Economic Geology Report ER84-2

Silica in Manitoba

By D.M. Watson

Manitoba
Energy and Mines
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INTRODUCTION

Silica sands were first reported in Manitoba by Dawson (1859). Since that time, sand deposits in Manitoba have been worked to provide silica-rich materials for such diverse uses as traction sand and as feed for glass plants.

Silica has been quarried in various forms and from different geological environments. Pleistocene deposits along the railroad and elsewhere provided sources of silica. More recently the Ordovician deposits of sandstone in the Black Island area have been exploited. In the future, sands of the Swan River Formation or quartz in Precambrian pegmatitic deposits may become economically viable.

In order to evaluate the potential for each type of deposit, the various silica-bearing deposits of Manitoba have been examined, sampled and tested. The results of this work along with the results of earlier work are herein presented.

PREVIOUS WORK

The various silica-bearing formations of Manitoba have been the subject of many geological investigations. The Pleistocene deposits have been looked at as potential sources of glass sand and raw material for other industries (Freeman, 1936, and Spiece, 1980). The geology of these surficial deposits has been the subject of investigations by both the Manitoba Department of Energy and Mines (Aggregate Resources), and the Manitoba Department of Natural Resources (Water Resources). These investigations have resulted in several reports by each Department.

The Cretaceous Swan River Formation has been studied by several workers but only a limited amount of outcrop and subsurface data is available. McCartney (1928), Venour (1957) and others have reported on the stratigraphy and depositional environment of these sand-bearing units; Wickenden (1944) and McNeil and Caldwell (1981) have discussed the fossil flora and fauna as well as the stratigraphy. The silica and kaolin potential of the Swan River Formation has been the subject of studies by both private industry and government departments.

The Ordovician Winnipeg Formation, because of its abundant reserves of high purity silica sand, has been the primary target of exploration. The stratigraphy has been discussed by Baillie (1952), Genik (1952), McCabe (1978) and others. The production of silica sand from it has been documented by Spiece (1980), Watson (1983) and Pearson (1984).

The Manasan and Tanco deposits of Precambrian age have been described in papers by staff members of the companies mining the deposits, and by government geologists (Cranstone et al., 1970; Crouse et al., 1979; and others).

PRESENT WORK

This report is part of a continuing project to provide an inventory of Manitoba's industrial minerals. As noted above, the geology of the various silica-rich deposits has been investigated by a number of workers. In this report an attempt is made to bring together all available information on their silica potential.

Each of the known silica-rich units was visited, sampled, and evaluated as a potential source of silica. In the Precambrian shield, only the two operating deposits (Tanco and Manasan) and the Churchill quartzites were considered. Occurrences of high purity quartzites that have been reported in remote areas, e.g. at Paulson Lake (Schledewitz, 1985) are not described in this report because of their relative inaccessibility.

Both grain size and chemical analyses are reported for various silica occurrences described in this report. Most of the work was done by the Analytical Laboratory of the Geological Services Branch, and the techniques used are outlined below. Where results are noted as originating from other sources, the analytical methods are generally not known.

All of the samples collected were split to give two or more representative portions. For samples of sands, one fraction was sieved and the other retained for chemical analysis. Rock samples were crushed before splitting. Silicon was determined by the ammonium blue method. Phosphorus also was determined colorimetrically. Ferrous iron was determined by titration and all other elements were determined by atomic absorption.

Sand samples were air dried and passed through a nest of sieves. The mesh sizes used were 10, 20, 40, 50, 70, 100, and 200. The fines were collected on a pan. Several batches were tested and a time of 10 minutes was selected as being the optimum for shaking; after that time most of the grains were separated. No attempt was made to further agitate the samples to disaggregate well cemented clusters of grains that occur sporadically in the Winnipeg sandstone.

ACKNOWLEDGEMENTS

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Lastly I would like to acknowledge the assistance provided by B. Bannatyne whose knowledge, help and extensive files were of great assistance in the preparation of this report.

SILICA: Uses and Specifications

Each of the many uses for silica-rich materials has its own set of requirements for purity and physical properties. These requirements are quite rigid, but may vary slightly from one user to another. For this reason the following "specifications" should be considered as guidelines rather than rigid requirements.

Silica Flux

Silica flux is by far the largest use of silica-rich materials. In Manitoba siliceous quartzites are quarried by Inco at the Manasan Quarry. In the smelting process, it is the free silica that is the active fluxing agent, and for this reason the quartz content must be as high as possible. The levels of impurities such as iron, alumina and lime are not particularly critical except that they reduce the amount of silica in the flux.

The size requirements for flux are also variable. Some smelters use material that is sand size, whereas others use mixtures of sand and 2.5 cm material. Smelters often use the closest available silica source and adapt their smelting process to the use of that material.

Ferrosilicon

Ferrosilicon manufacture requires material of much higher purity than silica flux. The rock must contain not less than 97.5% silica, and less than 0.2% each of calcium and magnesium oxides; iron must be uniform and less than 0.5%, and alumina must not exceed 1%. Some elements, such as phosphorus and arsenic should not be present at all.

Lump material, 1.5 to 12 cm in diameter, is used for the manufacture of ferrosilicon. The material used must be well cemented and not friable. Quartzite or well cemented sandstone is frequently used; however, lump quartz from pegmatite or quartz veins could be used in most operations.

Silicon Carbide

Coarse sand-sized material is preferred for the manufacture of silicon carbide. It provides the necessary porosity, and also enables

TABLE 1
Specifications for silica (data from Johnson, 1961)

	Composition				Grain Size
	SiO_2 (min.)	Al_2O_3 (min.)	Fe_2O_3 (max.)	CaO & MgO (max.)	(mm)
1. Glass sands					
Quality **type**					
1 Optical	99.8	0.1	0.02	0.10	
2 Flint, tableware	98.5	0.5	0.035	0.2	
3 Flint	95.0	4.0	0.035	0.5	
4 Sheet & rolled	98.5	0.5	0.06	0.5	
5	95.0	4.0	0.06	0.5	0.2 to 0.5
6 Green & window	98.0	0.5	0.3	0.5	
7 Green	95.0	4.0	0.3	0.5	
8 Amber	98.0	0.5	1.0	0.5	
9 Amber	95.0	4.0	1.0	0.5	
2. Refractories					
Silica brick	95-99	0.1-2.8	0.3-1.3	0.2-2.4*	0.1 to 0.2
Fire brick	80-90				
3. Metallurgical					
Fluxing		0.4	0.2	0.3	
Foundry sand					
4. Chemical					
Sodium silicate	99	1.0	0.1	0.5	
Silicon carbide	99-99.5				
Ferrosilicon	96-97	2.0	1.0	0.2	0.84 to 0.15

*CaO only

the silica and the carbon source (usually petroleum coke) to be intimately mixed.

Chemically, a pure silica sand is needed, with silica over 99.25%. Iron and alumina should be less than 0.1%, and other impurities are not acceptable.

Silica Brick

Quartzite is the preferred material for silica brick. The fine grained quartzite is ground to size (-4 + 2.8 mesh: 55%; -28 + 65 mesh: 20%; -65 mesh: 25%) mixed with 1 to 2% lime as a bonding agent, and then fired in a kiln. The firing converts the quartz to tridymite and cristobalite, and is accompanied by expansion. The finished brick can then be used as furnace linings.

Chemically, silica requirements are usually greater than 96%, and alumina must not exceed 1%. Iron must also not exceed 1% but the combination of iron and alumina must be below 1.5%. Alkalis, magnesia and lime should all be low.

Glass Sand

Silica-rich materials for the manufacture of glass must generally be very low in iron, alumina, titanium and other impurities.

The sand should be uniform in grain size, with 100% passing 20 mesh but less than 3% passing 80 mesh. The chemical requirements for various grades of glass are summarized in Table 1.

Other Uses

Silica-rich sands are used for many other uses including Portland cement, foundry sand, sand-lime brick, enamels and fillers. There are no general specifications for these uses. Sands that are used by one company may be rejected by another. In many cases the users have adapted their technique to a particular local source of sand and other types cannot be easily substituted.

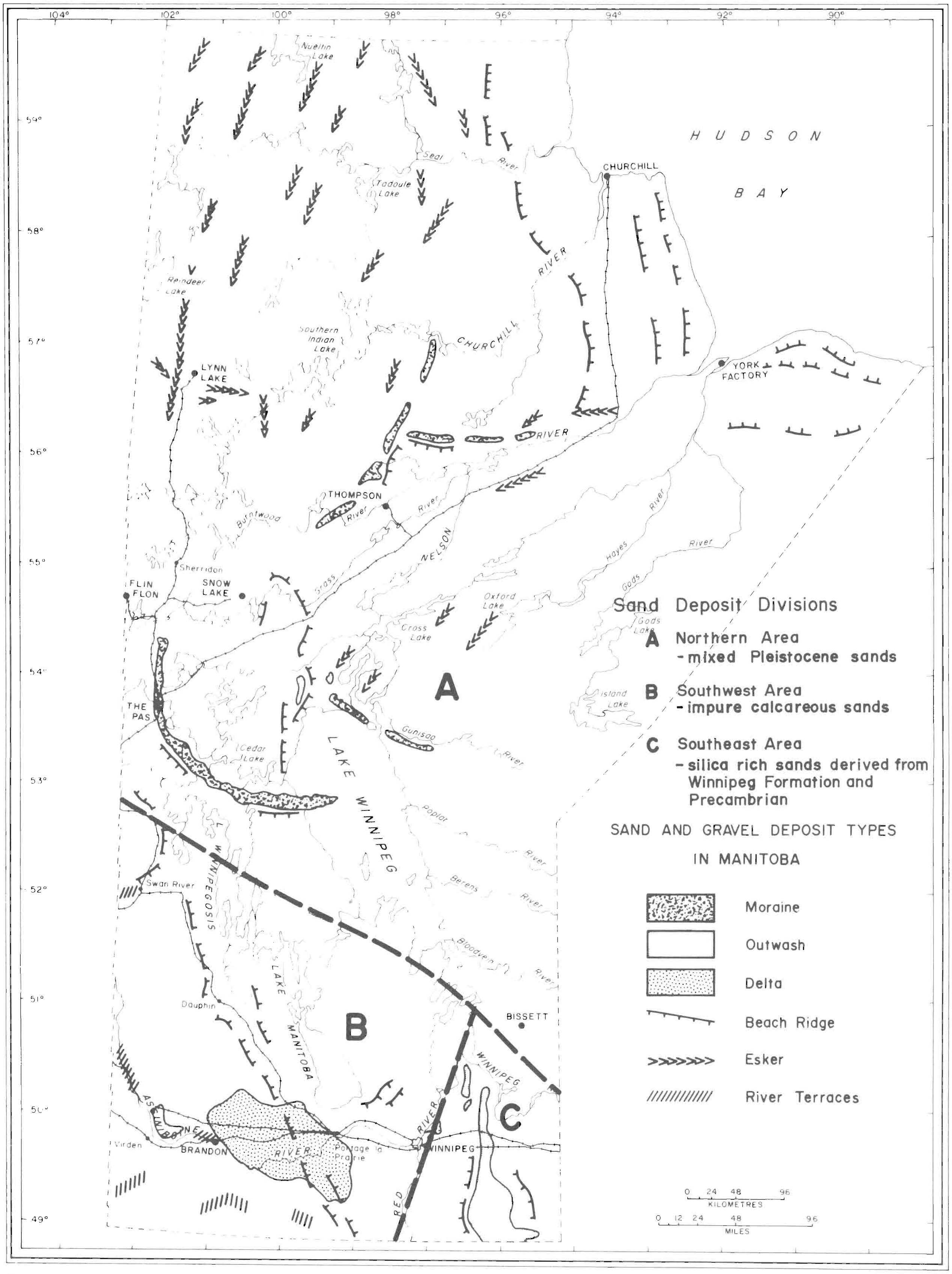

Figure 1: Pleistocene sand deposit divisions (after Large, 1978).

PLEISTOCENE SANDS

Pleistocene sands occur in many areas of southern Manitoba. Although some deposits have been worked for their silica content over the years, none of them meet the requirements of a modern silica-consuming industry without extensive upgrading.

The Pleistocene-covered portions of the Province may be divided into several regions (Fig. 1). In the north, the Pleistocene cover is made up largely of tills and sands that contain appreciable amounts of feldspars and other minerals in addition to quartz. These deposits tend to be thin and are not very uniform in composition. The deposits in the southwest are composed largely of carbonate and other non-silica minerals. Only in the southeastern portion of the Province are there deposits containing enough quartz to be considered potential sources of silica. This southeastern area can be further subdivided into those areas immediately down-ice or directly derived from the Winnipeg Formation, and other areas.

The various Pleistocene deposits that have been worked as sources of silica are all located in the southeastern part of the Province. They have been operated as sources of high silica material for glass manufacture, natural bonded foundry sand and silica for Portland cement. Some pits are currently being operated as sources of silica-rich material for traction sand and cement manufacture, but none could be utilized in an industry requiring a "pure" silica sand.

In 1984, Geological Services undertook an investigation of some of these sands in the Mars Hill area (Fig. 2). Shallow (5 m) test holes were

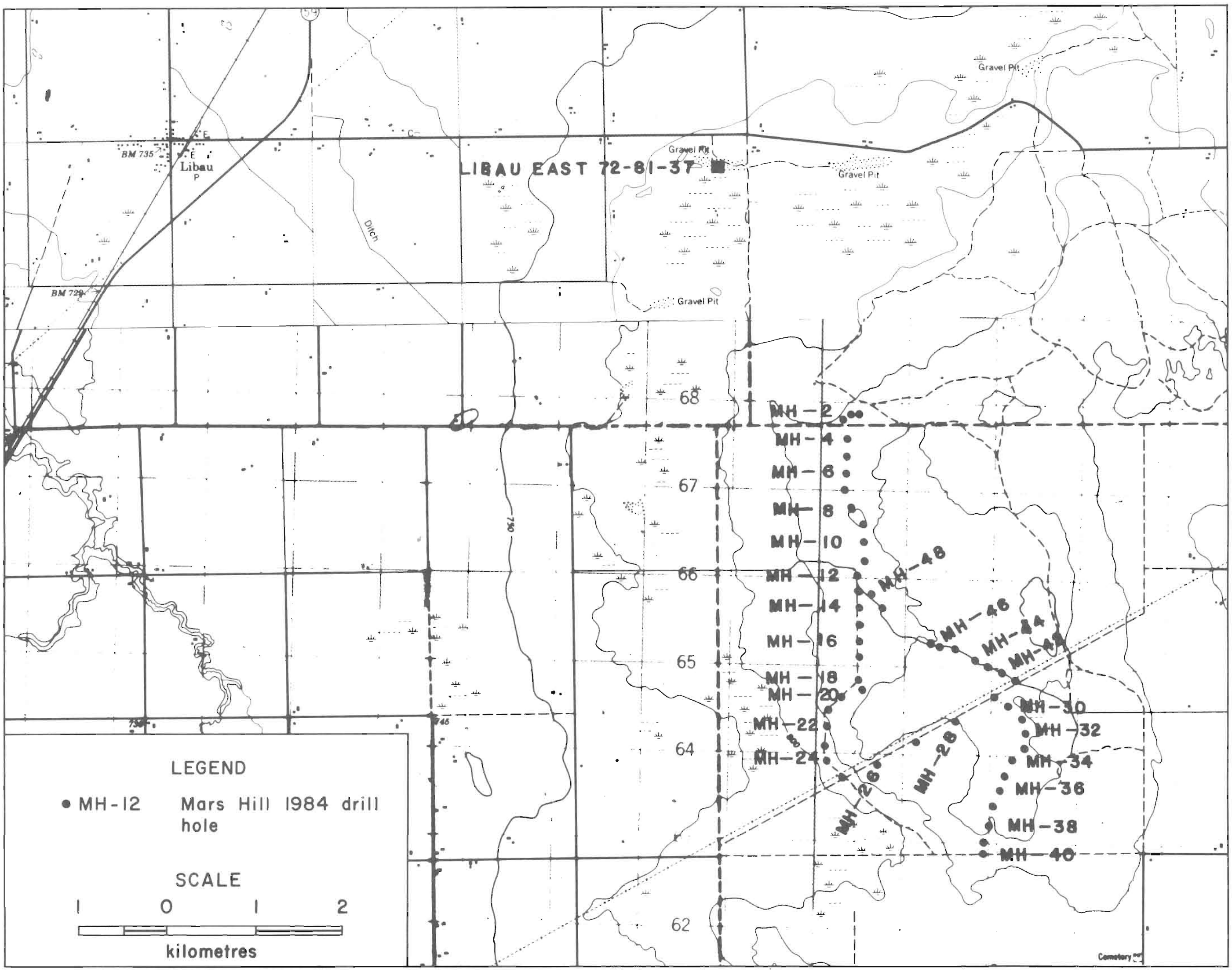

Figure 2: Location of Pleistocene deposits and sample sites, Libau-east and Mars Hill.

