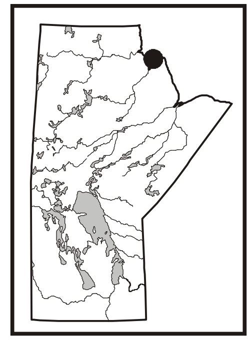
GS-39

INDUSTRIAL MINERALS OF THE CHURCHILL AREA (PARTS OF NTS 54K/13SE AND 54L/16SW)

by J.D. Bamburak



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SUMMARY

The Churchill area has a recorded history of industrial mineral production since 1733. Current production is mainly for aggregates and minor building stone. Although current production is considerably less than for most southern Manitoba localities, it is still a significant area in the province because rail transportation costs would make alternatives prohibitively expensive. Unique fossils, such as trilobites, have been found along the shoreline of Hudson Bay. Future exploitation may involve quartzite production as a source of silica, production of rare elements from quartz veins, and minor rock collecting.

INTRODUCTION

Industrial Mineral Commodities

Past and present production of industrial mineral commodities in the Churchill area has been mainly for aggregate purposes, such as road construction and maintenance. Sand and gravel, as well as crushed bedrock, were and are in production at numerous locations. The sand and gravel production is not covered in this paper. Production of building stone was carried out more than 250 years ago. Current production is limited, but is being carried out on one project.

Aggregate and, to a lesser extent, building stone are valuable commodities in the Churchill area, considering the long distance to equivalent materials, which can only be provided by rail.

Previous Investigations

In 1879, the Churchill area was visited by Bell (1881) of the Geological Survey of Canada (GSC), who documented the bedrock and surficial geology for the first time. He recognized an anticlinal structure in the vicinity of Churchill Harbour, and recommended that the term 'Churchill Quartzite' be used (Bostock, 1969). Tyrrell (1898) of the GSC described the glacial geology of the Churchill area and made some bedrock observations in 1893. He observed ripple marks and abundant crossbeds in the Churchill Quartzite (Bostock, 1969).

Williams (1948) spent a month at Churchill in 1947. He noted that the Churchill Quartzite commonly consists of 70% well rounded quartz and 30% interstitial sericite. Williams reinterpreted the structure at the mouth of the Churchill River to be a syncline and suggested that Silurian rocks underlie the Churchill area (Bostock, 1969). In 1967, Bostock mapped the Churchill area as part of Operation Winisk, a GSC helicopter-supported mapping project covering the Hudson Bay Lowlands. Table GS-39-1 is derived from his report (Bostock, 1969).

Table GS-39-1: Table of formations, Churchill area.

Formation/Member	Maximum thickness (m)	Lithology
Silurian:		
Severn River	150	Dolomitic limestone, with up to 25% quartz sand in lower beds
Ordovician:		
Churchill River Group	90	Dolomite and limestone
Precambrian:		
Churchill Quartzite	730	Quartzite, subgreywacke

In 1974, Schledewitz of Manitoba Energy and Mines mapped the extent of the Precambrian bedrock in the Churchill area. The Precambrian and Phanerozoic aggregate resources were documented by Young (1982a, b). Watson (1985) described sampling and analyses undertaken on the Churchill Quartzite.

The Manitoba Museum of Man and Nature and the Royal Ontario Museum have collected fossil specimens along the tidal flats east of Churchill for a number of years (Young et al., 1999).

Current Investigations

Precambrian and Phanerozoic bedrock outcrops and quarry locations in the Churchill area were inventoried over a nine-day period in July (Fig. GS-39-1). Introduction to the geology of the area and efficient access to outcrops and quarries were provided by staff of the Manitoba Museum of Man and Nature and the Royal Ontario Museum.

Dorne Lindal of the Manitoba Geological Survey is presently compiling a bedrock geology compilation map for NTS 54L, which includes part of the Churchill area (Manitoba Industry, Trade and Mines, in prep.).

GEOLOGY

The Precambrian and Paleozoic geology of the Churchill area is shown in Table GS-39-1. The Precambrian Churchill Quartzite is unconformably overlain by the Ordovician Churchill River Group, which is overlain by the Silurian Severn River Formation.

