Stone Construction in Grand Marais

An Investigation




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INTRODUCTION

In 2010-11 an inventory of buildings was undertaken in Grand Marais, called Special Places (the Special Places initiative is co-ordinated by the province's Historic Resources Branch, and involves other local communities in important research work). The primary purpose of the Special Places project is to identify those buildings and sites that have the strongest claims for heritage value, and which can be seen as effectively defining, by their physical presence and high levels of historic integrity, the main historical themes that define a community's past. For Grand Marais, this is specifically a cottage heritage, although also including some surviving aspects of public and commercial history.

The W.I. Isaac (now Stewart) Cottage is one of the sites noted by the Grand Marais Heritage Committee as having major local heritage value.

There were 152 buildings in the Grand Marais inventory. Eleven (11) were identified through careful analysis and assessment, and with the assistance of architectural historians of the Historic Resources Branch, as having significance as special places.

The sites on that short list are:

- Old St. Jude's Anglican Church
- Watt Cottage, 36 Hillbrow
- Doyle Cottage, 27 Oak
- Stewart Cottage, 275 Grand Marais
- English Cottage, 52 Hillbrow
- Kurtz Cottage, 77 Grand Marais
- Log Cabin, 58 Hillbrow
- Ashgrove Cottage, 31 Central
- Johnson Cottage, 28 Cameron
- Bremont Cottage, 13 Thorncliffe
- Lanky's Hot Dog Stand

It was observed over the course of the building inventory that nearly all of the short-listed cottages, and many of the inventoried sites, had stone foundations and interesting stone features—steps and rails, pathways, chimneys, fences – that clearly added to the general architectural character of Grand Marais, and which could be said to help define a distinctive heritage character when compared with other Lake Winnipeg resort communities like Gimli, Winnipeg Beach and Victoria Beach.

This study is an exploration of this unique aspect of our local heritage – its intent to suggest basic historical and technical aspects of common features; to determine who made them; and most importantly, to explore how they were made. It is hoped that the information here will be used by building owners, community heritage leaders and the St. Clements Heritage and Tourism Committee whenever issues of conservation or promotion need to be considered.

The study is organized by these headings:

- Geography of the Grand Marais Area
- Stone Types
- Brief History of Grand Marais
- The Stone Builders of Grand Marais
- Building with Stone
- Grand Marais Stone Features
- Foundations
- Steps
- Chimneys
- Pathways
- Other Structures
- Fences
- Conclusion

GEOGRAPHY OF THE GRAND MARAIS AREA

The primary storyline in this investigation is a contemporary one, or at least one of the late 20th and early 21st centuries, focusing on stone construction projects in Grand Marais. But there are three key prehistoric aspects of the geography and geology of the area that need to be explored first, in order to more effectively relate this story.

Map of North America showing the extent of the Canadian Shield in northern and eastern Canada.

We start roughly 4 billion years ago, with what is now called the Canadian Shield. The Shield is a large area of igneous and high-grade metamorphic rock which forms the ancient geological core of North America. It is more than 3.96 billion years old, dating to the Archeon Eon of the Precambrian Era, and makes up some of the earth's oldest rock. At one time, most of the Shield's terrain featured jagged mountain peaks about 12,000 metres or 39,000 feet high – much higher than most modern mountain ranges. Due to millions of years of erosion those Shield peaks now form rounded, low relief hills. The Canadian Shield's mountains had deep "roots" that floated on the dense mantle below. As their peaks eroded these roots rose and continued to erode. Subsequently the rock that we now know as the Canadian Shield was formerly deep below the earth's surface.

The Canadian Shield was also known for its volcanic activity. The subsequent cooling and solidification of lava forms igneous and metamorphic rocks. The Shield is the earth's greatest area of exposed Precambrian rock, and it is in the eastern areas of Manitoba, like the Whiteshell and towards the Ontario border, that the dramatic relief of the Shield is most apparent.