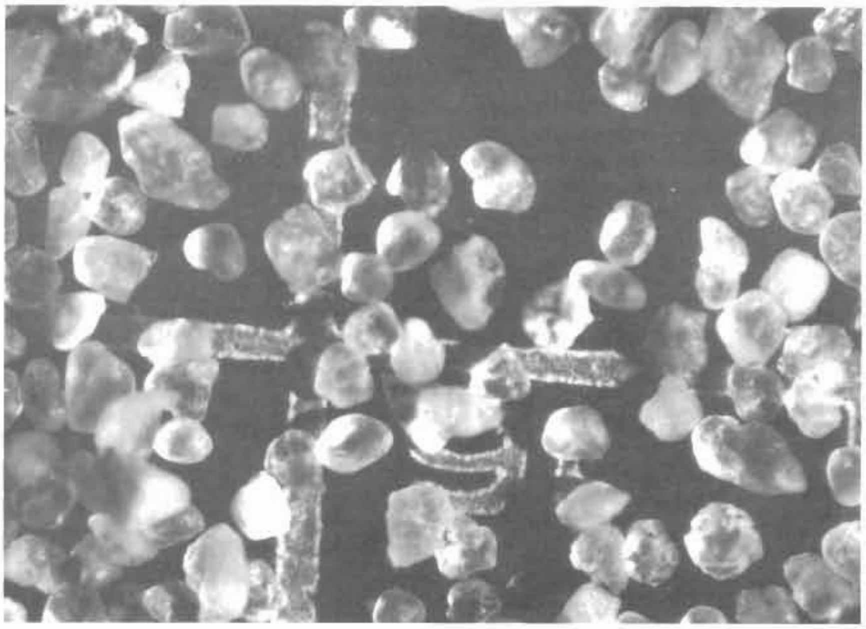

Figure 3:
Pleistocene sand, -40 +50 mesh fraction, Mars Hill. Note subangular grains and grains of feldspar.

TABLE 2
Chemical Analysis of Pleistocene Sands

Sample No.	Location	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	NaO	K_2O	H_2O	S	CO_2
						weight per cent						
HE-1	Richer	75.5	9.6	1.6	—	3.2	0.8	3.1	1.9	1.2	—	—
72.81.36	Gull Lake	86.4	6.2	0.5	0.3	1.8	0.4	1.6	1.1	0.4	0.01	0.9
72.81.35	Albert Beach	89.2	4.2	0.5	0.2	2.0	0.3	1.1	0.9	0.3	0.05	1.3
72.81.37	Libau East	89.0	4.2	0.4	0.2	2.1	0.2	1.2	0.7	0.4	Tr.	1.2
1984 SAMPLING PROGRAM MARS HILL (Average Analyses)											LOI	
MH-2		83.4	5.35	0.7		3.9	1.1	1.5	1.0		4.0	
MH-4		87.3	4.8	0.9		2.5	0.4	1.4	0.8		2.1	
MH-6		85.5	4.9	0.6		3.3	0.5	1.4	0.9		2.9	
MH-8		88.5	4.7	0.7		2.0	0.2	1.4	0.8		1.6	
MH-10		83.3	5.0	0.7		4.4	0.6	1.4	0.9		3.8	
MH-12		88.8	5.5	0.7		1.0	0.2	1.6	1.1		0.7	
MH-14		75.6	7.9	2.0		4.0	1.5	1.4	1.4		6.3	
MH-16		37.2	5.9	1.9		22.6	4.4	0.9	1.0		26.1	
MH-18		83.2	6.4	1.6		2.7	0.8	1.6	1.1		2.9	
MH-20		76.9	5.7	1.2		6.4	1.6	1.5	1.0		6.3	
MH-22		76.6	6.1	1.1		6.9	0.8	1.6	1.2		6.0	
MH-24		77.2	5.9	1.1		6.7	0.8	1.6	1.1		5.7	
MH-26		81.9	6.3	0.9		3.7	0.5	1.7	1.3		3.4	
MH-28		82.9	5.7	1.3		3.0	0.5	1.5	1.1		3.1	
MH-30		86.0	5.5	1.0		1.5	0.3	1.5	1.1		1.9	
MH-32		85.0	4.7	0.8		3.0	0.5	1.3	0.8		3.0	
MH-34		81.9	4.7	0.9		4.5	0.7	1.3	0.9		4.0	
MH-36		84.4	4.7	0.7		3.9	0.6	1.3	0.9		3.6	
MH-38		82.9	4.8	1.1		4.4	0.9	1.2	0.9		4.1	
MH-40		76.9	5.2	0.7		7.4	1.0	1.4	1.0		6.6	
MH-42		88.0	5.8	0.8		1.1	0.2	1.6	1.0		1.0	
MH-46		69.9	6.2	1.3		8.1	1.9	1.5	1.3		8.1	
MH-48		88.0	5.0	0.5		2.4	0.3	1.4	0.9		1.8	

drilled and the material collected was analyzed (Tables 2 and 3). The results show that this large body of Pleistocene origin is remarkably uniform in its chemical and physical properties. If a method of upgrading this sand to glass grade can be developed, this would represent an area of large resources close to transportation and potential markets.

A photograph of the -40 + 50 mesh fraction of one sample of these sands is shown in Figure 3.

DEPOSIT DESCRIPTIONS

Beausejour

The sand pit at Beausejour (Fig. 4) was opened in 1906. Initially, it supplied silica sand to an on-site glass plant until 1913, when the plant was taken over by Dominion Glass and subsequently closed. Since that time the deposit has been worked by several companies for such uses as traction sand and in cement. A complete history of ownership and production is given in Appendix I.

The sand deposit is of glaciofluvial origin. Cross- bedding, channel scours and other structures may be seen in the pit walls. The sand is well sorted and only a few pebbles or variations in grain size are apparent.

A major part of the sand in this area is thought to have been derived from the Winnipeg Formation. The outcrop belt of that formation lies only a few kilometres east of the Beausejour-Brokenhead area. Quartz grains in the deposit are very similar in size and physical appearance to quartz grains in the Winnipeg Formation. The Beausejour sands, however, contain more feldspar and heavy minerals than the cleaner Ordovician sands. These minerals are present as a contribution from the Precambrian terrain that also lies to the east of the deposit. Accessory minerals, in addition to feldspar, are tourmaline (green, blue and black), amphibole, pyroxene, garnet, and magnetite.

When examined in 1982, the pit was filled with water. The samples reported in Tables 2 and 3 were collected from stockpiles that were dredged from the pit bottom which is reported to be about 10 m below water level. They are assumed to be representative of the material quarried. The total thickness of the sand is about 30 m. The chemical analysis indicates that although this material is higher in silica than many other Pleistocene deposits in the area, considerable upgrading would be necessary to make a product suitable for use in a modern glass plant. The location of the pit within the town limits also limits the potential of the site.

Other sand deposits in the Beausejour area contain similar grades of sand and are described below under Brokenhead-Libau East area. Other deposits are reported by Conley (1980), and analyses for silica are reported by Watson (1981).

TABLE 3
Sieve Analysis of some Pleistocene Sands

Sample No.	Location	mesh size +20	-20 +40	-40 +50	-50 +70	-70 +100	-100 +200	PAN
72.81.36	Gull Lake	0.3	5.3	11.1	26.2	21.8	25.6	9.7
72.81.35	Albert Beach	0.5	4.7	8.0	49.3	25.2	11.4	0.9
72.81.18	Birds Hill	0.3	2.5	35.0	46.0	11.7	3.9	0.6
Various (Avg.)	Richer Area	0.0	0.5	0.5	0.8	6.4	86.9	4.9
Various (Avg.)	Beausejour Pit	4.9	19.3	28.3	25.4	12.8	6.9	2.4
72.81.37	Libau East Pit	0.0	0.1	5.2	61.0	26.6	6.8	0.3
1984 Sampling Program		(Average Analysis per hole)						
Mars Hill								
Hole No.								
MH-2		3.15	5.15	20.8	42.5	24.2	3.7	0.6
MH-4		0.2	0.3	3.7	35.0	44.5	15.4	1.0
MH-6		1.3	1.9	4.6	39.5	34.6	16.4	1.7
MH-8		0.4	0.6	6.5	42.8	36.7	12.0	0.9
MH-10		4.5	3.4	8.8	29.6	34.9	16.8	2.0
MH-12		0.3	5.0	14.6	45.3	27.7	6.7	0.5
MH-14		0.0	9.0	10.2	26.7	35.0	15.8	3.4
MH-16		0.0	26.3	14.2	14.2	12.0	15.6	17.7
MH-18		0.0	2.9	4.4	19.5	55.8	15.9	1.6
MH-20		0.0	8.5	8.0	20.0	50.0	12.5	1.1
MH-22		17.7	32.7	26.6	16.8	4.1	1.2	0.8
MH-24		4.9	22.8	19.9	17.0	21.2	12.7	1.9
MH-26		2.5	15.7	40.1	30.6	8.3	1.8	1.0
MH-28		0.3	4.2	15.9	32.7	21.4	17.6	8.1
MH-30		9.01	9.9	13.6	31.0	28.4	6.9	1.3
MH-32		0.0	3.0	8.6	29.3	40.8	16.8	1.4
MH-34		4.1	5.0	9.8	30.2	34.0	16.0	0.9
MH-36		0.0	6.3	26.6	44.9	17.6	3.8	0.8
MH-38		0.0	3.6	11.0	37.8	35.7	10.6	1.3
MH-40		0.0	40.3	22.9	16.0	12.4	6.6	1.8
MH-42		5.2	15.7	32.7	31.2	12.11	2.6	6.5
MH-46		0	4.8	5.8	9.4	21.4	43.5	15.2
MH-48		0.4	0.6	1.5	33.3	39.3	18.7	6.2

Figure 4:
Stockpiled sand and flooded pit, Beausejour.

Figure 5:
Pleistocene sand, Frailick pit, Mars Hill.

Brokenhead Quarry

This deposit has been worked since 1970 to provide silica sand to Red River Brick and Tile in Lockport. It is used in brick-making as an additive to clays to help control shrinkage and drying time.

The mineralogy of this deposit is similar to that of the Beausejour pit. The sand is composed mainly of reworked Winnipeg sand grains mixed with small amounts of carbonate. It also contains traces of feldspar and fragments of volcanic rocks, derived from Precambrian terrain. The sand would require considerable upgrading to meet the requirements of a glass plant or any other use requiring a high quality silica sand.

Libau East (Mars Hill)

Silica-rich sand from this pit has been used for railway traction sand, as an additive to Portland cement, and for several other uses. It is quarried by Frailick Ltd. of Beausejour (Fig. 5).

This sand is similar to the Libau and Beausejour deposits in that it is of glaciofluvial origin. Lenses of relatively clean silica sand occur within beds of less pure material. Considerable upgrading would be required to make this material suitable for a user requiring a "high silica" sand.

Moulding sands

Freeman (1936) examined more than a dozen deposits of naturally bonded moulding sands and described their uses and physical properties. These sands are silica-rich sands containing enough clay to bind the grains in a mould. The use of naturally bonded sands has now been replaced by blended sands. The deposits tested were all being used at the time of his report and had a thickness of over 3 m. The tests showed that sand from a deposit at Swan River was "the most refractory of all sands tested from Western Canada". The report also stated that one of the problems associated with that deposit would be the elimination of the associated beds of high purity silica sand and kaolin.

The other 12 deposits described in Freeman's report are all smaller, although in most cases not much work has been done to explore their limits. Because of the growth in the use of artificial sands these deposits would not be considered for large foundry uses. However, for the small craftsman or artist doing "one of" castings, they could very well provide a good alternative to the blended sands. The interested reader is referred to Freeman's (1936) report for further information.

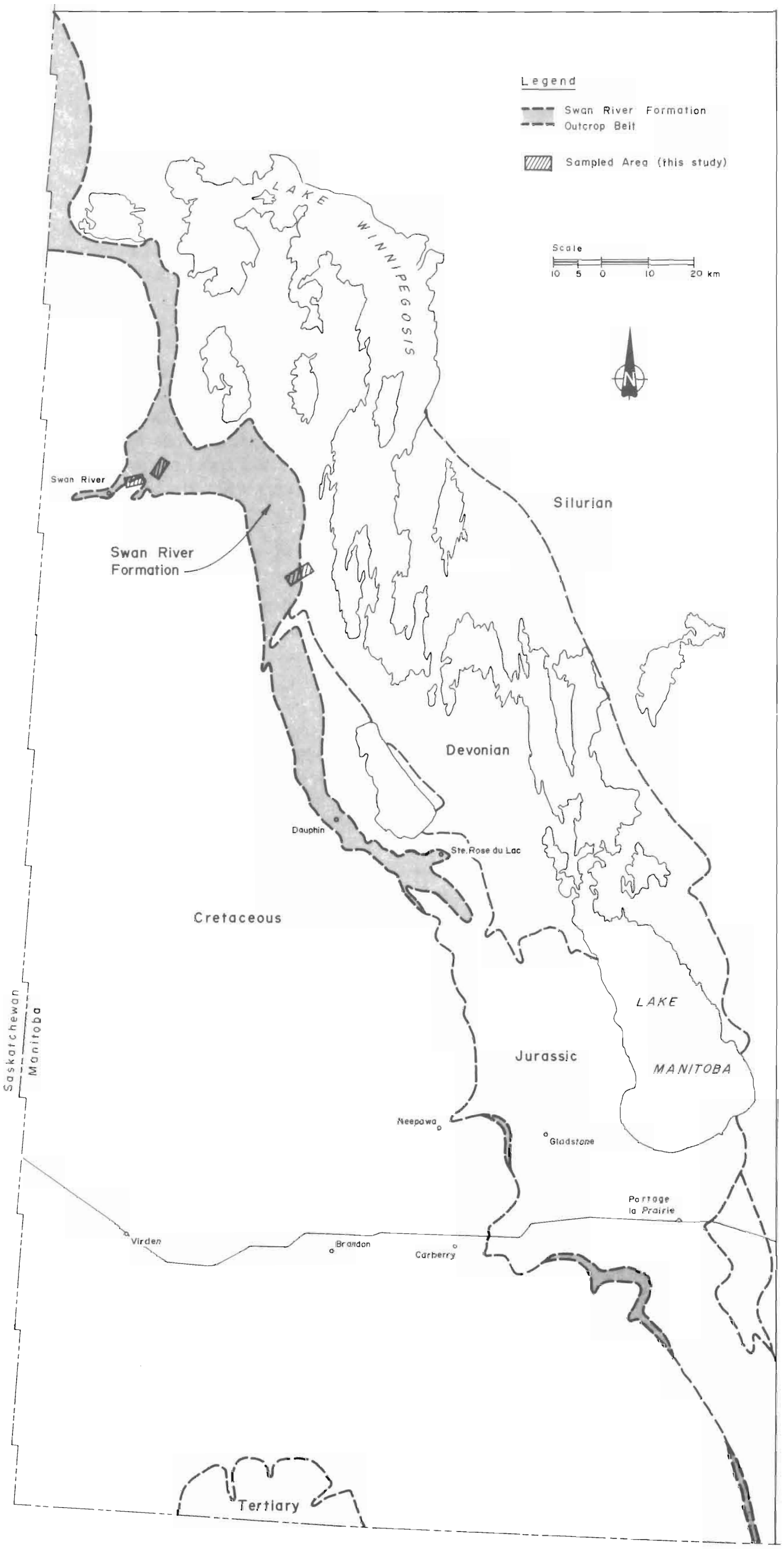

Figure 6. Location of Cretaceous Swan River Formation outcrop belt and sample locations.

CRETACEOUS SANDS

The Swan River Formation (Fig. 6) was first described by Tyrrell and Dowling (1893). From that time until 1957, references to the Swan River were usually brief and lacking in detail, in part due to the lack of good outcrop. Measured sections of scattered outcrops were reported by Wickenden (1944).

The first comprehensive study of the formation was presented by Venour (1957) as a M.Sc. thesis. The distribution of the Swan River Formation was divided into three areas, based partly on the lithologies present. The best exposures of the formation in outcrop are in Venour's northern area, north of the town of Swan River. One of those sections was examined and sampled as part of this study. In addition several auger holes to a maximum depth of 10 m were drilled to test the continuity and variation within the beds in that same area.

Outcrops of the Swan River Formation are also found along Pine River, west of the hamlet of Duck River (Fig. 6). Analyses of material from several sites in that area are presented for comparison with the results from the Swan River area (Tables 4 and 5).

GEOLOGY

The Swan River Formation is the basal formation of the Cretaceous section in Manitoba. In several locations in the Province it fills pre-Cretaceous erosional channels in the underlying rocks. It ranges in thickness from 10 to more than 60 m in the south, and is up to 100 m thick in the north. The Swan River is overlain by the Ashville Formation, also Cretaceous in age. The Ashville is in part composed of similar material to the Swan River and in drill sections the contact may be difficult to determine.

Typical sections of the Swan River are given in Venour and other reports. The section examined during the summer of 1982 (Fig. 7) is described below. It is located in section 6 township 37 range 26W. The exposure is in the bank of the Swan River and at the bottom is covered by slumped debris so that the entire thickness is not exposed.