Precambrian Churchill Quartzite forms a low ridge rising above dipping Ordovician Churchill Group beds in Figure GS-39-2. The Ordovician beds were draped over the flanks of the quartzite, which had been eroded prior to deposition of the younger sediment. The breccia clasts spalled from the quartzite were cemented by the carbonate infill (Fig. GS-39-3). Most of the Ordovician and Silurian beds have been removed from the tops of the Churchill Quartzite ridges. However, in places it is still possible to see remnants of the younger beds preserved in deep fissures (Fig. GS-39-4).

Pleistocene glacial sediments and Recent alluvium and bogs blanket the Churchill area, except near the shoreline of Hudson Bay.

CRUSHED STONE

Precambrian Churchill Quartzite

Five quartzite samples were collected as a potential source of aggregate in the Churchill area by Young (1982a, b). The samples were from the Precambrian Churchill Quartzite that outcrops for 25 km along the shoreline of Hudson Bay and in the mouth of the Churchill River. Four of the samples met the specifications for base course, traffic bituminous, concrete, ballast and terrazzo aggregate.

Recently, Churchill Quartzite was quarried on the west side of the Churchill River, south of Fort Prince of Wales, to construct a weir. The purpose of the weir was to pond fresh water for drinking purposes. A small quartzite quarry has been opened near the shoreline northeast of Churchill by Mervin Walkoski, a local resident.