There is no exposed Shield bedrock at Grand Marais, but it is important to note that much of the community’s rock and ground formations find their origins in the Shield.

Familiar Canadian Shield landscape in eastern Manitoba.

We now move to a period about 540 million years ago with the Paleozoic Era, and specifically the Ordovician Period of the Era, which occurred 430-490 million years ago. (The Ordovician Period followed the Cambrian Period and was followed by the Silurian Period.)

In North America and Europe, the Ordovician was a time of shallow continental seas rich in aquatic life. In the Early Ordovician, trilobites (extinct marine anthropods) were joined by many new types of organisms, including tabulate corals, strophomenid, rhynchonellid, and many new orthid brachiopods, bryozoans, planktonic graptolites and conodonts, and many types of molluscs and echinoderms, including the ophiuroids ("brittle stars") and the first sea stars. The first evidence of land plants also appeared, but life had yet to diversify on land.

Ordovician Period seascape, showing the kinds of plant and aquatic life that defined the shallow sea that once covered the Grand Marais area, and in fact all of North America and Europe.

Trilobites in the Ordovician were very different from their predecessors in the Cambrian. Many trilobites developed odd spines and nodules to defend against predators such as primitive eurypterids and nautiloids while other trilobites such as Aeglina prisca evolved to become swimming forms. Some trilobites even developed shovel-like snouts for ploughing through muddy sea bottoms. Some trilobites such as Asaphus kowalewski evolved long eyestalks to assist in detecting predators whereas other trilobite eyes disappeared completely.

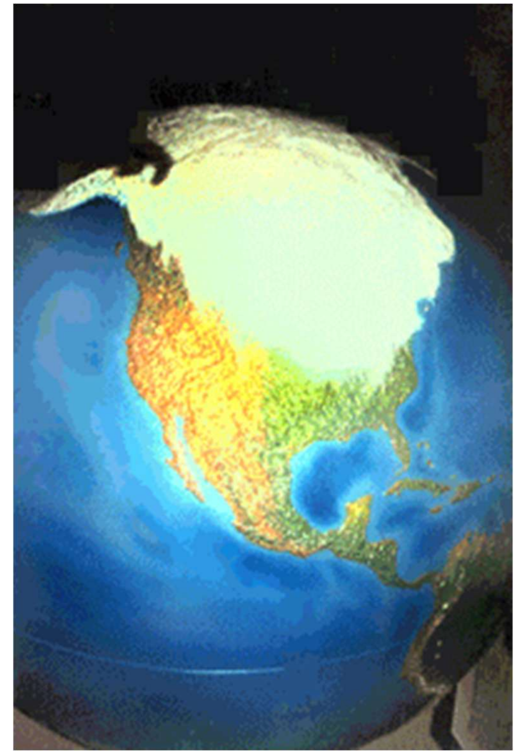
It was long thought that early fish, the first true vertebrates, appeared in the Ordovician, but recent discoveries in China reveal that they probably originated in the Early Cambrian. The very first gnathostome (jawed fish) did appear in the Late Ordovician epoch.

In the Middle Ordovician, the trilobite-dominated Early Ordovician communities were replaced by generally more mixed ecosystems, in which brachiopods, bryozoans, molluscs, cornulitids, tentaculitids and echinoderms all flourished. Tabulate corals diversified and the first rugose corals appeared; trilobites were no longer predominant. One of the earliest known armoured agnathan ("ostracoderm") vertebrate, Arandaspis, dates from the Middle Ordovician.

Ordovician sea with trilobites, endoceros, brachiopodas.

The final ancient geological aspect, and the one which gives us our current Grand Marais landscape, involves the creation and movement of glaciers starting about 30,000 years ago. The materials that now cover the surface of the Grand Marais area—shale, limestone and sandstone, granite and gneiss—were derived from the Precambrian highlands.