Surface	0-0 - 0.8 m	organic soil layer
	0.8 - 3.8 m	white loose sand. Contains approximately 30% kaolin and minor amounts of pyrite.
	3.8 - 4.0 m	dark grey loose sand. This layer contains many iron sulphide (pyritic/marcasitic) concretions. There are also limy concentrations with lignite inclusions.
	4.0 - 6.4 m	white to light grey sand. The sand contains slightly more clay than the upper layer. The sand is loose when wet but upon drying becomes sticky.
	6.4 - 8.0 m	the lower portion to the water's edge is covered with rubble. Where visible the underlying sand is similar to that of the overlying section.

In general, the Swan River sands are not as pure as those of the Winnipeg Formation. McCartney (1928), reported the heavy mineral content of the sands was 0.51 to 0.95%, with the major impurities being magnetite and glauconite. Venour (1957) further analysed the mineral assemblages present and decided that there were several sources of the material in the Swan River. He proposed that the sands from the Northern area contain more minerals derived from high grade metamorphic terrains. In addition, he stated that the sands from the northern area are well sorted, very fine and angular. In the other areas the grain size is slightly coarser and the sands tend to be more rounded.

In addition to the heavy minerals making up less than 1% of the rock, the Swan River sands contain considerable amounts of kaolin. Some beds contain up to 75% kaolin. Small quantities of lignite and carbonate are present in some sections. These impurities, although present in varying amounts in each section, are usually confined to definite stratigraphic layers separating relatively pure beds of silica sand.

Figure 7: High-silica sands (Swan River Fm.) with lignitic layers, sec. 6-37-26W.

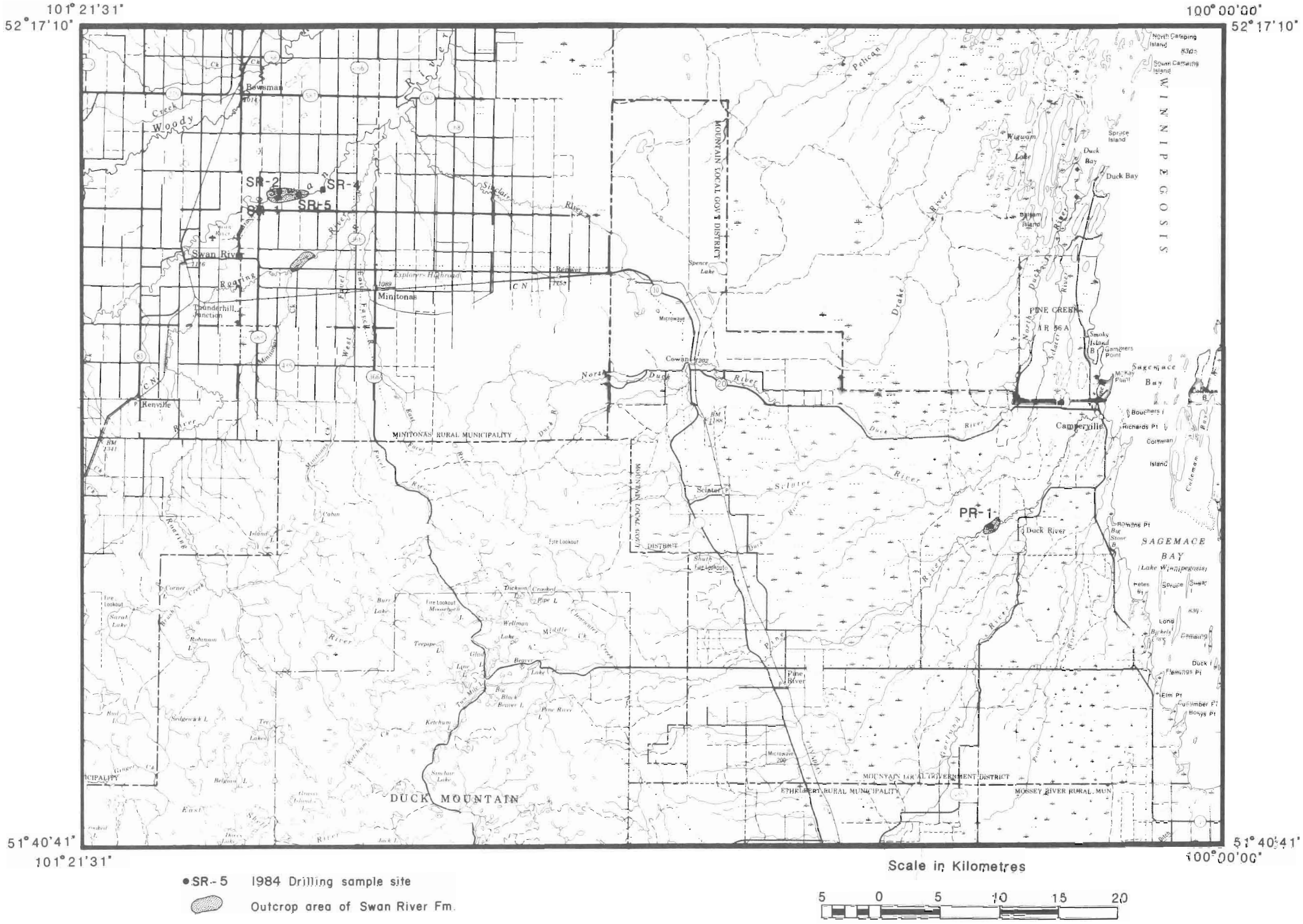

Figure 8. Sample locations near Swan River and Pine River.

DEPOSIT DESCRIPTIONS

Swan River Area

In the Swan River and Duck River areas (Fig. 8) several pits have been put down over the years to evaluate the Swan River Formation as a potential source of either coal (lignite) or kaolin. In both cases, one of the problems associated with extracting either of those materials was the need to dispose of the silica sand.

During the 1982 field season, the Swan River sands were sampled in the Swan River valley near Bowsman and also near Duck River (Fig. 8). In the approximately 10 m of section examined at Swan River, it would appear that the sand is quite pure (a conclusion supported by the analyses, Table 4). However, it is uncertain whether or not this may be due in part to the exposed nature of the occurrence, as it is possible that some of the clay and other impurities may have been washed out of the sand exposed in the river banks.

During the 1984 field season, a drilling program was carried out to investigate variations in grain size and chemical composition of the sands in the areas of Bowsman and Duck River. These two areas were chosen because it was already known that the Swan River formation was present beneath minimal overburden. The results of the chemical and sieve chemical analyses are given in Tables 4 and 5.

The chemical analyses show the silica content ranges from 95 to 99% (average of 24 analyses is 97.5 SiO_2) with corresponding variations in the other, minor, constituents. In general, samples with lower silica are higher in alumina and LOI (predominantly water), and represent a high clay content. Although the clay reduces the SiO_2 content of the raw material, it could be easily removed from the product in any mining operation.

In addition to a fairly constant chemical composition, the sands have a uniform grain size distribution. Several sections, however,

TABLE 4

Chemical Analyses of Cretaceous (Swan River Formation) Sands

Sample No.	Location	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	NaO	K_2O	H_2O	S	CO_2	Source*
						weight per cent							
72.81.24	Tudale Neepawa DH.	89.35	5.98	0.47	0.13	0.06	0.18	0.25	0.35	2.65	0.11	0.48	1
72.81.25	Tudale Neepawa DH.	69.30	10.45	4.32	0.97	0.08	0.55	0.58	1.55	6.67	2.42	2.46*	1
72.81.26	Tudale Neepawa DH.	64.20	15.92	4.67	0.60	0.11	0.55	0.56	1.22	8.06	2.41	1.00*	1
72.81.27	Tudale Neepawa DH.	66.50	15.50	3.08	0.79	0.22	0.90	0.66	2.18	7.55	0.49	0.86	1
72.84.51-1	Bowsman	93.5	2.1	0.9	—	0.3	0.3	0.1	0.4				
1984 Drill Program											LOI		
Hole	**Depth (m)**												
SR-1	0-1	93.5	2.1	0.9	—	0.3	0.3	0.1	0.4		1.9		1
SR-1	1-2	96.6	1.0	0.5	—	0.1	0.1	0.0	0.2		0.9		1
SR-1	2-3	98.8	0.4	0.2	—	0.1	0.0	0.0	0.2		0.4		
SR-1	3-4	98.8	0.4	0.2	—	0.1	0.0	0.0	0.2		0.5		1
SR-1	4-5	97.8	0.7	0.3	—	0.2	0.1	0.2	0.1		1.0		1
SR-3	0-1	94.2	2.0	0.9	—	0.4	0.3	0.0	0.4		2.0		1
SR-3	1-2	96.9	1.0	0.5	—	0.1	0.1	0.0	0.2		1.0		1
SR-3	2-3	98.7	0.5	0.3	—	0.1	0.1	0.0	0.2		0.6		1
SR-3	3-4	98.9	0.4	0.2	—	0.1	0.1	0.0	0.2		0.5		1
SR-3	4-5	97.5	0.8	0.4	—	0.1	0.1	0.0	0.3		0.9		1
SR-5	0-1	99.1	0.2	0.3	—	0.0	0.0	0.0	0.1		0.3		1
SR-5	1-2	98.9	0.3	0.1	—	0.1	0.0	0.0	0.1		0.3		1
SR-5	2-3	97.7	0.7	0.4	—	0.1	0.1	0.0	0.2		0.9		1
SR-5	3-4	99.1	0.2	0.2	—	0.0	0.0	0.0	0.2		0.4		1
SR-5	4-5	99.1	0.1	0.2	—	0.0	0.0	0.0	0.1		0.3		1
SR-5	5-6	95.4	1.6	0.6	—	0.1	0.2	0.0	0.3		1.9		1
SR-5	6-7	99.2	0.1	0.2	—	0.1	0.0	0.0	0.1		0.4		1
SR-5	7-8	98.1	0.4	0.4	—	0.1	0.1	0.0	0.1		0.9		1
SR-5	8-9	99.5	0.1	0.2	—	0.1	0.0	0.0	0.1		0.2		1
SR-5	9-10	99.3	0.1	0.3	—	0.1	0.0	0.0	0.0		0.3		1
SR-5	10-11	94.4	0.6	1.9	—	0.4	0.1	0.0	0.2		1.7		1
PINE RIVER #1		96.7	0.9	0.9	—	0.1	0.0	0.0	0.0		0.9		2
PINE RIVER #2		95.5	0.4	0.3	—	0.1	0.0	0.0	0.2		0.7		2
PINE RIVER #3		96.0	1.6	0.2	—	0.1	0.0	0.0	0.2		1.2		2

*These samples contained minor amounts of lignite.

Sources 1) material collected this study; 2) MRD files; samples collected by B.B. Bannatyne.

contain more of the coarse (greater than 40 mesh) fraction, a highly desirable size fraction for some commercial uses (Table 1).

Overall, the samples from both areas show little variation in grain size or chemical composition. Data from the Water Well Drilling Reports, published by the Department of Natural Resources, indicate that sands similar to those sampled may be found throughout most of the Swan River Valley and in the Pine River-Duck River area. The present data base indicates that the area contains about 23 750 tonnes of silica product per hectare for each metre of depth, or 237 500 tonnes per hectare to a depth of 10 m (the depth evaluated by the sampling program). Further drilling may prove the existence of high grade silica sands to even greater depths; however, mining of sands to depths of greater than 10 m would likely involve extensive groundwater control problems.

The sands exposed in the river valley could be sufficiently upgraded by washing to produce a high grade silica sand. In addition, the washings may contain enough kaolin to make them attractive as sources of filler-type kaolin. Another advantage of these deposits is the ease of access and proximity to transportation routes as compared to the other potential sources of high quality silica in the province (e.g. Winnipeg Formation sands).

Cretaceous (Swan River Formation) Channels

The Swan River Formation lies unconformably on Jurassic and older rocks. Pre-Cretaceous erosion resulted in development of deep channels prior to deposition of the Swan River sands. These channels have been discovered in several areas of Manitoba (Fig. 9) and a few have been investigated as possible sources of clay and lignite. Some of the sand-filled depressions may represent solution channels and others are interpreted as sinkholes, both of which may be related to karsting during the post-Devonian pre-Cretaceous erosional event (McCabe et al., 1982).

The best documented example of Swan River material filling an earlier channel is in the area north of Arborg (Fig. 10). This deposit was originally investigated as a source of coal after fragments of lignite were found in the 1920s during the excavation of a water well. In the mid-1950s, the kaolin potential of the deposit was investigated. At that time, a number of rotary drill holes were put down and, together with an electromagnetic survey, outlined the channel over a length of 5 km. Three test pits were excavated to test the clay. The results of this work were reported by Bannatyne (1970).

TABLE 5
Sieve Analysis of some Cretaceous (Swan River Formation) Sands

1984 Drill Program		mesh size						
Hole No.	Depth (m)	+20	-20 +40	-40 +50	-50 +70	-70 +100	-100 +200	PAN
SR-1	0-1	—	8.1	6.9	18.5	36.3	24.1	4.7
SR-1	1-2	3.9	4.3	6.0	25.0	39.8	18.8	2.3
SR-1	2-3	0.4	0.7	2.2	17.9	55.1	21.5	2.2
SR-1	3-4	0.4	0.5	1.0	11.7	57.5	26.6	2.5
SR-1	4-5	1.1	1.1	1.4	10.4	50.8	31.8	3.3
SR-3	0-1	9.4	5.8	5.5	21.3	36.2	18.1	3.7
SR-3	1-2	4.4	3.4	5.1	23.3	43.0	19.0	1.8
SR-3	2-3	0.8	0.9	2.8	18.8	56.2	19.2	1.4
SR-3	3-4	0.1	0.2	0.9	10.0	59.7	27.7	1.4
SR-3	4-5	1.9	2.5	6.2	20.7	43.0	22.6	3.0
SR-5	0-1	0.0	0.5	2.7	14.8	55.7	25.4	0.9
SR-5	1-2	0.0	0.6	5.1	13.9	54.9	25.0	0.5
SR-5	2-3	3.2	6.8	29.1	23.4	19.7	14.3	3.5
SR-5	3-4	0.7	1.4	6.1	15.0	50.5	25.8	0.5
SR-5	4-5	0.0	0.7	2.3	14.8	57.8	23.7	0.7
SR-5	5-6	0.0	0.7	2.3	14.8	58.2	23.3	0.7
SR-5	6-7	9.0	5.9	22.0	31.1	22.4	7.4	2.2
SR-5	7-8	0.1	3.4	12.1	26.8	40.9	16.0	0.9
SR-5	8-9	5.0	11.6	33.2	19.8	19.3	9.5	1.6
SR-5	9-10	0.0	5.1	18.7	20.4	41.6	13.9	0.4
SR-5	10-11	0.0	5.4	17.7	23.5	41.1	11.8	0.5
SR-5	11-12	8.1	7.9	12.6	15.0	33.9	19.2	3.3
Pine River #1		2.1	0.6	0.7	5.1	31.4	48.0	12.1(1)
Pine River #2		11.7	0.1	0.4	19.1	42.9	22.1	3.7(1)
Pine River #3		3.8	0.8	5.3	30.7	35.7	20.4	3.2(1)

(1) MRD files, samples collected by B. Bannatyne.

The silica sand content of the material tested from the Arborg deposit ranges from 20 to > 40%. The size of the silica varies from < 2 microns to +20 mesh. Approximately 5% is in the -20 +30 mesh size range. The −20 +150 mesh fraction analyzed 98.5% SiO_2.

Sands have been recovered from several other areas of the Province (Fig. 9) that are comparable in composition and characteristics to the Arborg material. Water well drillers have reported "silica sand and clay mixed with carbonaceous material", that are probably Swan River-type material filling similar channels or sinkholes. Most of these latter occurrences have not been investigated beyond the original discovery. A catalogue of some of these occurrences has been prepared by Barker (1984).

These relatively impure "channel" occurrences are similar to the Swan River Formation deposits, and may represent potential sources of silica. The mixture of kaolin and silica varies from place to place; however, in many occurrences the two could be separated. Although neither product would pay for the processing on its own, a viable operation may be possible if both products were to be recovered.

