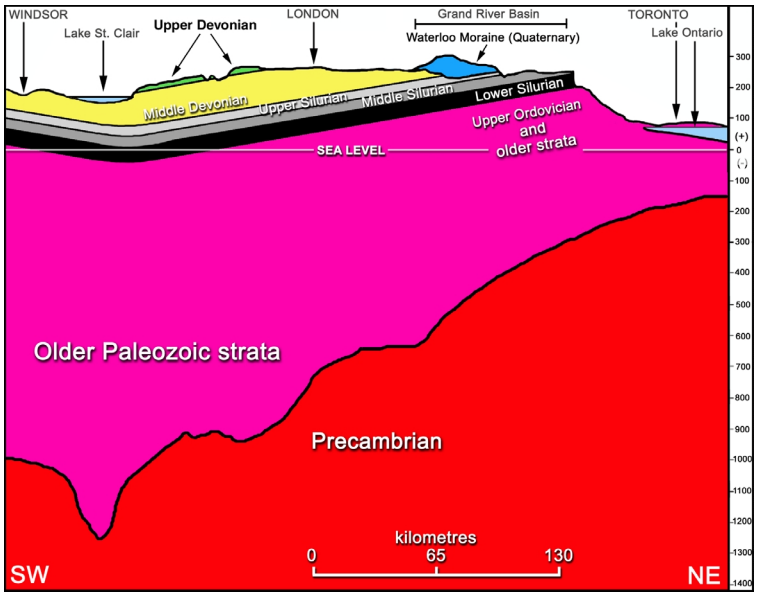
Some Comments on the Geology of the Cruickston Property



Introduction

Today's hike will take us through a geologically interesting area along the western bank of the Grand River just north of Cambridge. This is one of the few occurrences of bedrock that outcrop in Waterloo Region and the only one that provides a high, exposed cliff face along this section of the river.

Paleozoic time

Figure 1: *Diagrammatic geologic cross-section from Toronto to Windsor, Ontario. True dips and thicknesses are not accurately represented. The vertical scale is greatly exaggerated.* ***The Cruickston property lies just south and east of the Waterloo Moraine on rocks of Middle Silurian Age.***

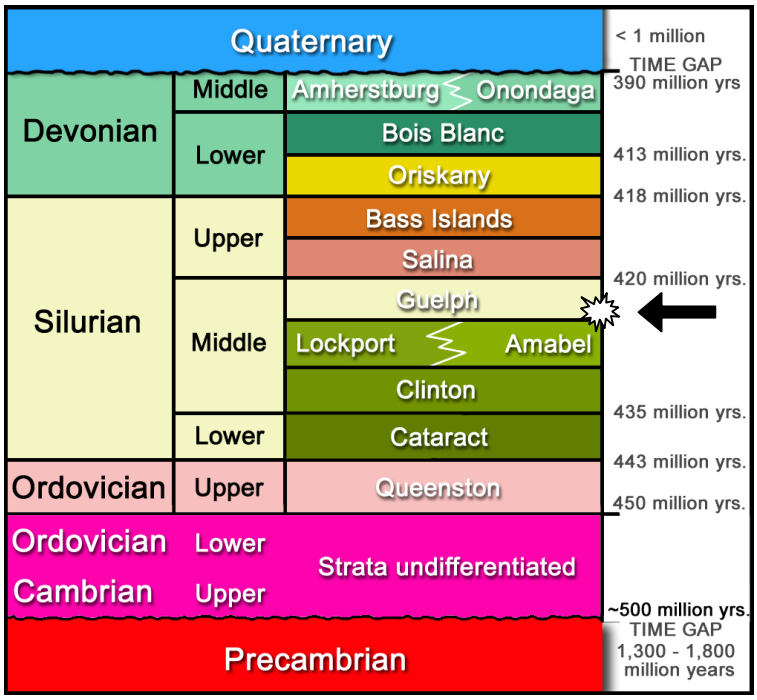


Figure 2: *The Cambrian, Ordovician, Silurian and Devonian Periods are part of Paleozoic time. The beds below the Queenston are grouped together, although upper Cambrian strata are present in the lower Grand Valley. Wavy lines are major unconformities or "time gaps". They represent long time intervals when the rocks of this area had been elevated and were being eroded and carried away to other, more remote, depositional regions.* ***The Cruickston rocks belong to the lower part of the Guelph Formation in what is known as the Eramosa Member (little explosion and arrow).***