During the last Ice Age, known as the Wisconsin glaciations (30,000 to 10,000 years ago), northern North America was covered by a continental ice sheet, which alternately advanced and deteriorated with variations in the climate. As the ice sheet disintegrated, it created at its front an immense proglacial lake formed from its meltwaters.

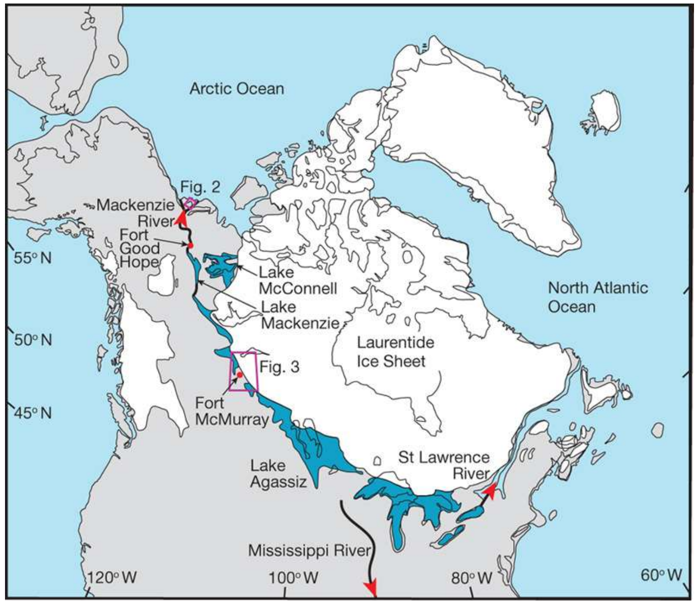


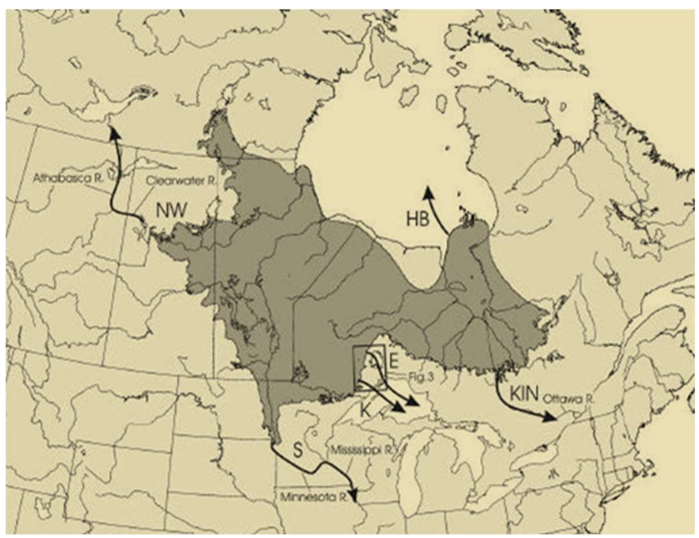
A view from space of what North America would have looked like during an ice age. (Image courtesy of the Illinois State Geological Survey)

Around 13,000 years ago, the lake came to cover much of Manitoba, northwestern Ontario, northern Minnesota, eastern North Dakota and Saskatchewan. At its greatest extent, it may have covered as much as 440,000 square kilometers (170,000 square miles), larger than any contemporary lake in the world and approximately the size of the Black Sea.

The lake drained at various times, south through the Traverse Gap into what is now the Minnesota River (a tributary of the Mississippi River), east through what is now Lake Superior, or west via the Mackenzie River through the Northwest Territories. But when ice and glaciation returned, around 10,000 years ago, Lake Agassiz refilled. The last major shift in drainage occurred around 8,200 years ago, when the melting of remaining Hudson Bay ice caused Lake Agassiz to drain nearly completely. This final drainage is associated with an estimated 0.8 to 2.8 metre (2.6 to 9.2 foot) rise in global sea levels.