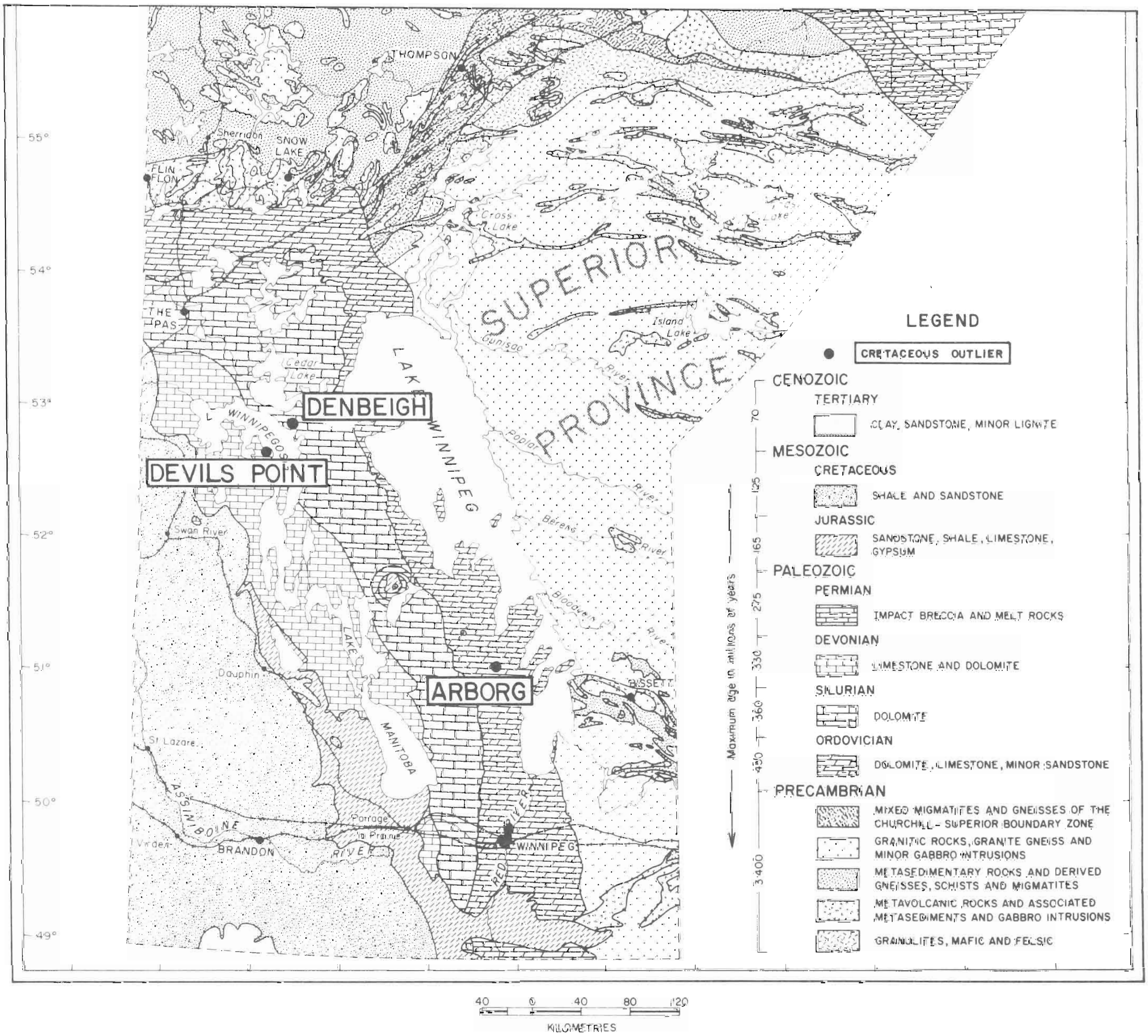

Figure 9. Location of Cretaceous Swan River Formation outliers.

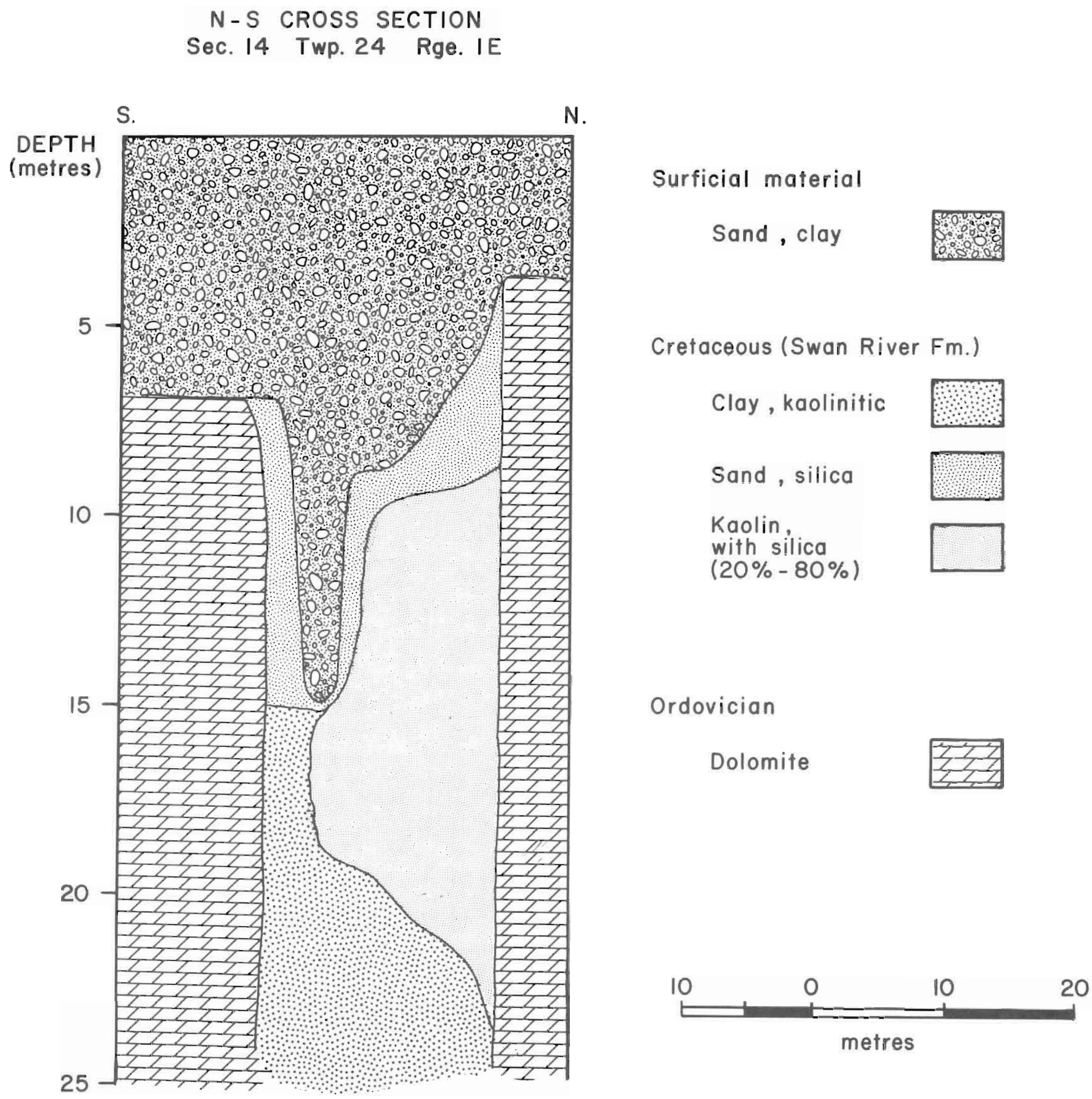

Figure 10. Section through Cretaceous channel at Arborg.

ORDOVICIAN SANDS

The Ordovician Winnipeg Formation contains the largest reserves of high silica material in the Province. It is not only high in silica, but also low in iron and other deleterious elements. Along the outcrop belt, the sands are loosely cemented with kaolin (Fig. 11) which may be easily removed by washing (Fig. 12).

The Winnipeg Formation sands were first described in detail by Dowling (1900). Most of the outcrop occurs on the western shore of Lake Winnipeg (Fig. 13) and on islands in the lake (Black, Punk, Little Punk and Deer Islands). The formation is exposed also on the east shore of Lake Winnipeg near Seymourville, and in the Wekusko-Athapapuskow Lakes area.

The various facies and faunal assemblages of the Winnipeg Formation have been described by Baillie (1952), Genik (1952), McCabe (1978), and others. The character of the sands and the heavy mineral assemblages were described by McCartney (1928).

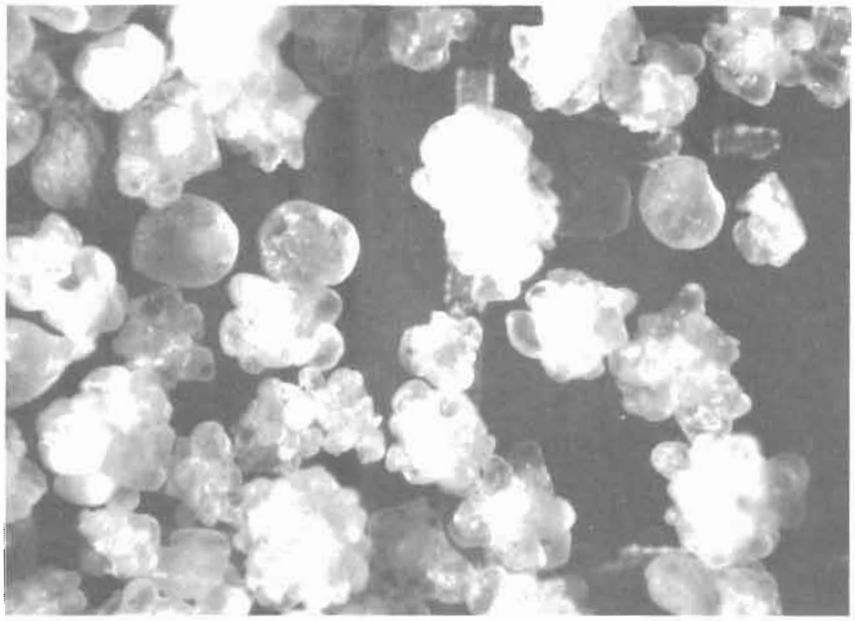

Figure 11:
Winnipeg Formation sands, +20 mesh fraction.
Note cemented aggregates of grains.

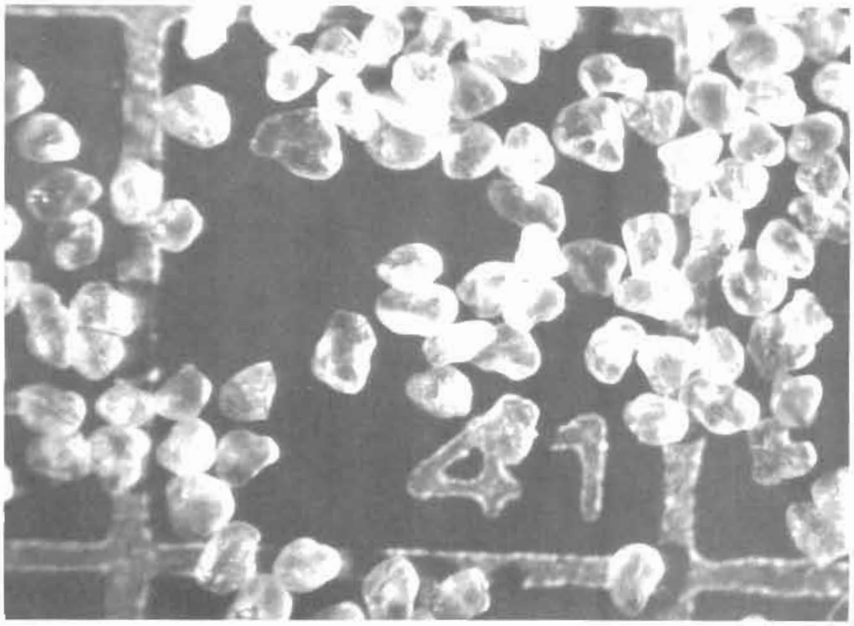

Figure 12:
Winnipeg Formation sands, -40 +50 mesh fraction,
Note well rounded, frosted quartz grains.

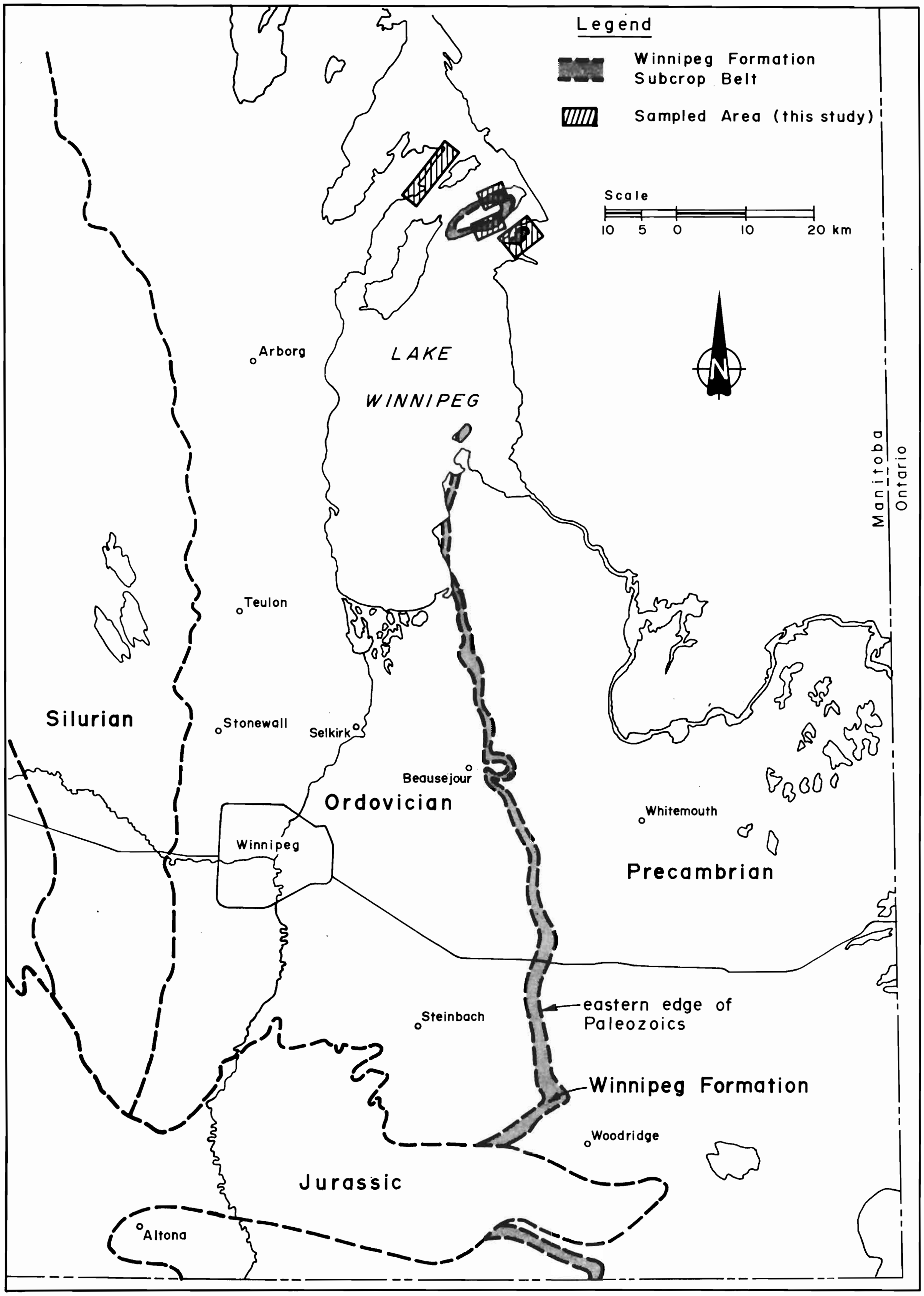

Figure 13. Location of Ordovician Winnipeg Formation outcrop belt and sampled areas.

GENERAL GEOLOGY

The Winnipeg Formation consists of the interlayered sands and shales that underlie the Red River Formation carbonate rocks. In the eastern part of the Province they lie unconformably on the Precambrian basement. In the extreme southwestern area the Winnipeg is known from drilling to lie unconformably on the Cambrian Deadwood Formation (McCabe, 1978). The unit ranges in thickness from 0 to 60 m, and in composition from 90% shale to 90% sand.

The relative proportions of sand and shale vary considerably from area to area as does the thickness of the upper and lower units. These variations are discussed by McCabe (1978) and others and will not be treated in any detail here except to point out that it is the lower unit of the formation that outcrops along the shores of Lake Winnipeg and shows the most promise for silica development. The upper unit (the Carman sand) was tested near Ste. Anne (see deposit description) but could not be economically recovered (Underwood McLellan and Associates Limited, 1967).

DEPOSIT DESCRIPTIONS

In February 1984 only one deposit of Winnipeg sandstone, the Black Island deposit of Steel Brothers (Canada) Limited, was being worked (Fig. 14). One other deposit on Black Island was worked in the past and is described below and in Appendix I. In addition an attempt was made to mine sand from the upper unit of the Winnipeg Formation near Ste. Anne, and some work has been done on a deposit near Seymourville (Watson, 1981). Chemical and sieve analyses of the sands are given with the descriptions below and in Tables 6 and 7.