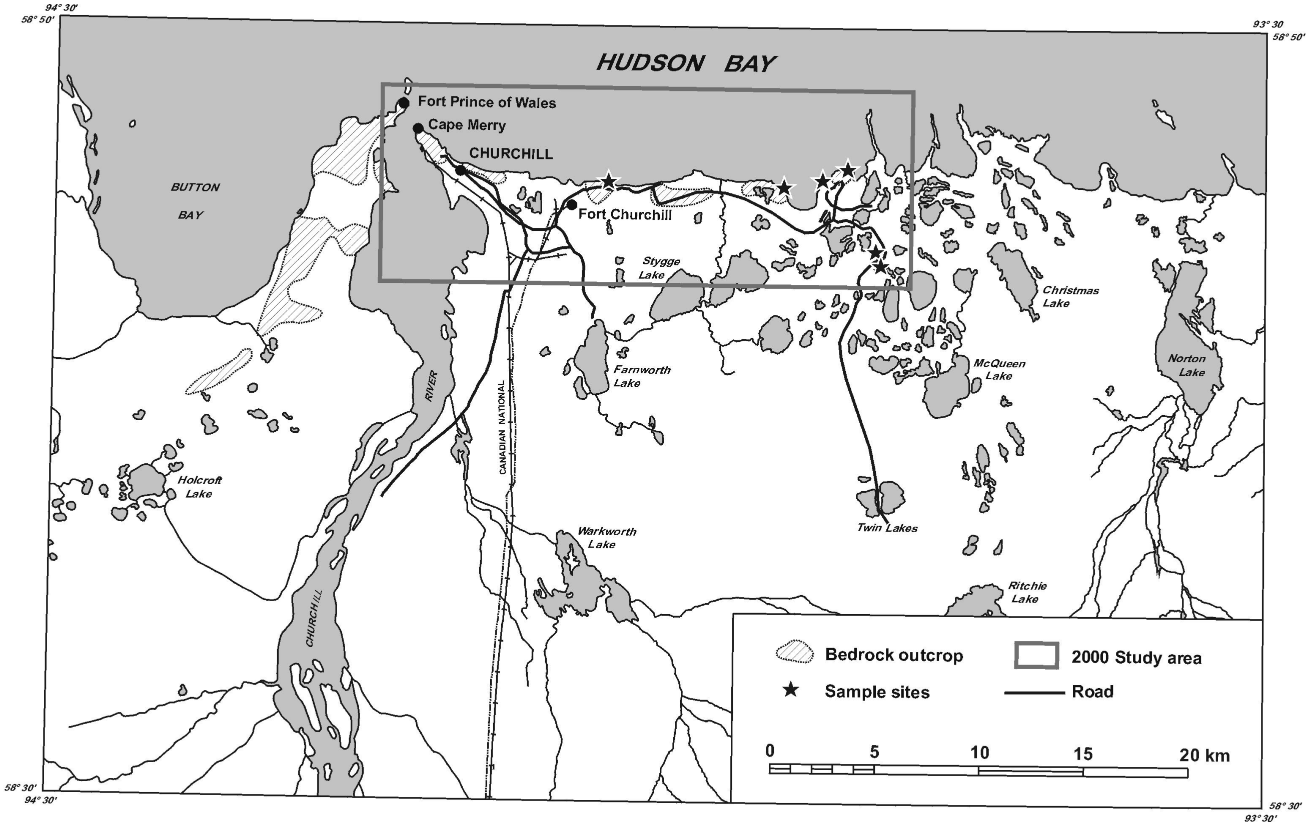

Figure GS-39-1: Location of the Churchill area in northern Manitoba, with outcrop sampling sites.

Figure GS-39-2: View looking east along Hudson Bay shoreline, east of Churchill. Dark-coloured Precambrian Churchill Quartzite (in backgound) forms a low ridge above light-coloured, dipping Ordovician Churchill Group dolomite (in fore-ground). Note individuals near 'bergy-bit' in upper right of photo for scale.

Ordovician and Silurian Dolomite and Limestone

Ordovician and Silurian carbonate rocks were not evaluated as a potential source of aggregate by Young (1982a, b). Mervin Walkoski is currently producing aggregate from quarries within Ordovician and Silurian beds in the vicinity of the above quartzite quarry.

BUILDING STONE

Fort Prince of Wales and Cape Merry

According to Tyrrell (1898), the Hudson's Bay Company began construction of Fort Prince of Wales in 1733. The fort was built on the summit of the low point to the west of the entrance to Churchill Harbour (Fig. GS-39-1). Churchill Quartzite was quarried a short distance to the west of the fort, along the shore. To prevent the cannons on the top of the fort walls from recoiling into the courtyard, the walls of the fort were made 12 m thick (Fig. GS-39-5). Some field stone was also used, in the construction of the interior walls. In the past few years, stone has been quarried to rebuild portions of the outer walls of the fort.

The Hudson's Bay Company also built a cannon wall in the 1700s at Cape Merry, using a similar construction method to that used at the fort. The Cape Merry battery was constructed on the east side of the entrance to Churchill Harbour to ensure that enemy vessels could be caught in a crossfire.

Fort Prince of Wales and Cape Merry are both preserved as Historic Sites by the Federal Government. These sites are popular tourist attractions (Fig. GS-39-5).

Figure GS-39-3: Dark-coloured quartzite breccia clasts within light-coloured Ordovician dolomite.

Figure GS-39-4: Silurian Severn River remnant, with quartzite clasts, within a light-coloured, smooth-weathered, Precambrian Churchill Quartzite fissure.

Figure GS-39-5: Fort Prince of Wales, interior view looking northwest across courtyard. Note tourists in upper right of photo for scale.

Brian Ladoon's Hotel

Brian Ladoon, a local resident, is constructing a hotel from field stone and Churchill Quartzite (Fig. GS-39-6). According to the Winnipeg Free Press (Jan. 12, 1997), the hotel was scheduled for completion by August 1999 at a cost of $700 000–900 000.

SILICA SOURCE

Watson (1985) analyzed eleven Churchill Quartzite samples, collected by Schledewitz in 1974. He concluded that most of the samples, which ranged from 75.50 to 97.65% SiO_2, met the specifications for silicon carbide, ferro-silicon and various fluxes. The main impurities in the quartzite are mica and minor feldspar.

MINERAL AND FOSSIL COLLECTING

Lazulite

The first recorded occurrence of lazulite (hydrated Mg-Fe-Al phosphate) in Canada was made in 1879 by Bell (1881) at a locality situated about 3 km east of Churchill (Hoffman, 1881; Bostock, 1969). Pegmatitic lazulite and chlorite are present as rare accessory minerals in quartz veins that intruded the Churchill Quartzite, according to Schledewitz (1986). The lazulite is blue, massive and forms irregular masses up to 4 cm across. The most abundant lazulite can be found on the east bank of the Churchill River in the vicinity of Cape Merry.

