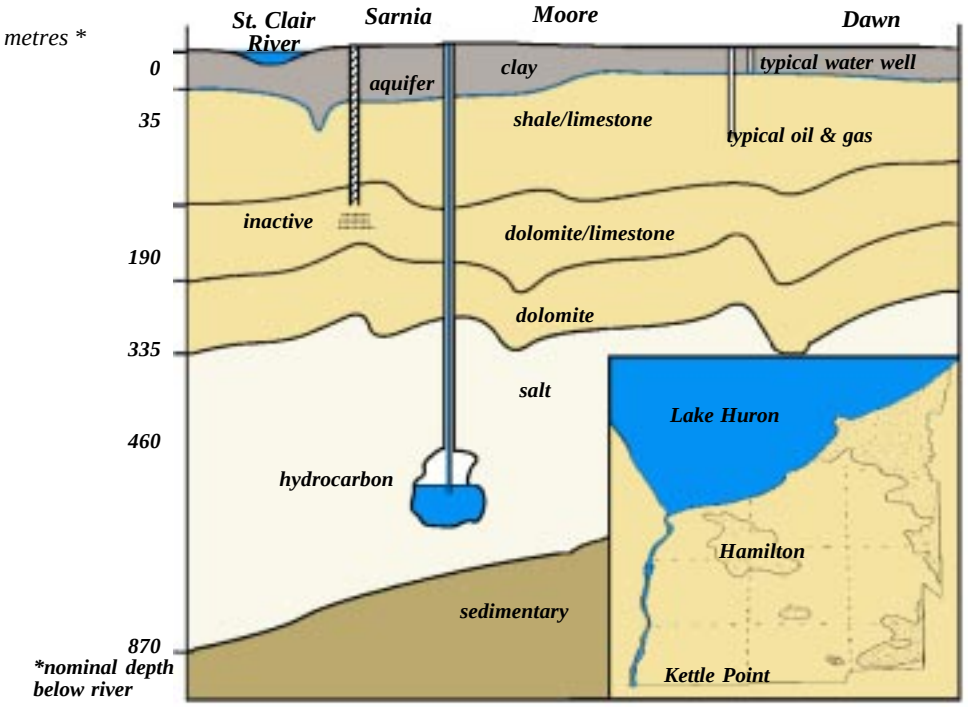
Kettle Point/ Hamilton/Dundee

Detroit River

Bois Blanc/ Bass Island

Salina

Guelph/Lockport



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 occurences 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.

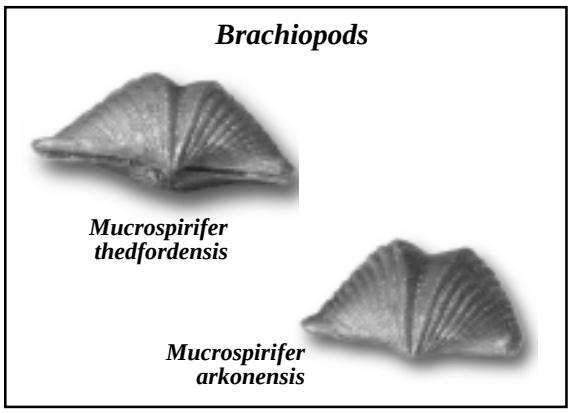
Salina composed of alternating beds of salt, dolomite, shale, and gypsum. The largest salt beds, at a depth of approximately 600 metres, contain man-made caverns which are used for storage of hydrocarbons. *Middleton, T.A. et al, p 5-7*

Generalized Geological Section
Southwestern Ontario

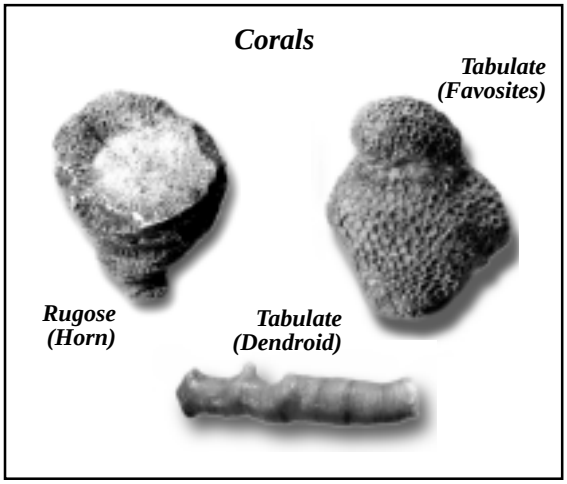
Approx. Depths (metres)	Period	Era	Group or Formation		Section	Lithology
	Miss.		Drift			clays, gravels
50	Devonian	upper	Port Lambton			sandstone, shale
			Kettle Point			shale
		middle				limestone, shaly limestone
			Dundee			limestone
			Detroit River / Lucas / Amherstburg			dolomite cherty limestone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

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

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

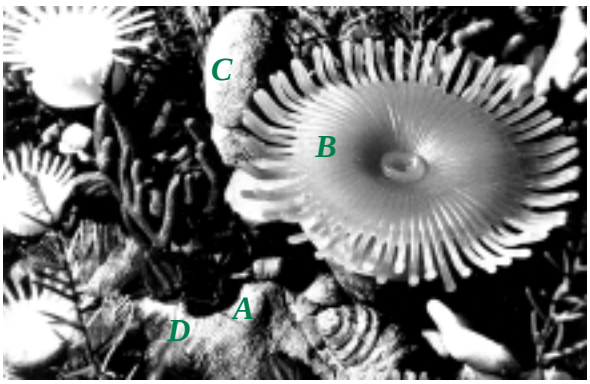


Fossils are often named after the areas in which they have been found. Arkona and Thedford are sources of Devonian fossils.



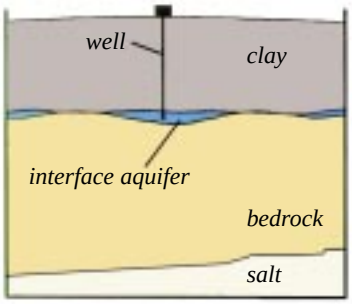
Dating systems indicate that some 400-350 million years ago, what is now Ontario was probably covered by warm salt seas. These seas contained a rich variety of creatures which included:

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



Photograph provided by: Biology - Earth Science Musuem, University of Waterloo

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

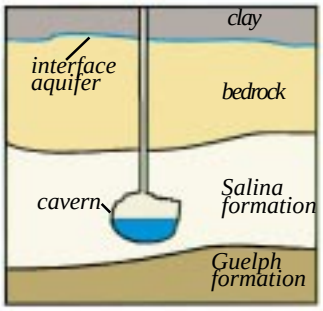
Hazardous Waste Disposal

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

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