Lake Agassiz's major drainage reorganization events were of such magnitudes that they had significant impacts on climate, sea levels and possibly early human civilization. Major freshwater releases into the Arctic Ocean are considered to have disrupted oceanic circulation and caused temporary cooling. A recent study links the





These two images suggest the size of Lake Agassiz, with the topmost map showing it in relation to glacial ice sheets. Arrows on the lower map show likely drainage routes when the glacier retreated at various times.

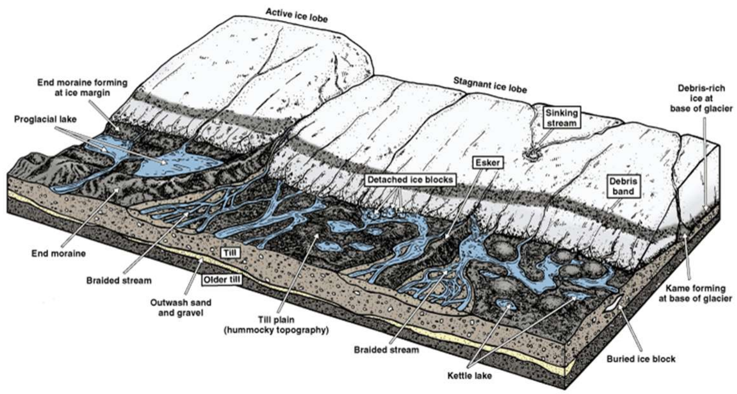
drainage 8,500 years ago to the expansion of agriculture from east to west across Europe. There are even suggestions that Lake Agassiz drainage may account for various flood myths of prehistoric cultures, including the Biblical flood narrative.

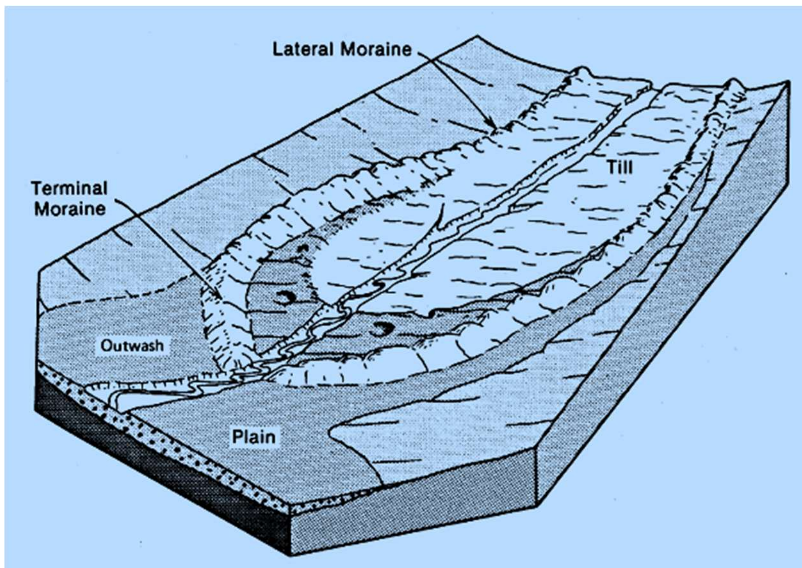
With the end of the Ice Age, and the final draining of Lake Agassiz, the old lake's great basin was reformed as a landscape we now call the Manitoba Lowlands. The Lowlands comprise the flattest lands in the interior plains and cover the stratified lacustrine sediments that were deposited by meltwater outwash from the terminus of glaciers at the end of the last Ice Age, approximately 11,000 years ago. This sediment was reformed over centuries by wave action overturning the sediment. Numerous lakes formed in the old glacial lake basin. The best known are the so-called Great Lakes of Manitoba – Lake Winnipeg, Lake Manitoba and Lake Winnipegosis.