TABLE 6
Chemical Analyses of Ordovician (Winnipeg Formation) Sands

Sample No.	Location	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	NaO	K_2O	H_2O	S	CO_2
						Weight per cent						
72.81.17	Waskada DH	97.75	0.54	0.19	0.06	0.16	0.16	0.01	0.15	1.49	0.13	0.39
72.81.18	Waskada DH	93.10	1.80	0.47	0.16	1.60	0.22	0.12	0.26	1.07	1.14	0.34
72.81.22	Waskada DH	97.40	0.79	0.13	0.05	0.08	0.11	0.04	0.18	0.30	0.09	0.29
72.81.23	Waskada DH	97.40	0.74	0.63	0.04	NIL	0.08	0.04	0.11	0.23	0.48	0.17
72.81.19	Waskada DH	75.15	9.86	0.73	1.75	2.20	0.75	0.28	1.47	4.51	1.11	0.65
72.81.20	Waskada DH	86.90	1.19	0.75	0.07	3.99	0.13	0.07	9.31	1.25	2.68	0.13
72.81.16	Waskada DH	90.75	0.68	4.94	0.12	0.11	0.11	0.11	0.09	0.86	3.90	0.26
72.81.15	I. Madeline DH	94.60	0.48	0.33	0.05	1.27	0.16	0.07	0.25	0.78	0.89	0.40
72.81.28	I. Madeline DH	90.10	4.50	0.70	0.12	0.27	0.18	0.25	2.25	1.01	0.33	0.56
72.81.29	Tudale Neepawa DH	85.70	6.71	0.88	0.19	0.03	0.28	0.34	2.66	2.22	0.36	0.63
72.81.30	Tudale Neepawa DH	68.25	11.80	4.70	0.81	0.38	0.63	0.50	1.13	7.38	2.84	0.97
72.81.31	Tudale Neepawa DH	72.50	14.86	0.93	1.40	0.05	0.68	0.67	1.03	6.48	0.10	1.09
72.81.1	MANIGOTAGAN DH* (Average)	95.22	1.14	0.76	0.19	0.16	0.09	0.08	0.61	0.49	0.54	0.55

*Average of 10 Analyses. Some contain trace amounts of H_2O, and S which were entered as 0.00 when calculating averages.

TABLE 7
Sieve Analyses of Ordovician (Winnipeg Formation) Sands

Sample No.	Location	+20	-20 +40	-40 +50	-50 +70	-70 +100	-100 +200	PAN
					mesh size			
Drill hole 2 (Avg.)	Seymourville	0.2	3.3	16.3	33.3	24.9	18.0	4.0
Drill hole 1 (Avg.)	Seymourville	0.2	10.5	21.9	34.2	20.9	10.9	1.4
22.81.12	Punk Island	0.0	1.0	8.0	75.4	12.2	3.0	0.5
72.81.14	Seymourville	0.1	14.1	33.5	34.2	12.8	5.2	1.0
82.81.1	Black Island	0.1	12.2	20.2	26.9	20.8	17.4	2.5

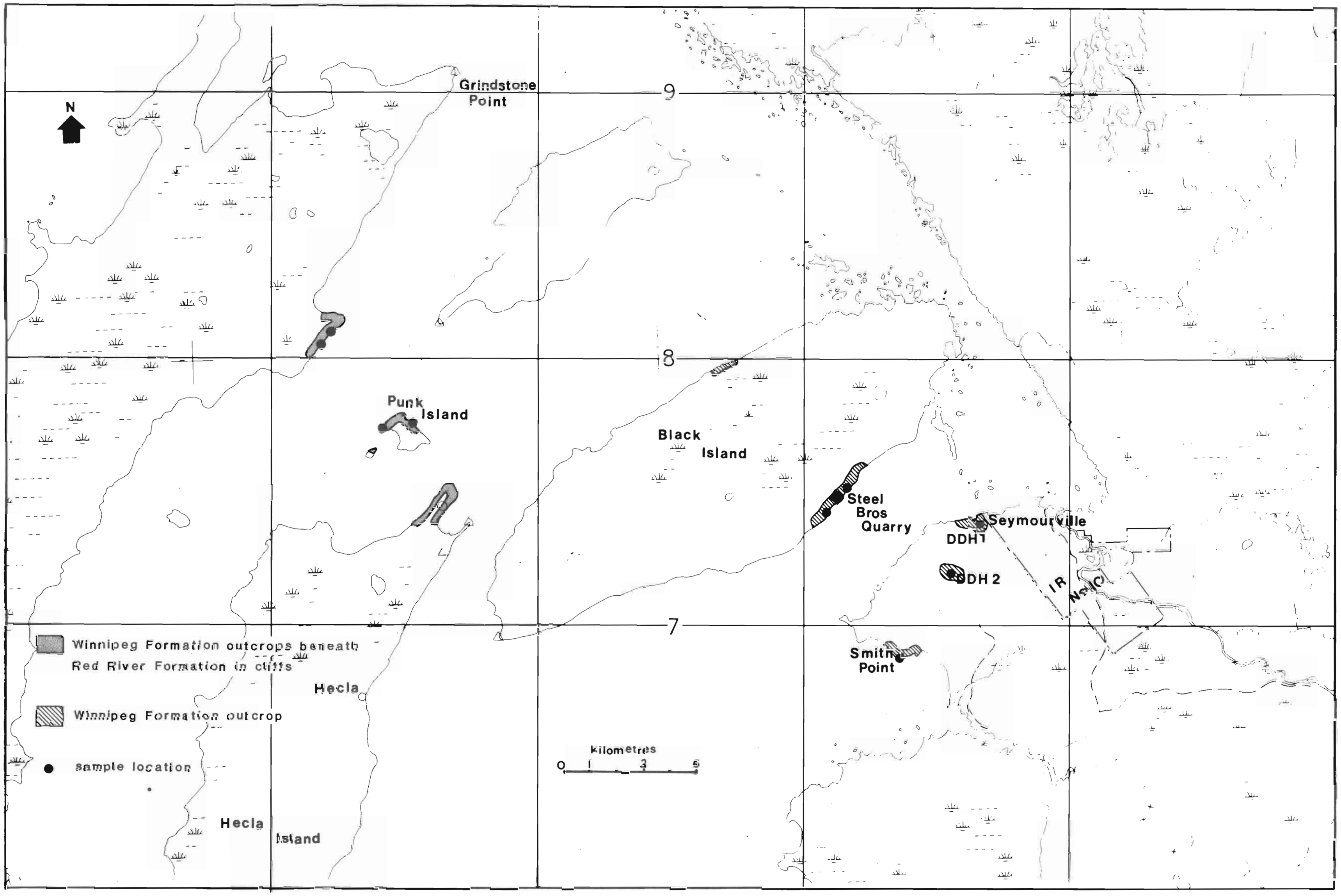

Figure 14. Location of sample sites in the Hecla-Black Island-Seymourville area.

Black Island

The first claims for silica on Black Island were staked in 1910, just 10 years after their initial description by Dowling (1900). Leases were acquired on both the north and south shores of the island; however, development was not undertaken until 1929, when Lakeshore Sand and Gravel started to quarry silica sand which was barged to Mid-West Glass in Winnipeg. This operation was on the south shore (Fig. 15) near the site of the present Steel Brothers quarry. Operations were moved in 1930 to the north shore (Fig. 14) and a 365 m pier was built to allow the sand to be mined on-shore and pumped into barges. The quarrying ceased in 1932 after troubles were experienced in maintaining the pier due to the exposed location. A further attempt was made to mine sand from this area in the 1950s by Dyson Limited. They quarried sand from the north shore and shipped it to their plant in Selkirk. In 1962, the Selkirk Silica Division of The Winnipeg Supply and Fuel Company Limited renewed quarrying on the south shore near the site of the original quarry. This operation was acquired by Steel Brothers in 1969 and is still active.

Steel Brothers quarries up to 100 000 tonnes per year from the lower unit of the Winnipeg (Fig. 16). The sand is drilled and blasted and hauled a short distance to the washing plant. The washing step disaggregates the sand, removes the slight iron coating on some grains, and washes out any kaolin and fine grained impurities. The sand is then stockpiled for shipment to Selkirk by barge. The quarry operates only during the summer months, but silica is shipped from the Selkirk plant all year round. At Selkirk the sand is screened and blended to meet specifications for the various customers.

The quarry operation is described by Spiece (1980) and Pearson (1984).

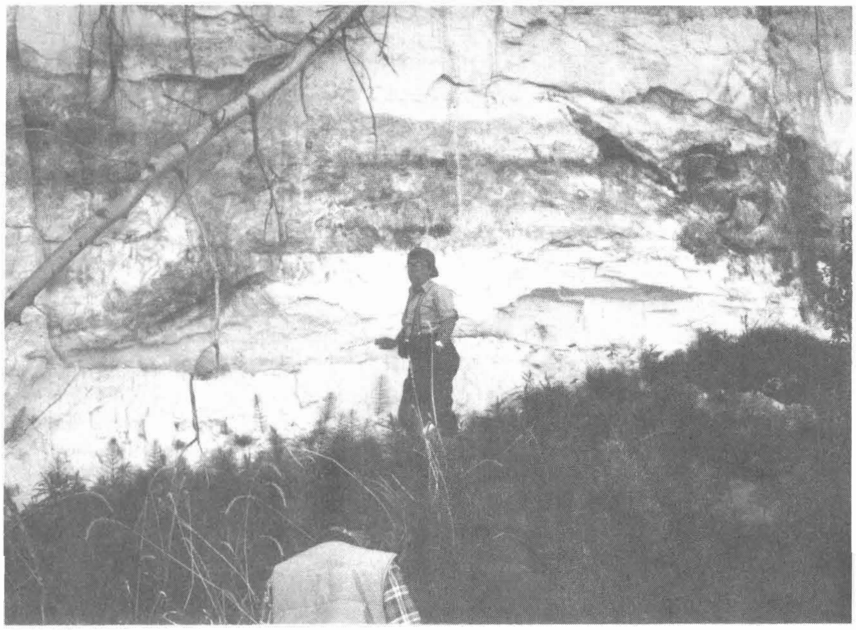

Figure 15:
Winnipeg sandstone, south shore, Black Island.

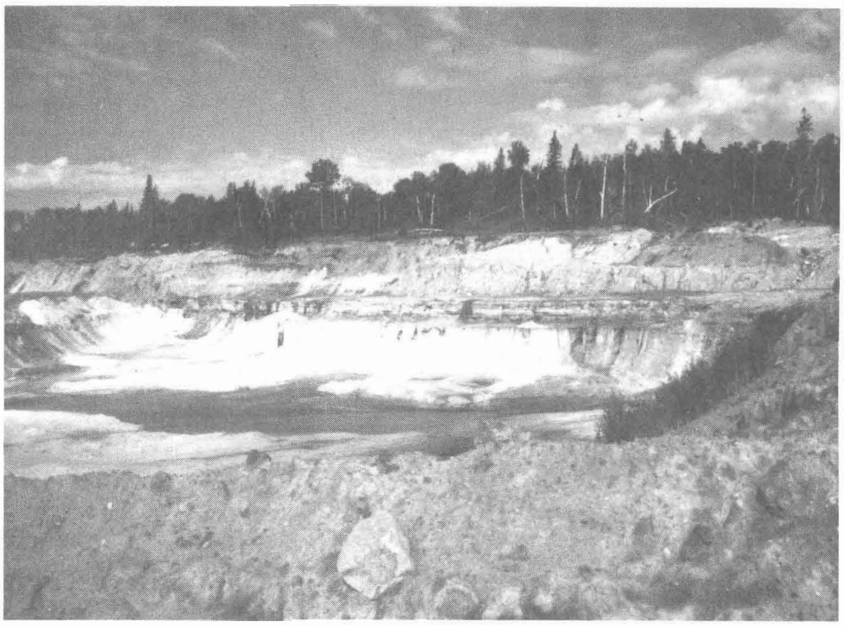

Figure 16:
General view, Black Island quarry.

Figure 17: Oolitic pyrite layer in Winnipeg sandstone, Black Island quarry.

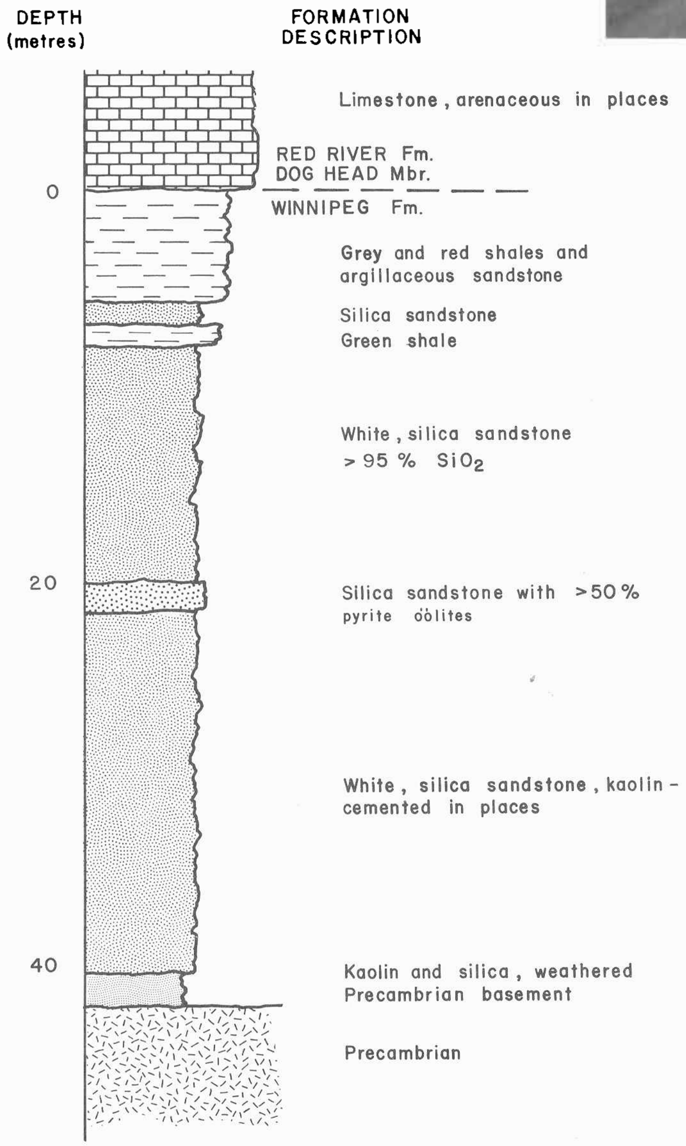

Figure 18. Cross-section of the Winnipeg Formation, Lake Winnipeg area.

Geology

The Winnipeg section as exposed in the Steel Brothers pit is typical of the basal sand (Lower unit) of the formation. At the base the sand becomes progressively more kaolinitic and grades into weathered Precambrian rock consisting of kaolin and weathered out quartz grains. This zone is overlain by 7 to 10 m of pure sandstone. The sand in this layer is slightly cemented by kaolin and iron oxides. The next layer is 0.5 to 1 m in thickness and is composed of sand with numerous desiccation cracks and burrows. These structures are filled with either silty sand or pyrite oolites. Oolites are typical of the next 2 m layer (Fig. 17). The pyrite oolites have been described by Genik (1952). The layer in which they occur consists of up to 75% pyrite with lesser amounts of sand and silty material. In some other areas the oolites are limonite. The limonite oolites occur at the same stratigraphic level as the pyritic oolites and presumably have been altered by groundwater action since deposition. Above the pyrite-rich layer and separated from it by a sharp boundary there is a layer of relatively pure sandstone 4 to 6 m thick. This was the uppermost layer exposed in the quarry in 1983. A diagrammatic cross-section is given in Figure 18 for comparison with several other areas.

Black Island and the nearby islands of Lake Winnipeg are now all part of Hecla Provincial Park. Although the Black Island quarry has reserves sufficient for many years of operation , and there is a large quantity of sand exposed on the other islands, it is unlikely that another quarrying operation will be permitted in the area.

Seymourville

Outcrops of Winnipeg sandstone have been known to occur on the east shore of Lake Winnipeg since Tyrrell and Dowling (1900) made their initial investigations in the area. Unfortunately their easily erodible nature causes some of these outcrops to be undercut and covered by slumped material. In addition the water level has been known to fluctuate enough to cover several of the reported outcrops. One such outcrop, on Smith Point, near Manigotagan, was examined during the 1982 field season. The report of a "sand pit" near Seymourville (Fig. 19) that seemed to expose similiar material (E. Nielsen and B. Bannatyne, pers. comm.) lead to additional work being undertaken by the author.

Figure 19: Winnipeg sandstone, Seymourville pit.

Initial investigation of the sand pit revealed that the sand was identical in character to the Winnipeg sandstone exposed on Black Island. A cap of hard, siliceous material (Fig. 15) containing black phosphate specks occurs at the top of the section above the main layer of sandstone. On Black Island this layer occurs at the western end of the pit. This unit is underlain by a 2 to 3 m thick fine, white, loosely cemented sandstone with minor iron staining and a minor amount of kaolin. A drill hole in the pit intersected 10.2 m of Winnipeg sandstone; however, another hole 2 km to the south in a Pleistocene sand pit intersected 26.8 m of Winnipeg sandstone. The material contains approximately 96% silica (Table 6). An inverval of lower silica content in hole number 2 corresponds with the pyritic layer described previously. This oolite layer contains pyritic oolites identical in character and mode of occurrence to those found in the Black Island quarry. Similar oolitic layers have also been found in cores from the Winnipeg (city) area and several other parts of the province.

No additional work has been done on this area. Part of the area is now held by the Seymourville Town Council, and part remains open. Based on the drill results and an altimeter survey, and estimated thickness above the predicted Precambrian, an estimated 600 million tonnes of silica sand averaging 95% SiO_2 is present over an area of 1800 hectares. Detailed drilling is required to confirm this estimate, as it is possible that thick glacial overburden may be present in some places. As this area is outside the boundaries of Hecla Provincial Park, and is accessible by road, it is the most promising area for future development of a deposit in the Winnnipeg Formation.