Although these rocks appear today in a continental situation they were deposited in a warm tropical sea about 420 million years ago. At that time marine waters had encroached into this area of North America, with two deeper water basins to the northwest (the Michigan Basin) and the southeast (the Appalachian Basin). The region between the two basins (and Cruickston lies in the centre of this area) was intermittently exposed and drowned by fluctuating sea levels. It is known geologically as the "Algonquin Arch". The Guelph Formation and its basal Eramosa Member are approximately equivalent to the rocks that make up the top part of the Niagara Escarpment further east. Just as the Eramosa deposition commenced sea levels rose rapidly and the beds that we will see today represent sequences laid down in a rapid marine transgression across the Algonquin Arch. Technically (as described by Brett *et al.*, 1990) there is an "upward shoaling trend from coral-stromatoporoid biostromal layers to domal and laminar stromatolites and oolitic dolostones". Later in time and somewhat further west a large barrier reef developed that probably

would resemble parts of the Australian Great Barrier Reef of today. However, unfortunately, none of these more fossiliferous rocks are seen at Cruickson. We know from studies elsewhere that stromatoporoids preferred shallow (less than 30m water depth), wave-agitated waters. Stromatoporoids are intriguing, but singularly dull fossils! They are calcareous, and form domal masses that consist of thin sheets or lamina with occasional vertical rods. They can range up to several metres in size, sometimes forming small reefs, but most specimens locally (and they are seen well in rocks further east) are usually tens of cm in size. This group of organisms is present in rocks from the Cambrian to the Cretaceous, but very common in rocks of Silurian age. We do not know their true taxonomic position (most likely they are hydrozoans) and they are now extinct.

1). The rocks exposed in the quarry just north of Cambridge and along the cliffs of the Grand River at Cruickston are buff and brown, thinly to thickly bedded, fine to medium crystalline dolostones overlain by a finely crystalline tan-grey vuggy dolostone with traces of the fossil clam *Megalomus canadensis*. Unfortunately the rocks are sparsely fossiliferous and the fossils that are present are also poorly preserved. A careful search will reveal remnants of gastropods (snails) bivalves, such as *Megalomus*, brachiopods, cephalopods, stromatoporoids and corals.

2). The quarry section consists of a lower 4.5m of buff, fine to medium crystalline dolostone with medium to thick bedding. *Megalomus* are preserved as molds, averaging about 5cm, to as large as 14cm. Above this is a further 2.5m of finely crystalline, thinly bedded, buff to grey dolostone. This unit contains stromatoporoids (up to 20 cm), some corals and gastropods, and can be examined at the top of the zig-zag path west of the quarry.

3). Further northwest there is a change to sandier sequences that are largely unfossiliferous although there are some layers of crinoidal detritus and a few fossiliferous bands in the higher portions of the section. Still further west and north the units become thinly bedded and a biostrome is present with some better preserved fossils (gastropods, stromatoporoids, bryozoa, and occasional bivalves and corals). These thinly-bedded units are prone to development of small cavities and these can attain dimensions of up to several metres. They do not continue as true cave formations, but seem to represent isolated caverns within the formation.

Quaternary time

This area was subject to glaciation at the end of the Quaternary period, and scattered glacial erratics can be found in the area. Some of these have been re-located by floods of meltwater that came down the Grand Basin, especially in the closing stages of the last “Ice Age”. Farming has moved others on the property. Many of the morphological forms carved into, or molded upon, the bedrock in the Cruickston property are likely created by meltwater, although they might have a primary genesis within the karst. Some of these are small bioherms that stand above the general level of the bedrock. Frequently these show minor grike and clint development on the top surfaces, and, in a few cases some of the joints have become relatively enlarged. In other situations what look like sink holes are most likely “swirl” cavities enlarged by water when the Grand was a major glacial meltwater stream. Finally voids and enlarged joints seen in many areas are almost certainly a product of the last 12,000 years of geologic time.

Reference

Brett, C.E., Goodman, W.M., and LoDuca, S.T. 1990. Sequences, cycles and basin dynamics in the Silurian of the Appalachian Foreland Basin. In: *Processes and Patterns in Epeiric Basins* (eds. T. Aigner and R.H. Dott). Sedimentary Geology **69**, 191-244.

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