One last feature of the Ice Age, minor in the great scheme of things, but significant for the Grand Marais area, was the formation of the Belair Moraine. A moraine is any glacially formed accumulation of unconsolidated glacial debris (soil and rock) that occurs in currently glaciated and formerly glaciated regions on Earth. Moraines may be composed of debris ranging in size from silt-sized glacial flour to large boulders. The debris is typically sub-angular to rounded in shape. Moraines may be on the glacier's surface or deposited as piles or sheets of debris where the glacier has melted. Moraines may also occur when glacier- or iceberg-transported rocks fall into a body of water as the ice melts.

There are several types of moraines, a common one being a lateral moraine. Lateral moraines are parallel ridges of debris deposited along the sides of a glacier. The debris can be deposited on top of the glacier by frost shattering of valley walls or from tributary streams flowing into a valley. The till is carried along the glacial margin until the glacier melts. Because lateral moraines are deposited on top of the glacier, they do not experience the postglacial erosion of the valley floor and therefore, as the glacier melts, lateral moraines are usually preserved as high ridges.

Continental Glacier





These two images show geographic effects of continental glaciations: the topmost drawing shows the leading edge of a glacier and the various water features and rock debris fields that would be common. (Image courtesy of the Illinois State Geological Survey). The lower drawing shows the features of a typical lateral moraine, like the Belair Moraine near Grand Marais. (Image courtesy of NASA)

The Belair Moraine is a lateral moraine, and forms a belt of broken ridges extending north from Beausejour to Lake Winnipeg in a north-south direction. It runs 100 kilometres from the Red River Lowlands to the eastern shoreline of Lake Winnipeg and includes Grand Beach and Grand Marais. The moraine is the result of two vast ice sheets making direct edge-to-edge contact about 14,000 years ago – one from the northeast and the other from the northwest. As they moved they caused the rocks below them to grind together, forming sediment, depositing huge amounts of white sand, gravel and boulders, and forming high, hilly landscapes. Because of erosion by waves on Lake Agassiz many parts of this once extensive moraine are now low lying hills, rising 30 to 60 metres above lower elevations.

To summarize Grand Marais's geographic and geological legacy, those forces of the past that define our current landscape and inform some of our building construction options, especially those with stone: we look back 4 billion years to the Canadian Shield for the types of rock and other solid materials that make up key parts of the physical form; we look to the Ordovician Period of about 450 million years ago for the types of sea creatures that were laid down as fossils in various stone; and finally we look to the most recent period of glaciation, about 10,000 years ago, during which the lakes and stone deposits (moraines) became the major players in sculpting the topography and geography in and around Grand Marais.

STONE TYPES

Given that this project is focused on construction with stone, it is obviously necessary to say something about the nature and variety of stone. There are many different types of stone and rock found on planet Earth. They differ mainly in their composition of minerals, texture, colour, hardness, size of grains and permeability. For the purpose of classification, all rocks have been divided into three major types, namely igneous, metamorphic and sedimentary.

Igneous rock (derived from the Latin word *ignis,* meaning fire) is formed through the cooling and solidification of molten rock material – lava. Igneous rock may form with or without crystallization, either below the surface as intrusive (plutonic) rocks or on the surface as extrusive (volcanic) rocks. Over 700 types of igneous rocks have been described, most of them having formed beneath the surface of Earth's crust. Some of the common igneous types are granite, basalt, obsidian and pumice.

Metamorphic rocks have been modified by heat, pressure and chemical processes, usually while buried deep below Earth's surface. Exposure to these extreme conditions has altered the mineralogy, texture and chemical composition of the rocks. There are two basic types of metamorphic rocks: 1) foliated metamorphic rocks which have a layered or banded appearance that is produced by exposure to heat and directed pressure; and 2) non-foliated metamorphic rocks which do not have a layered or banded appearance. Common types of metamorphic rock include quartz, marble, schist, gneiss and slate.

Sedimentary rocks are formed by the deposition of material at the Earth's surface and within bodies of water. Particles that form a sedimentary rock by accumulation are called sediment. Before being deposited, sediment was formed by weathering and erosion in a source area, and then transported to the place of deposition by water, wind, ice, mass movement of glaciers which are called agents of denudation. Common examples of sedimentary rock are limestone, sandstone, chert and coal.