Ste. Anne

A thickened portion of the upper part of the Winnipeg sandstone near Ste. Anne was tested for possible mining by hydraulic methods. This unit, known as the Carman sand body, varies in thickness and extent. It is generally about 27 m thick and extends westward from Ste. Anne for about 240 km to Ninette. It ranges in width from 24 to 100 km (McCabe, 1978).

The sand in this body is similar to that in the lower Winnipeg at Black Island. It is a separate body, however, and is separated from the rest of the sand section elsewhere by shale-rich rocks. The body is probably a former offshore bar and the increased thickness of the Winnipeg section is due to the compaction of the sandstone being less than for the shale-rich sections elsewhere.

In 1966, the deposit was drilled in the area east of Steinbach (Fig. 13) by Norlica Minerals Limited (Underwood McLellan and Associates Limited, 1967). The drill holes intersected silica sand intermixed with shale, with high quality sand beneath the upper sand-shale layer. The sand ranged from loose to well cemented. Various methods were tried to loosen the sand, including water jets, suction and a mechanical cutter, in order to pump it from drill holes These methods were unsuccessful largely due to the presence of hard sandstone and shale layers within the section. The hard layers could not be broken and thereby prevented slumping and breakup of the sand layers between them. The sand that was recovered during this testing was upgraded to glass grade sand.

Although the 1966 program was unsuccessful, this area still has some potential as a source of silica. The sand is close to markets and transportation, and this alone would make up in part for the increased costs of extraction as compared to quarrying. The Government of Ontario is currently experimenting with new drills that have been successfully used to mine even harder material. If their tests are successful then the mining of some of the Carman body is definitely possible.

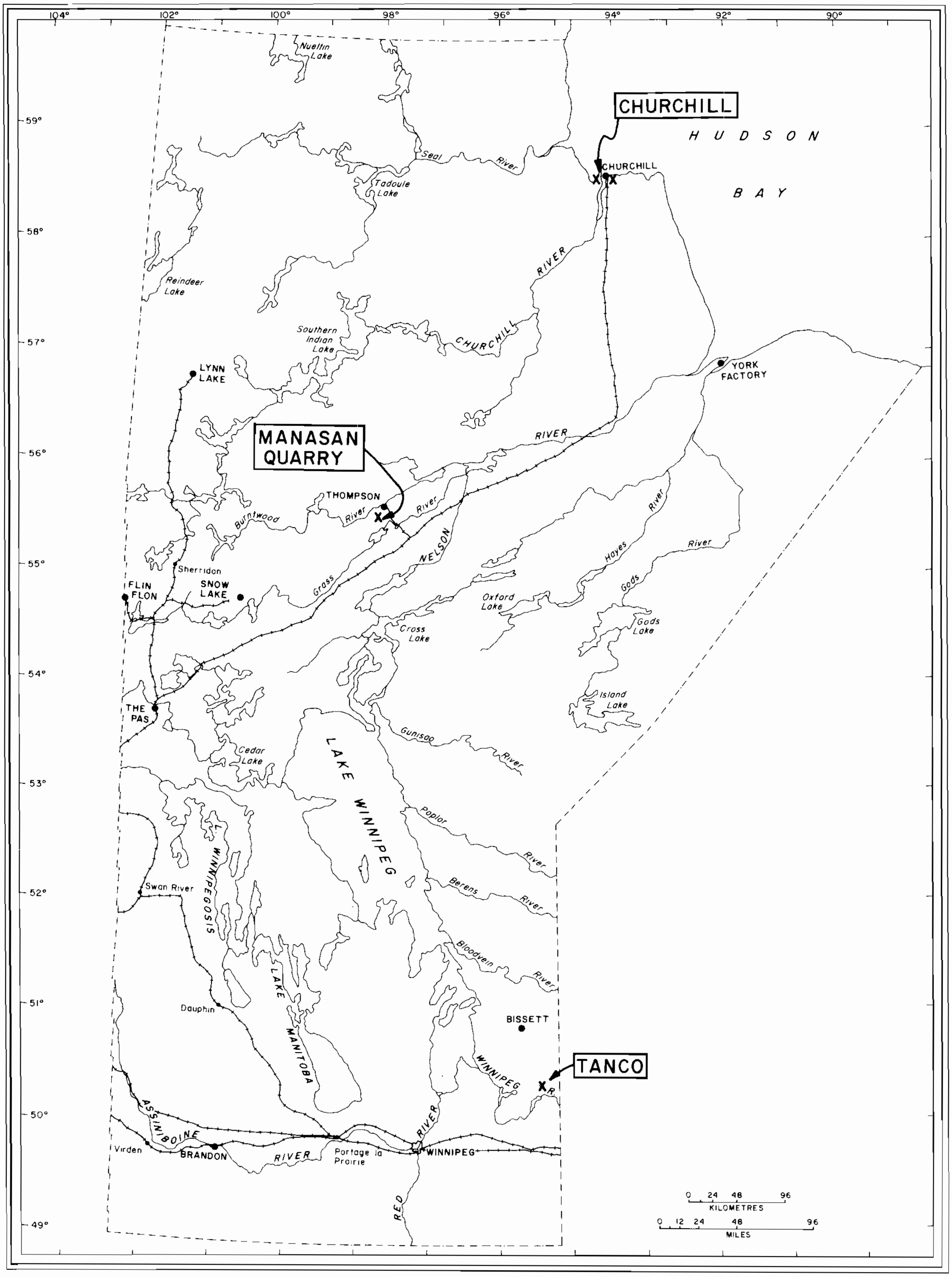

Figure 20. Location of described silica-rich Precambrian rocks.

Over 60% of Manitoba is underlain by Precambrian rocks. A few of these rocks are high enough in silica to be of interest as potential sources of silica. In general, the silica-rich rocks are metamorphosed equivalents of sandstones or other sediments. In addition many of the numerous pegmatite bodies in the province contain enough quartz to be of interest as a source of very pure silica-rich material. These pegmatite bodies have been described by Cerný et al. (1981) and Bannatyne (1985).

One Precambrian deposit is currently being worked as a source of silica; the Manasan Quarry supplies silica flux for the smelter at Thompson. Quartz production has also been considered at the Tanco Mine. The quartz portion of the Tanco pegmatite has been estimated to contain 780 000 tonnes of pure quartz (Crouse et al., 1979). A small amount of quartz has been produced as a decorative aggregate in the past. Locations of the described deposits are shown in Figure 20.

DEPOSIT DESCRIPTIONS

Manasan Quarry

The Manasan Quarry is operated for Inco Ltd. to supply approximately 100 000 tonnes of flux to the smelter at Thompson. The quarry is about 20 km southwest of town. The rock is crushed at the quarry and hauled by truck to the smelter.

The deposit consists of a series of meta-arkoses (Cranstone et al. 1970) that have been folded into a horseshoe shape (Fig. 21). The grade is variable but averages 80% silica. The material contains minor amounts of iron and alumina that do not affect its use as a flux. The rock has not been evaluated for its potential for other silica uses.

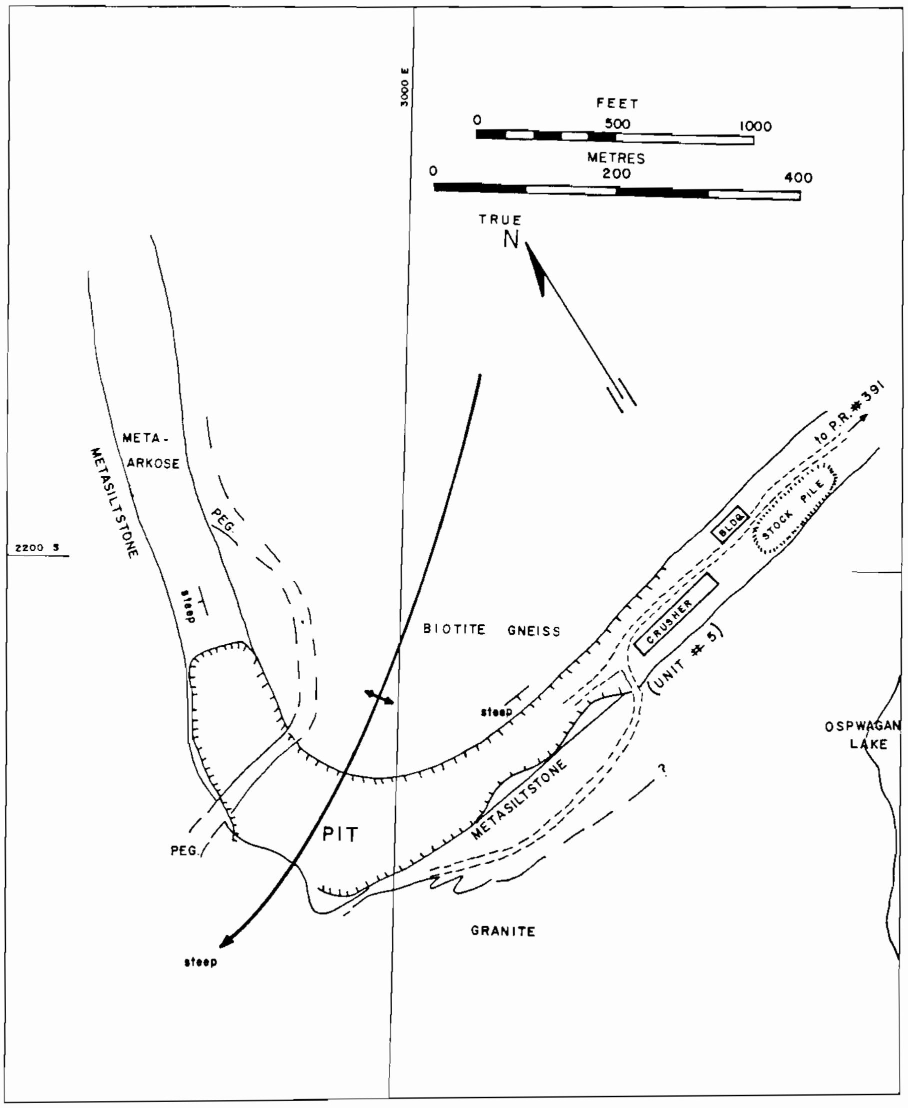

Figure 21. Geology of the Manasan deposit (from Cranstone et al., 1970).

Tanco Mine

The Winnipeg River - Cat Lake area contains many pegmatite bodies, some of which contain appreciable amounts of quartz. The area has been described by Cerny et al. (1981), and the Tanco pegmatite (Fig. 22) has been described in a paper by Crouse et al. (1979) and by Trueman and Turnock (1982). The Tanco pegmatite has been operated for tantalum and other minerals, and only a small amount of quartz has been produced for decorative aggregate. However, the pegmatite contains at least 780 000 tonnes of pure quartz. The quartz is almost pure silica, as it contains very little iron or other undesirable material.

A considerable amount of quartz is present in the tailings from the tantalum mining operation. These tailings consist of quartz, feldspars and mica, and although no test work has been undertaken it may be possible to separate these minerals. A chemical analysis of the tailings is given in Table 8.

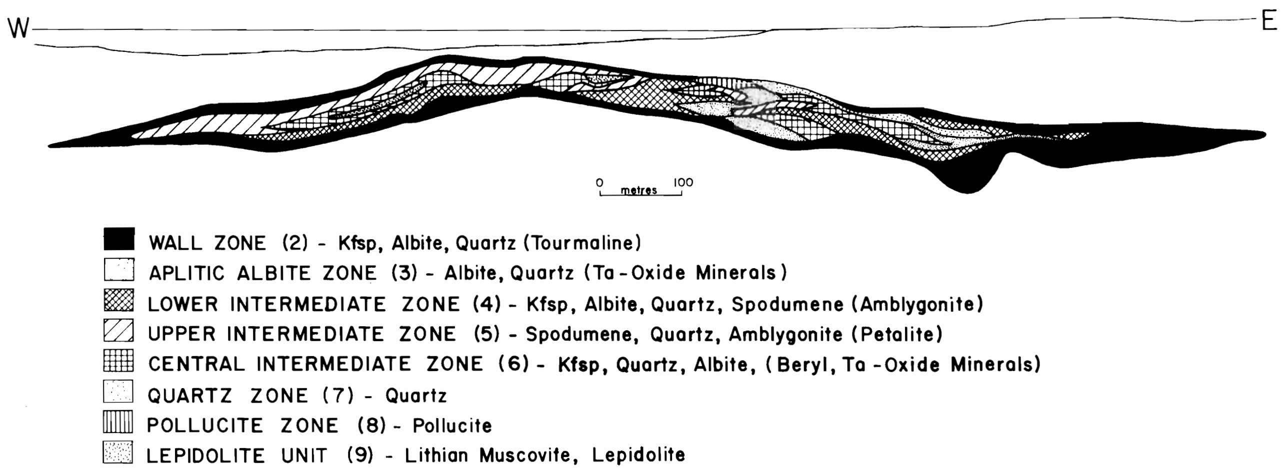

Figure 22. General geology of the Tanco deposit (from Trueman and Turnock, 1982).

TABLE 8
Chemical Analyses of Churchill Quartzite and Tanco Tailings

Sample No.	Location	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	NaO	K_2O	H_2O	S	CO_2	Source*
						Weight per cent							
72.82.01	See Figure 23	85.44	6.80	3.81	0.26	0.06	0.13	0.08	1.58	0.95	TR	0.03	1
72.82.02		94.51	1.65	0.88	0.16	0.06	0.18	0.03	0.72	0.48	NIL	0.15	1
72.82.03		85.15	7.44	3.39	0.32	0.09	0.13	0.08	1.46	1.25	NIL	0.07	1
72.82.04		88.07	6.45	2.70	0.24	0.06	0.15	0.09	1.31	1.00	0.08	0.07	1
72.82.05		86.32	6.59	2.97	0.28	0.06	0.13	0.08	1.55	1.02	0.01	0.35	1
72.82.06		96.85	0.91	0.83	0.17	0.03	0.06	0.04	0.33	0.27	0.01	0.12	1
72.82.07		86.02	7.23	2.85	0.26	0.09	0.13	0.08	1.31	1.14	TR	0.15	1
72.82.09		88.37	5.66	2.04	0.24	0.07	0.39	0.05	1.60	0.79	NIL	0.07	1
72.82.11		89.24	5.21	1.90	0.18	0.01	0.27	0.05	1.50	0.71	NIL	0.07	1
24.4.0019	See Figure 23	97.00	1.62	0.31	0.12	0.07	0.05	0.02	0.49	0.42	0.02	0.15	2
24.4.0012-1		97.20	1.27	0.68	0.12	0.01	0.02	0.04	0.28	0.46	NIL	0.14	2
24.4.0012-3		97.65	0.98	0.60	0.12	NIL	0.02	0.02	0.21	0.28	0.01	0.12	2
24.4.0013		75.50	12.87	3.82	0.28	0.01	0.89	0.07	3.82	1.88	0.01	0.15	2
24.4.0034		87.25	6.35	2.96	0.16	0.01	0.11	0.04	1.86	0.76	NIL	0.09	2
24.4.2001		87.95	6.20	2.44	0.16	0.01	0.11	0.03	1.69	0.88	NIL	0.27	2
24.4.0001-1		88.65	5.70	1.65	0.20	0.07	0.23	0.08	1.84	0.90	TR	0.30	2
24.4.0010		90.90	4.66	1.88	0.16	0.03	0.21	0.05	1.45	0.81	TR	0.15	2
24.4.0007		87.55	6.36	2.21	0.16	0.04	0.17	0.04	1.89	1.12	NIL	0.15	2
24.4.0022		88.70	6.02	1.35	0.16	0.01	0.30	0.03	2.03	0.95	0.01	0.15	2
24.4.0021		88.15	6.24	1.78	0.16	0.01	0.30	0.04	2.10	1.05	NIL	0.23	2
72.81.38	Tanco tailings	74.6	15.12	0.02	0.35	0.36	0.18	3.73	2.83	0.83	TR	0.14	1

*Sources 1) material collected this study; 2) MRD files; Samples collected by D.C.P. Schledewitz.

Churchill Quartzite

The Churchill quartzite outcrops as a series of low-lying ridges in the vicinity of the town of Churchill and along the shores of Hudson Bay on both sides of Churchill River (Fig. 23).

The rocks are a series of fairly pure quartzites containing up to 95% silica or more (Table 8). The main impurities are mica and minor feldspar. The beds of quartzite are massive and almost featureless, containing very few inclusions of other rock types. Exposures to the east of Churchill consist of a few beds that contain small pods of coarser material that cannot be traced for more than a few metres nor correlated between outcrops. The Churchill quartzite has been described by Bostock (1969) and Schledewitz (1985).

At this time no testing has been done to determine whether or not this material could be upgraded to glass grade; however it already meets the classical specifications for several uses requiring lump material including silicon carbide, ferro-silicon and various fluxes (Table 1).