Specular Hematite

Bostock (1969) noted that quartz veins in the Churchill Quartzite (his 'subgreywacke') had local concentrations of specular hematite. Laminae of specular hematite, up to 1 cm thick, were also observed to locally form 4 to 5% of the subgreywacke. Schledewitz (1986) also reported coarse-grained specular hematite within 1 to 2 mm wide quartz veins that intruded the Churchill Quartzite. Like Bostock, he found specular hematite along the bedding planes and as disseminated grains in the quartzite.

Samples of specular hematite were collected in July 2000 for trace-element analysis.

Pyrite

Bell (1881) reported tiny pyrite grains in some veins and green Cu carbonate in one. Bostock (1969) observed finely disseminated pyrite, apparently associated with fractures in the Churchill Quartzite, near the east margin of exposure in the Churchill area.

Well developed cubes of pyrite can be found within the Ordovician Churchill Group. The largest cubes are about 1 cm on a side and are usually found in a larger mass of sulphide. Pyrite clots are also present in the overlying Ordovician Severn River Formation, where the beds are draped directly over the Precambrian Churchill Quartzite. Samples collected during July 2000 will be tested to determine if sulphide minerals, other than pyrite, are present.

Ordovician and Silurian Fossils

A 70 cm long by 30 cm wide trilobite was found on the tidal flat near Churchill in July 1998 by Dave Rudkin of the Royal Ontario Museum. It is the largest recorded complete fossil of a trilobite ever found (Winnipeg Free Press, May 27, 2000). The trilobite was within the Ordovician Churchill River Group. In 1985, a smaller 42 cm long trilobite was also found. A small trilobite found during July 2000 is shown in Figure GS-39-7. Other fossils preserved at the site include conodonts, aulacerid stromatoporoids and branching tabulate coral (Young et al., 1999).

In the same general area, Silurian fossils have been located in the Severn River Formation. These include stromatoporoids, corals, cephalopods and brachiopods (Young et al., 1999).

ACKNOWLEDGMENTS

The assistance of the staff of the Manitoba Museum of Man and Nature and of the Royal Ontario Museum is gratefully acknowledged. The locations they provided for the bedrock exposures on the tidal flats saved countless hours in determining outcrop availability and access. In particular, I would like to acknowledge Dave Wright and Ed Dobrzanski for acting as field assistants and watching for polar bears.

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Figure GS-39-6: Brian Ladoon's hotel site, front entrance.

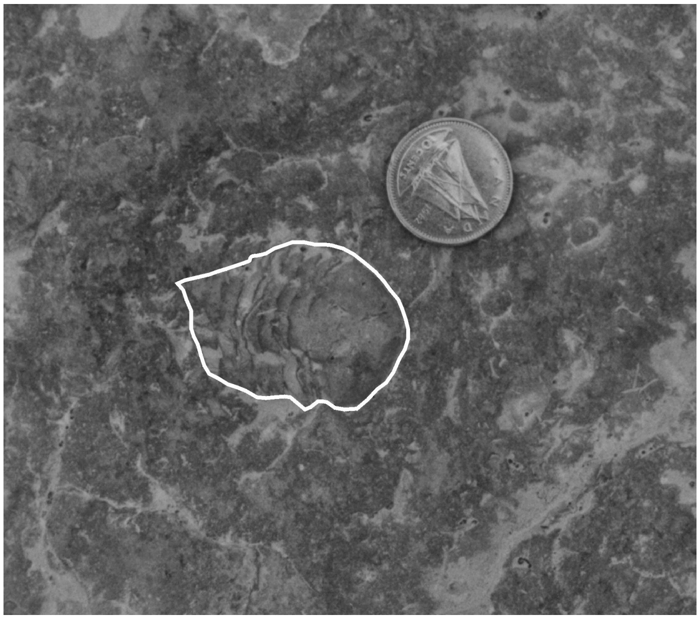

Figure GS-39-7: Trilobite fossil, found July 2000.

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