Granite is an example of igneous rock.

Quartz is an example of metamorphic rock.

The stones that abound in Grand Marais, on its beaches and in yards and parks, are comprised largely of granite, gneiss, basalt and limestone. It is important for this study to understand some of the specifics of these four distinct stones.

Granite

Granite is a hard igneous rock that is mostly comprised of feldspar and quartz. Granite has a crystalline structure, and is coarse grained. It can have a wide range of colours, from grey to pink to red. The colour of a granite rock is dependent on the composition of minerals. Any igneous rock that contains one fifth of quartz is labeled as granite. The pink shade of many granite rocks is due to the presence of alkali feldspar. Granite has many uses in building construction and architectural design. Its durability, beauty and abundance make it a preferred choice over most other types of stone. It is tough, hard and resistant to fracture given the tight interlocking of minerals within. It is weather resistant, heat resistant and even chemical resistant. Its porosity (the a measure of the void (i.e., "empty") spaces in a material) is negligible, between 0.3-4%.

Gneiss

Gneiss is a hard rock that has a mineral composition similar to granite as it contains feldspar, mica and quartz. This is a rock that is formed from pre-existing igneous rocks such as granite that have been subject to additional conditions of high pressure and temperature. Gneiss often has a distinct banding. It is medium- to coarse-grained and may contain abundant quartz and feldspar. The banding is usually due to the presence of differing proportions of minerals in the various bands. Dark and light bands may alternate because of the separation of mafic (dark) and felsic (light) minerals. Banding can also be caused by differing grain sizes of the same minerals.

Limestone is an example of a sedimentary rock.

The tell-tale banding of a gneiss rock, which distinguishes it from granite, its cousin in the rock world.

Basalt

Basalt is a common extrusive igneous (volcanic) rock formed from the rapid cooling of basaltic lava exposed at or very near the surface. Basalt has a fine-grained mineral texture due to the molten rock cooling too quickly for large mineral crystals to grow. Basalt includes in its composition about 20% quartz and about 10% feldspar, and features a glassy matrix interspersed with minerals. Basalt is usually grey to black in colour, but exhibits a wide range of shading due to regional geochemical processes.

Basalt is sometimes called "black granite" in Manitoba.

Limestone

Limestone is a sedimentary rock composed mainly of calcium carbonate (CaCO3). It may contain considerable amounts of magnesium carbonate (dolomite) as well. Minor constituents also commonly present include clay, iron carbonate, feldspar, pyrite, and quartz. Most limestones have a granular texture. In many cases, the grains are microscopic fragments of fossil animal shells. Limestone has two origins: 1) biogenic precipitation from seawater, the primary agents being lime-secreting organisms and foraminifera; and 2) mechanical transport and deposition. Limestone has long fascinated earth scientists because of its rich fossil content. Much knowledge of the Earth's chronology and development has been derived from the study of fossils embedded in limestone and other carbonate rocks. Limestone also has considerable commercial importance. Limestone has a wide range of porosity, from close to 0 in dense compacted limestone to almost spongy in other loosely compacted rock. Exposed limestone often becomes even more porous because it is slightly soluble and water increases the number and size of the pores. Manitoba is famous for its Tyndall stone, quarried in the Birds Hill area near the community of Tyndall. It is renowned for its grey-cream colour with pervasive mottling, caused by the burrowing of marine creatures when the limestone was deposited. It also contains numerous gastropod, brachiopod, cephalopod, trilobite, coral and stromatoporoid fossils. It is important to note, however, that not all Manitoba limestone adheres to the qualities of Tyndall stone – there is considerable variety. And in fact many of the limestone samples at Grand Marais are a much softer stone, and tend to white and beautiful white-orange varieties.

Grand Marais limestone samples, showing the typical range of colours – from whites to soft tans to orangy mottles.