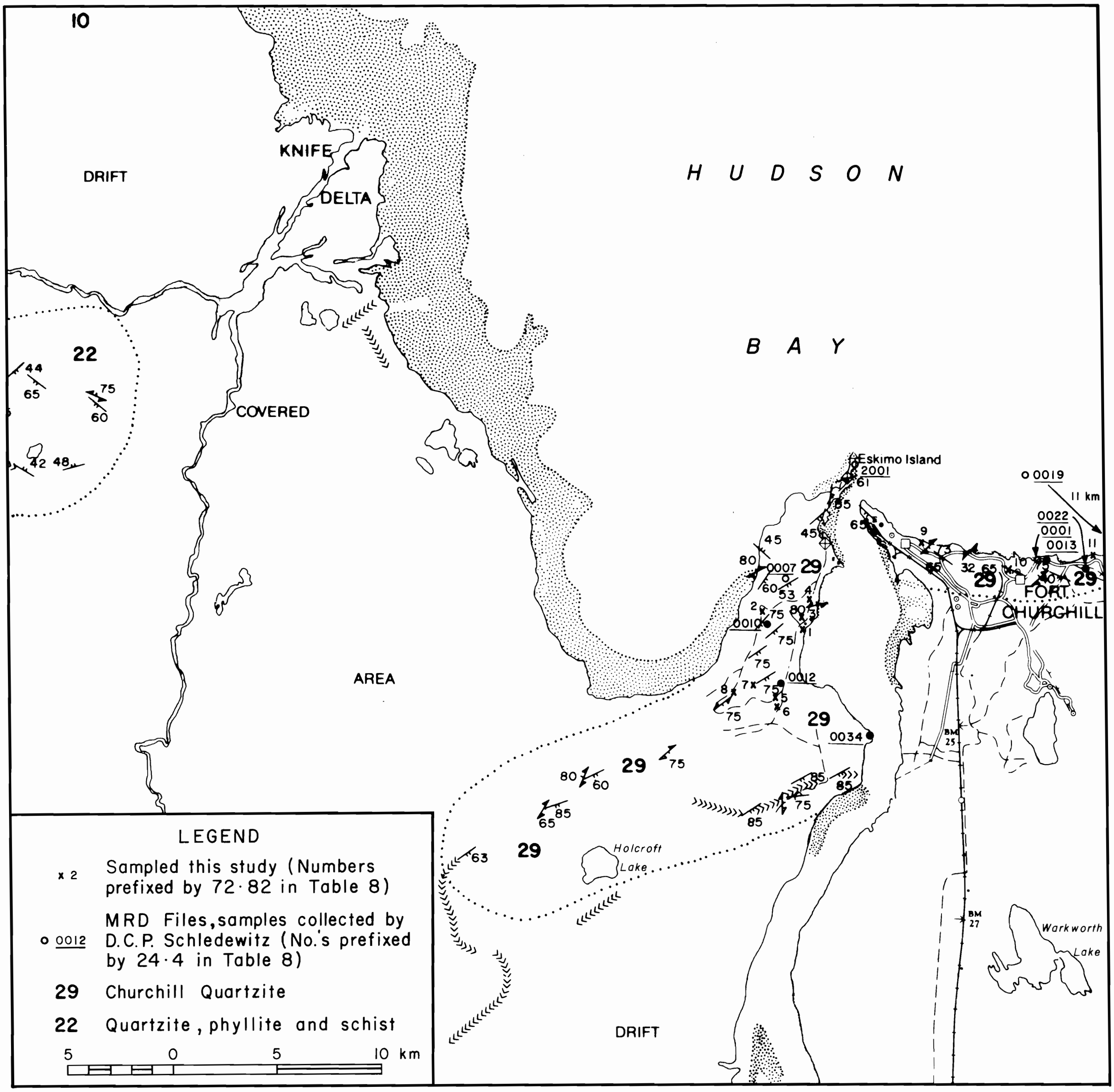

Figure 23. Distribution of Churchill quartzite and sample locations (from Map GR80-9-4 in Schledewitz, 1985).

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APPENDIX: MINERAL INVENTORY CARDS

PRODUCT	SILICA SAND	PROVINCE OR TERRITORY	Manitoba	N.T.S. AREA	62I/2 SW	REF.	SIA1

NAME OF PROPERTY BEAUSEJOUR

OBJECT LOCATED Sand Quarry

UNCERTAINTY IN METRES 50 Lat. 50° 03'20" Long. 96° 31'20"

Mining Division (Winnipeg) District

County Township or Parish

Lot Concession or Range

Sec 35, 36 Tp. 12 R. 7 EPM

OWNER OR OPERATOR AND ADDRESS

Alsip Brick, Tile and Lumber Co. Ltd.
1 Cole Avenue
Winnipeg, Manitoba
R2L 1J3

DESCRIPTION OF DEPOSIT

Silica sand is quarried in Beausejour from a Pleistocene delta deposit. The fine, unconsolidated, frosted sand shows angular bedding with muscovite lying along the bedding planes. The sand is thought to be largely derived from the Winnipeg Formation sandstone. There is an appreciable amount of grains present other than silica, such as limestone, feldspar, hornblende and pyroxene.

Physical Properties: The sand is of a uniform grade (See Fig. 11, Macauley 1952). (Screen analyses and other tests can be found in Cole 1928 and Macauley 1952).

Chemical Properties: SiO_2 ranges from 76.30% to 89.60% and Fe_2O_3 from 0.43% to 0.88% (see Cole 1928).

Uses: Portland cement; in the past, for sand-lime brick and glass (bottles).

HISTORY OF PRODUCTION

1906 to 1913 – Diamond Flint Glass Co. Ltd. quarried sand for its glass plant and for the sand-lime brick plant in Beausejour. Some was shipped to the Dominion Glass Co. Ltd. plant in Redcliff, Alta.

1946 – By 1946 Alsip Brick, Tile and Lumber Co. Ltd. was operating the quarry. From 1946 to 1953, production of sand ranged between 13580 and 22170 m^3, used mainly in portland cement.

1966 – Production dropped from 40845 tonnes in 1965 to 13540 tonnes due to a drop in demand by cement manufacturers

Shipping Point Beausejour Distance from Mine 64 km
Material Shipped silica sand Carrier Mail
Destination Fort Whyte – Canada Cement Lafarge Ltd.

MAP REFERENCES

Fig. 1, silica in Canada (Cole, 1928) sketch

#Map, 1977 Wpg.-13, 62I/2 Selkirk, Quaternary Geology Preliminary Map, Sc. 1:50 000, Man. MRD.

Map 62I/2 Selkirk, (Topo.), 1:50 000; Surveys and Mapping Br., Ottawa.

REMARKS The heavy mineral content, forming 1.5% of the sample, consists of hornblende, epidote, garnet, magnetite, rutile, zircon, glaucophane, hematite, monazite, staurolite, and tourmaline (Wallace and McCartney, 1928).

The glass plant operation is referred to in an unpublished report as the Manitoba Glass Co., chartered in 1909.

Comp./Rev. By N.L.L.
Date 06-78

HISTORY OF EXPLORATION AND DEVELOPMENT

Beausejour is approximately 58 km northeast of Winnipeg.

1906 – Lamont Glass Co. established a glass plant and quarry in Beausejour under the name of Diamond Flint Glass Co. Ltd. It had ceased operation by 1913 when it was amalgamated into the Dominion Glass Co. Ltd.

1908 – From 1908 to 1913 Manitoba Pressed Brick Co., operated a sand-lime brick plant in Beausejour using the sand from the quarry, and lime from the Tyndall-Garson area.

1913 – After the plants were shut down some sand was shipped to the Dominion Glass plant in Redcliff, Alta.

1928 – In 1928 the pit was owned by the town and was not being operated.

1946 – By 1946 Alsip Brick, Tile and Lumber Co. Ltd. was operating the quarry for Portland cement, sand-lime brick and mould dusting. They produced 17 585 m^3 of sand.

1967 – The sand was mined with scrapers, loaded into bins and conveyed directly to railcars. In the late 1960s the company began recovering sand by pumping it from beneath the water (9m deep). The sand-water slurry is fed to the top of the stockpile where a scraper loader is used to move the sand to railcars.

1973 – By 1973 the quarry was about 365 m at its longest point by 260 m wide. It extended to 10 m beneath the water level and 5.5 m above in the southwest corner.

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PRODUCT SILICA SAND

PROVINCE OR TERRITORY Manitoba

N.T.S. AREA 62I/7 SE

REF. SIA1

NAME OF PROPERTY BROKENHEAD

OBJECT LOCATED Silica Sand Quarry

UNCERTAINTY IN METRES 50 Lat. 50° 16'00" Long. 96°34'15"

Mining Division (Winnipeg) District

County Township or Parish

Lot Concession or Range

L.S. 15 Sec 9 Tp. 15 R. 7EPM

OWNER OR OPERATOR AND ADDRESS

Red River Brick and Tile
(I-XL Industries Ltd.)
PTH No. 44
Lockport, Manitoba

DESCRIPTION OF DEPOSIT

Sand with a high silica content is quarried in a small pit near Brokenhead from a large pocket which is bounded on both sides by other sands which contain a considerable amount of limestone. The silica sand itself is very high in quartz particles with only a slight trace of limestone or dolomite, but it is accompanied by particles of feldspar and volcanic and sedimentary rocks. It is thought to originate from weathering of Precambrian rocks and from Ordovician Winnipeg Formation sand, reworked in the Pleistocene. The sand is light beige and fires to a very pale tan color.

Uses: It is used in brick making as an admixture with other clays to improve drying and to control shrinkage.

HISTORY OF PRODUCTION

1971 - In 1971 Red River Brick and Tile (a division of I-XL Industries) began quarrying silica sand for their brick plant 2 mile east of Lockport. Production continues to the present (1978).

Shipping Point - Brokenhead Distance from Mine - 70 km.

Material Shipped - silica sand Carrier - Truck

Destination - Red River Brick & Tile (3 km. east of Lockport on Highway 44).

MAP REFERENCES

#Map, 1977: WPG-18, 62I/7 Red River Delta, Quaternary Geology Preliminary Map, 1:50 000, Man. MRD.

Map 62I/7, Red River Delta (Topo.), 1:50 000; Surveys & Mapping Br., Ottawa.

REMARKS

Comp./Rev. By N.L.L.
Date 06/78

HISTORY OF EXPLORATION AND DEVELOPMENT

The pit is located south of Provincial Road 317, nearly mid-way between Highways 12 and 59.

1970 - G. H. Sissons (for Medicine Hat Brick and Tile) took out quarry permit W1681 and W1682.

1971 - W1681 and W1682 were cancelled and Medicine Hat Brick and Tile Co. took out quarry leases M602 and M603 on the same land. The leases were assigned to the Manitoba Development Corp. the same year. Medicine Hat Brick and Tile began quarrying in 1971 and have continued under the name of Red River Brick and Tile, to the present.

1978 - M602 and M603 were converted to Q.L. 145.

REFERENCES

Shayna, M., 1975: Clays of Manitoba and Specific Clays used by Red River Brick and Tile for Brick Products; C.I.M. Bulletin, Sept., 1975, p. 81-84.

PRODUCT SILICA SAND | PROVINCE OR TERRITORY Manitoba | N.T.S. AREA 62I/7 SE | REF. SIA 2

NAME OF PROPERTY LIBAU EAST

OBJECT LOCATED

UNCERTAINTY IN METRES Lat. 50°16' Long. 96°34'

Mining Division District

County Township or Parish

Lot Concession or Range

Sec 9 Tp. 15 R. 7 EPM

L.S. 11

OWNER OR OPERATOR AND ADDRESS

Frailick Ltd.
Box 96
Beausejour, Manitoba
ROE 0C0

DESCRIPTION OF DEPOSIT

Silica sand of glaciofluvial origin is used by Frailick Ltd. to prepare dried sand for railway traction sand, as an additive for Portland Cement, and for other uses.

Physical Properties: None available.
Chemical Properties: None available; very low carbonate content
Use: Used for railway traction sand, in cement, and other uses.

HISTORY OF EXPLORATION AND DEVELOPMENT

The pit is located approximately 10 km east of Libau, and is on Crown Land.

1978: Quarry Lease 189 was issued to Frailick Ltd. in August for the removal of sand and gravel from the W½ of the W½ of l.s. 10, and the E½ of the W½ and the E½ of l.s. 11 in sec. 9-15-7E.

1979: Quarry Leases 269-272 were issued to Frailick Ltd. on April 12 for the removal of sand and gravel. Quarry Lease 269 covers the E½, and the E½ of the W½ of l.s. 10-9-15-7E. Quarry Lease 270 covers the W½ of the W½ of l.s. 11-9-15-7E. Quarry Lease 271 covers the W½ of l.s. 1, l.s. 2, E½ of l.s. 6, and l.s. 7-9-15-7E. Quarry Lease 272 covers the E½ of l.s. 10, l.s. 9, l.s. 15, and l.s. 16-4-15-7E.

The first production of sand occurred during the summer of 1979 from l.s. 11-9-15-7E. The pit was 30 m x 60 m, and 6 to 8 m deep. The upper 1 m is impure and is discarded. A kiln on the site is used to prepare dried sand for railway traction sand.

HISTORY OF PRODUCTION

Production figures are unavailable:

Shipping Point: Pit
Distance from Mine: 65 km
Material Shipped: Sand (silica-rich)
Destination: Winnipeg - Various
Carrier: Truck

REFERENCES

Industrial Minerals Geologist Files, Man. MRD.
Mining Recording Files, Man. MRD.
Neilsen, E., personal communication, July, 1979.

MAP REFERENCES

Map 62I/7, Red River Delta (Topo.); 1:50 000; Surveys Br., Mapping Br., Ottawa.

REMARKS

According to Erik Neilsen (personal communication, July, 1979) the sand deposit shows features (ripple marks, cross-bedding) indicating a glaciofluvial origin. The pit is near the north edge of the Mars Hill Wildlife Management area.

Comp./Rev. By	CWJ
Date	08-79

PRODUCT	SILICA SAND (LIGNITE)	PROVINCE OR TERRITORY	Manitoba	N.T.S. AREA	62N/16 NE	REF.	SIA 1

NAME OF PROPERTY PINE RIVER

OBJECT LOCATED Sand Pits

UNCERTAINTY IN METRES Lat. 51°54'30" Long. 100°17'00"

Mining Division District

County Township or Parish

Lot Concession or Range

Sec	Tp.	R.
6, 7	34	20WPM
1	34	21WPM

OWNER OR OPERATOR AND ADDRESS

J. C. Maillard
Ste. Rose du Lac
Manitoba

DESCRIPTION OF DEPOSIT

Silica sand of the Lower Cretaceous Swan River Group was tested to see if the sand was suitable for use as an iron-foundry sand. Samples of the sand were selected from various locations in Sec. 6 and 7, Twp. 34, R. 20 W., and Sec. 1, Twp 34, R. 21W. Analysis of sand from Sec. 7 indicated a high grade silica sand, which could probably be used as a source of material for glass. The sand in Secs. 6 and 1 are of glacial origin.

Chemical Properties: a single analysis of the sand yielded 99.56% SiO_2 and 0.10% Fe_2O_3 in 1943 (Swan River Group).

Physical Properties: as above

Use : the sand was to be used for iron foundry sand

(Work in the mid-1930's and in 1947-1953 was involved with unsuccessful development of lignite).

Associated minerals or products of value

Lignite

SKB-174

HISTORY OF PRODUCTION

Production records are unavailable. The initial interest in the deposits, as early as 1936 by J. H. Furber, was for the lignite potential. A shaft or shafts sunk about that time were reported to have intersected lignite seams above the 18.2 m level. The shafts and pits are located in sandy strata in the north shore of Pine River, and were water-filled or caved when examined by Mines Branch personnel. A. D. Baillie described an outcrop of a 1 m seam of coaly material along the river bank in this area. The work in the 1960's was directed toward development of a market for the associated silica sand, and nearby glacial sands.

MAP REFERENCES

Map 62N/16, Sagemace Bay (Topo.), 1:50 000; Surveys & Mapping Br., Ottawa.

Map 12, Industrial Minerals Producers (Index), 1:1000 000; Man. MRD.

REMARKS

Several other Quarry Permits were issued to various individuals for the removal of silica sand in Sec. 6, and Sec. 7 of Twp. 34, R. 20W., and Sec. 1 of Twp. 34, R. 21W. between 1943 and 1979. No removal or exploratory work is known. (cont'd)

Comp./Rev. By CWJ

Date 03-79

HISTORY OF EXPLORATION AND DEVELOPMENT

The deposits are located approximately 33.7 km northeast of Pine River. Some shaft(s)? for lignite were sunk about 1936.

1943-Boring Permit No. 154 was issued to J. H. Furber covering 258.9 hectares in Sec. 7, Twp. 34, R. 20W on April 27. Later that year J. H. Furber was issued Quarry Permit W-48 covering 16.1 hectares in l.s. 14 of Sec. 7, Twp. 34, R. 20W for the removal of silica sand.

1945-Quarry Permits W-61, and W-80 were issued to J. H. Furber covering 80 acres in l.s. 11, 15 of Sec. 7, Twp 34, R. 20W for the removal of silica sand.

1947-Minor exploratory work was carried out on l.s. 11 and l.s. 15 of Sec. 7, Twp. 34, R. 20W. The work consisted of sinking prospect pits and drilling test holes.

1948-According to the Manitoba Mines Branch during 1948 Silico Limited carried out exploratory work on leases held for coal, clay and silica sand on Sec. 7, Twp. 34, R. 20W. An occurrence of lignite coal is known to outcrop on the north bank of the Pine River at this location. Previous operators sank several prospect pits in an attempt to prove up the extent and thickness of the seam. Little information was obtained other than encountering of lignitic material. During 1948 overburden was removed to a depth of 4.2 m using a bulldozer. This work was stopped, as the stripping of the clay to a greater depth proved impractical. At the year end, one of the old shafts was being cleaned out in the hope that coal could be proven in the old workings.

1949-The bulldozing of overburden was carried out.

1950-51-Drill testing was carried out on Quarry Permit W-61 and W-80.

1952-53-Exploratory shafts were sunk on l.s. 11, 15 of Sec. 7, Twp. 34, R. 20W. These shafts were 1.2m x 1.8m x 6.0m in dimension.

1961-Quarry Permits W-48, W-61, and W-80 were assigned to Ray W. Johnson in March, and were cancelled in October.

1962-Quarry Permits W-851, W-852, and W-855 were issued to Edward W. Hawkins covering the E½ of l.s. 10, W½ of l.s. 11, and the W½ of l.s. 14 of Sec. 6, Twp. 34, R. 20W on Sept. 31, 1962 (cont'd)

REFERENCES

Annual Report, 21st, p. 89.

Bannatyne, B.B., 1978: Summary of Available Data on Lignite Deposits, Turtle Mountain, Manitoba (with a note on other Occurrences in the Province); Econ. Geol. Rept. 77/1, Man. MRD, p. 20.

Baillie, A.D., 1949: Coal at Pine River; memo on file, MRD.

Industrial Minerals Geologist Files, Man. MRD.

Mining Recording Files, Man. MRD.

DESCRIPTION OF DEPOSIT (cont'd)

Lignite: According to Bannatyne (1978), "Selected samples, reported to be from the (Furber and Johnson) shaft, were analyzed. They showed a high ash content (over 25 per cent) and a best calorific value of 4790 BTU/lb (as received) or 7,760 BTU-lb (dry basis)."

HISTORY OF EXPLORATION AND DEVELOPMENT (cont'd)

1963-Quarry Permits W-901 and W-906 were issued to Edward W. Hawkins, and J. C. Maillard covering l.s. 2 and l.s. 7 of Sec. 7, Twp. 34, R. 20W on May 13, 1963.

1963-1966-Small quantities of sand, mainly for foundry sand, were removed from Q.P. W-851, W-852, W-853, W-901, and W-906 about 1963 to 1966, and may have been used mainly for test purposes.

1964-Samples in the area were collected by the Manitoba Mines Branch from the Swan River Group and were tested by the Mines Branch, Ottawa.

1968-Q.P. W-855 was cancelled.

1972-Q.P. W-851 and W-852 were cancelled.

1976-Former Quarry Permits W-901, and W-906 were converted to Quarry Leases 149 and 150.

REMARKS (cont'd)

The test pits located in Sec. 6, Twp. 34, R. 20W, and Sec. 1, Twp. 34, R. 21W are located on glacial beach ridges.

PRODUCT SILICA SAND | PROVINCE OR TERRITORY Manitoba | N.T.S. AREA 62 P/1 NW | REF. SIA1

NAME OF PROPERTY BLACK ISLAND - SOUTHEAST SHORE

OBJECT LOCATED Sandstone Quarry

UNCERTAINTY IN METRES 500 Lat. 51°11'55" Long. 96°24'00"

Mining Division (Winnipeg) District

County Township or Parish

Lot Concession or Range

Sec 10 Tp. 26 R. 8EPM

OWNER OR OPERATOR AND ADDRESS

Steel Brothers Canada Ltd.
1325 Ellice Avenue
Winnipeg 21, Manitoba
R3G 0G1

DESCRIPTION OF DEPOSIT

A band of sandstone of the Winnipeg Formation (Ordovician) outcrops for 2135 m along the southeast shore, northeast from a point midway along the shore. It is believed to extend 6096 m. across the island. The outcrop on the north shore is described on card 62P/1, SIA2. The south shore cliffs rise up to 21 m from the beach, 30 to 152 m back from the water level. The semi-consolidated, nearly flat-lying beds (to nearly 14 m thick) consist of rounded, frosted quartz grains loosely cemented with limonite and kaolinite. It ranges from pure white to iron-stained chocolate brown. The deposit is capped in places by a firmly cemented chocolate colored till.

Physical Properties: Heavy Minerals are present in a total concentration of less than 1%: mainly tourmaline, zircon, and magnetite (Genik, 1952). For grain size analyses, see Cole.

Chemical Properties: Unwashed analyses ranged from 95.52 to 97.48% SiO_2 and 0.192% to 0.096% Fe_2O_3 (See Cole). Washed yielded 99.588% SiO_2 and 0.02% Fe_2O_3 (See Bannatyne). (cont'd)

Associated minerals or products of value

Kaolin: Kaolinized schistose rock was encountered during dredging at the quarry site in 1963.

HISTORY OF PRODUCTION

1929 - to approximately 1931 - Lake Bar Sand and Gravel Co. Ltd. quarried and shipped silica sand to Mid-West Co. Ltd. in Winnipeg.

1962 - Mining commenced by Selkirk Silica Co. Ltd. and 9070 tonnes of silica sand was shipped to Selkirk.

1964 - By 1964 the average annual tonnage was 42,878 tonnes.

1978 - Quarrying continues to present.

Shipping Point - Black Island Distance from Mine 135km (water)

Material Shipped - Silica Sand Carrier - Barge

Destination - Selkirk Silica Co. Ltd, Selkirk, Manitoba

MAP REFERENCES

Map and Section (Cole 1928)

Map 62P, Hecla (Topo.), 1:250 000; Surveys & Mapping Br., Ottawa.

Map 12, Industrial Minerals Producers (Index), 1:1000,000; Man. MRD.

#Claim Map Series N.W. 1 - 62P, Sc. 1:31, 680, 1961+, Mining Recording, Man. MRD.

REMARKS The heavy mineral content is discussed by R. C. Wallace and G. C. McCartney in "Heavy minerals in Sand Horizons in Manitoba and Eastern Saskatchewan", (1928) Trans. Roy. Soc. Can., 3rd series, Vol. 22, Sec. IV, p. 199-214.

Comp./Rev. By N.L.L.

Date 05/78

HISTORY OF EXPLORATION AND DEVELOPMENT

Black Island is situated in Lake Winnipeg, approximately 97 km north of the southern end of the Lake.

1910 - J. H. Sutherland, J.R. Sutherland and J. S. Sutherland took out quarry leases 18, 30 and 17.

1924 - By this time all claims were controlled by J.H. Sutherland.

1929 - Lake Bar Sand and Gravel Co. Ltd. quarried silica sand and waterhauled it to Mid-West-Glass Co. Ltd. in Winnipeg.

1931 - Prior to 1931 operations were moved to the north shore where claims were acquired in 1930.

1934 - The quarry leases were cancelled.

1960 - A silica sand plant at Selkirk owned by Selkirk Silica Co. Ltd. was acquired by the Winnipeg Supply and Fuel Co. Ltd.

1961 - 1966
E. E. Robertson was issued quarry permits W619(1961), W969(1963) and W1361, W1363, W1364 (1966).

1962 - A 91 m dock was constructed and mining was begun in August. The sandstone was drilled and blasted, disaggregated with a hydraulic monitor, and pumped through a hydroclone. 9070 tonnes of silica sand was barged to the screening and drying plant at Selkirk.

1965 - A washing and screening plant was built at the quarry site, and 3 different size ranges of silica sand were stockpiled.

1966 - 72,575 tonnes of silica sand were shipped to the classification plant in Selkirk. The company drilled 7 holes into the Winnipeg Formation under Industrial Minerals Drilling Permits. Quarry permits 1361, 1363, 1364 were assigned to the Winnipeg Supply and Fuel Co. Ltd. Quarry permits W619 and W969 were converted to M574 and M575 and assigned to Winnipeg Supply.

(cont'd)

REFERENCES

Ann. Repts., Man. Mines Br., 1963, p. 8; 1968, p. 37.

Baillie, A.D., 1952: Ordovician Geology of Lake Winnipeg and Adjacent Areas; Man. Mines Br., Publ. 51-6.

Bannatyne, B.B., 1971: Industrial Minerals of the Sedimentary Area of Southern Manitoba; Geol. Ass. Can., Special Paper No. 9, p. 243.

Cole, L.H., 1928: Silica in Canada, Its Occurrence, Exploitation, and Uses, Part II Western Canada; Mines Branch Ottawa, Rept. 686, p. 13-25.

Davies, J.F., 1951: Geology of the Manigotagan-Rice River Area; Man. Mines Br., Publ. 50-2, p.11-12.

Genik, G.S., 1952: Regional Study of the Winnipeg Formation; M.Sc., thesis, U. of Man.

Quarry Leases 69, 70, Files 72071, 72072, Mining Recording Files, Man. MRD.

Robertson, E.E., 1965: Black Island Silica Sand; Paper presented at C.I.M. conference, Winnipeg.

DESCRIPTION OF DEPOSIT (cont'd)

Uses: Glass, also as foundry sand, in filter beds, for sandblasting and other uses.

HISTORY OF EXPLORATION AND DEVELOPMENT (cont'd)

1967 - All the quarry leases were assigned to the Manitoba Development Fund. An attrition unit was added to the washing plant at the quarry site.

1968 - Production increased and the plant on Black Island was redesigned to produce higher quality sand.

1972 - Quarry permits 1361, 1363, 1364 and M574 were assigned to Steel Brothers Canada Ltd. and M575 was assigned to them in 1976.

1977 - Quarry permits 1363, 1361, M575 and M574 were converted to Q.L. 69. Quarry permit 1364 was converted to Q.L. 70.

PRODUCT SILICA SAND | PROVINCE OR TERRITORY Manitoba | N.T.S. AREA 62P/1 NW | REF. SIA2

NAME OF PROPERTY BLACK ISLAND - NORTHWEST SHORE

OBJECT LOCATED Sandstone Quarry

UNCERTAINTY IN METRES 500 Lat. 51°14'50" Long. 96°26'50"

Mining Division (Winnipeg) District

County Township or Parish

Lot Concession or Range

Sec Tp. 26 R. 9, 8EPM

OWNER OR OPERATOR AND ADDRESS

(Selkirk Silica Co. Ltd,
Selkirk, Manitoba)

DESCRIPTION OF DEPOSIT

Sandstone of the Winnipeg Formation (Ordovician) is exposed for nearly 5km along the northwest shore of Black Island. It is believed to extend 6096 m across the island. (The outcrop on the south shore is described on card 62P/1, SIA1). The sandstone banks rise 8 to 10m,30 to 150 m back from the water level, leaving a sloping beach of fine white sand. The semi-consolidated quartzose sandstone is loosely cemented with limonite and kaolinite and ranges in color from pure white to iron-stained chocolate brown. Minor pyrite concretions were found in one location in a grey porous bed.

Physical Properties: Results of screening and other tests are available in Murton 1954, and Cole 1928.

Chemical Properties: Chemical composition is like that of the south shore outcrop. Chemical analyses are available in Cole, 1928 and in the Industrial minerals geologist's file, Manitoba Mines Branch. Unwashed analyses average 97.72% SiO_2 and 0.31% Fe_2O_3. Washed analyses average 99.4% SiO_2 and 0.02% Fe_2O_3. (cont'd)

Associated minerals

HISTORY OF PRODUCTION

1931 - 16 740 tonnes of silica sand were quarried by Lake Bar Sand and Gravel Co. Ltd. and barged to Mid-West Glass Co. Ltd. in Winnipeg. Some was shipped to Dominion Glass Co. in Redcliff, Alta.

1932 - 37 690 tonnes were quarried and shipped. (see the Pre-Cambrian). Quarrying seems to have ceased in 1933.

1956 - About 2278 tonnes were quarried and barged to Selkirk by Winnipeg Selkirk Sand Co. Ltd. (Gamey, 1957).

1957 - They quarried about 22780 tonnes. (see Cowie, 1959).

1959 - They suspended operations April 30th (Collings, 1962).

HISTORY OF EXPLORATION AND DEVELOPMENT (cont'd from below)

1959 - Operations were suspended April 30th. Quarry lease M-54 was cancelled in 1962 while 119 was renewed (1963), assigned to The Winnipeg Supply and Fuel Co. Ltd.(1966), assigned to the Manitoba Development Fund (1967) and finally cancelled in 1975.

MAP REFERENCES

Map (Cole, 1928)
Map 62P, Hecla (Topo.), 1:250 000; Surveys & Mapping Br., Ottawa.
Map 12, Industrial Minerals Producers (Index), 1:1000 000; Man. MRD.
#Claim Map Series N.W. 1-62P, Sc. 1:31 680, 1931-1975, Mining Recording, Man. MRD.

REFERENCES (cont'd)

Wallace, R.C. and McCartney, G.C., 1928: Heavy Minerals in Sand Horizons in Manitoba and Eastern Saskatchewan; Trans. Roy. Soc. Can., 3rd Series, Vol.22, Sec.IV,p.214.

REMARKS

50 tons of silica were removed for testing in 1913 by J. Howell on nearby quarry lease 120, cancelled in 1924. Heavy mineral content of magnetite, pyrite, zircon, tourmaline, staurolite, rutile, garnet, and hornblende is described by Wallace and McCartney (1928).

Comp./Rev. By N.L.L.

Date 06/78

HISTORY OF EXPLORATION AND DEVELOPMENT

Black Island is situated in Lake Winnipeg, approximately 97 km north of the southern end of the Lake.

1911 - J.H. Thompson acquired Quarry Lease No. 119.

1929 - Quarry Lease 949 was issued to John Steven, then assigned to W. J. Holmes.

1930 - No work had been done on W.L. 119 and it was assigned to W.J. Holmes. Lake Bar Sand and Gravel Co. Ltd. moved their quarrying operations to this side of the island around 1930. A pier 365m long appears to have been built and a breakwater nearly 100 m long was constructed. A dragline was used to cut into the deposits on shore. The silica sand was then loaded into mine cars and trammed to a sump 60 m out in the lake where it was pumped by a suction dredge into barges. It was shipped to Mid-West Glass Co. Ltd. in Winnipeg and some to Dominion Glass Co. in Redcliff, Alta. The quarrying was terminated after 1932.

1939 - Both claims were assigned to W.J. Holmes and Sons Ltd.

1948 - 5 tons of silica sand were removed in 1948 and 1949 for testing.

1950 - Q.L. 949 was renewed under the new number M-54.

1950 - A sampling survey was carried out by the Manitoba Mines Branch.

1952 - M-54 was assigned to D.W. Dyson and the Manitoba Mines Branch took samples of silica sand.

1954 - The renewed Q.L. 119 was assigned to D.W. Dyson.

1955 - Both quarry leases were assigned to Winnipeg Selkirk Sand Co. Ltd. which became Selkirk Silica Sand Co. Ltd. in 1958. Seven boreholes were put down and the Man. Mines Br. carried out mapping, sampling and testing. (cont'd)

Mineral Development Sector, Department of Energy, Mines and Resources, Ottawa

REFERENCES

Ann. Rept., Man. Mines Br., 1956, p. 11.

Cole, L.H., 1928: Silica in Canada, Its Occurrence, Exploitation, and Uses, Part II Western Canada; Mines Branch, Ottawa, Rept. 686, p. 13-25.

Collings, R.K. 1962: Report in The Canadian Mineral Industry, 1959; Mineral Report 5 (1962), p. 422.

Cowie, W.G. 1959: Industrial Minerals in Manitoba; Production and Utilization; C.I.M. Vol. 52, No. 564, p. 274.

Davies, J.F., 1951: Geology of the Manigotagan-Rice River Area; Man. Mines Br., Publ. 50-2, p. 11-12.

Gamey, F.S. 1957: Letter in Industrial Minerals Geologist's File, Man. MRD.

Murton, A.E. 1954: Report of the Division of Physical Metallurgy, Investigation No. PM3013, Mines Br., Ottawa.

Robertson, E.E., 1965: Black Island Silica Sand; Paper Presented at C.I.M. conference, Winnipeg.

The Pre-Cambrian, Sept. 1932, p. 9.
(cont'd)

DESCRIPTION OF DEPOSIT (cont'd)

Uses: glass, sand blasting, sales to Canada Cement, gypsum companies and to oil companies for sand frac.

HISTORY OF EXPLORATION AND DEVELOPMENT (cont'd)

1956 - About 2278 tonnes of silica sand was dredged and barged to Selkirk where a washing and screening plant was being constructed. A breakwater and a crib and pipe line 549 m long were built at the quarry site.

1957 - 22780 tonnes were removed using a cutter head dredge which sucked silica and water into a dredge pump. The material was pumped 549 m out under the lake to a platform where barges were loaded with the wet slurry at a pulp density of about 30%. In Selkirk the silica was passed through a trash screen and put through a 2-stage dewatering screw process.
(cont'd above)

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