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The occurrence of silica rich sand in the Beausejour-Brokenhead area has been known and exploited since the early 1900s. A glass plant was established in the town of Beausejour in 1906, and made use of sand quarried on the plant site. This pit, along with others near Libau, is still being worked in 1984. A renewed interest in using this sand as feed for a modern glass plant (or other silica-consuming plant) prompted the present study.

Past Work

The sands of the Beausejour-Libau area have been examined and reported in publications such as "Silica in Canada", (Cole, 1928) and "The Non-Metallic Mineral Resources of Manitoba", (Wallace and Greer, 1927). The physical and chemical properties have also been the subject of reports by Macauley (1952) and Wallace and McCartney (1928).

More recently, the sands were examined by McPherson (1970), Michalyna et al. (1975) and Watson (1982, 1983).

Present Work

Although a considerable amount of data has been generated on the distribution, thickness, and properties of the sand, it has not been put together in one package. In this study, the various drilling results and surficial maps have been combined in order to provide a basis for delineating the silica sand distribution.

In addition to compiling existing data, a total of 50 holes were bored using an Atlas Copco Minuteman drill with 4" (10 cm) augers. These holes range in depth from 1 to 5 metres. Samples collected were analyzed for several chemical and physical properties as reported in Table 1.

Geology

The sand lenses exposed at Beausejour and in the pits in the Libau-Mars Hill areas are all of Quaternary age and are all part of the Belair Moraine. This unit consists of interlayered tills, sand bodies, and glaciofluvial gravel deposits. A number of beach ridges have formed on the flanks of the moraine (Nielsen and Matile, 1982). The sand in the Libau and Beausejour pits was probably deposited as distal outwash between two ice sheets.

In the area of the Frailick Pit, the sand is more than 30 m deep, and overlies 6 m of till at depth. At Beausejour, the sand has been dredged to a depth of 20 m and may be as deep as 30 m. Although there are some clay lenses within these sand bodies, they are generally very consistent in grain size and chemical composition from top to bottom.

The surficial distribution of the sands (Fig. 2) has been determined from: 1) field observations by Geological Services Branch staff; 2) maps published by the Department of Municipal Affairs - Municipal Planning Branch (Michalyna et al. 1975); and 3) drill logs published by the Department of Natural Resources - Water Resources Division.

The various units used by the Soil Survey have been lumped together to provide one division each for fine sand, loamy sand and sandy loam; the physical properties of the sand are of more concern than the particular soil series. In some places the sand is overlain by organic soil, till or gravel but was counted as "surface sand" if this cover was less than one metre.

The holes drilled as part of the 1984 testing program are shown in Figure 1, along with test holes reported by Water Resources, and those drilled by McPherson. These holes have been coded to show thickness of the "surface" sand unit. The holes drilled by Geological Services Branch were drilled to a maximum depth of 5 m and therefore in most cases did not drill through the sand layer. At several locations the hole was stopped in clay because of the limitations of the drill, while in others the clay was only 0.5-1 m thick.

As can be seen from a comparison of the drill results and the soil map, holes with more than 25 m of sand do not appear to be restricted to a particular unit. When the chemical analyses for these holes are compared to the soils map however, (Fig. 2) it can be seen that holes with lower silica content correspond to areas with the fine loamy sand classification. This soil type seems to be developed on sands containing considerably more alumina and alkalis that effectively reduce the silica content.

Silica Reserves

Based on the surface sand distribution and excluding the fine loamy sands, there are approximately 25 square km within the tested area. Drilling by Geological Services Branch staff has shown the minimum thickness of the sand to be 5 m and other drilling has shown the thickness to exceed 25 m in most places. On the basis of these figures there are a minimum of 125 x 10^6 or 625 x 10^6 m^3 to depths of 5 or 25 m, respectively. Using an average value of 80% recoverable silica this would give 170 x 10^6 or 850 x 10^6 tonnes of silica sand.

Soils Report 15 for the Lac du Bonnet area (Smith and Ehrlich, 1967), reports 14,870 acres of Sandilands-Woodridge type outwash and stratified sand deposits along with 1,450 acres of Sandilands-Lonesand sands. Using the same 5 and 25 metre thicknesses for these areas (extending from Provincial Road 317 to Victoria Beach) an additional 325 x 10^6 or 1625 x 10^6 m^3 or 442 x 10^6 m^3 to 2210 x 10^6 tonnes of material may be available to the north of this area. This area has not been drilled however and the percentage and thickness of sands to the north is unknown.

Conclusions

The area extending from Beausejour to Provincial Road 317 at Mars Hill is underlain by sand bodies ranging in thickness to more than 25 m. One area of Mars Hill has been extensively tested and contains more than 625 million tonnes of silica to depths of 25 m. This sand already meets specifications for some uses (brick, cement, etc.) and if it can be upgraded in silica content it could be utilized in a number of other silica-consuming uses.

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TABLE 1

CHEMICAL AND SIEVE ANALYSES OF 1984 MARS HILL SAMPLING PROGRAM

Hole No.	MH-2	MH-4	MH-6	MH-8	MH-10	MH-12	MH-14
Oxide, %							
SiO_2	83.4	87.3	85.5	88.5	83.3	88.8	75.6
Al_2O_3	5.4	4.8	4.9	4.7	5.0	5.5	7.9
Fe_2O_3	0.7	0.9	0.6	0.7	0.7	0.7	2.0
CaO	3.9	2.5	3.3	2.0	4.4	1.0	4.0
MgO	1.1	0.4	0.5	0.2	0.6	0.2	1.5
Na_2O	1.5	1.4	1.4	1.4	1.4	1.6	1.4
K_2O	1.0	0.8	0.9	0.8	0.9	1.1	1.4
LOI	4.0	2.1	2.9	1.6	3.8	0.7	6.3
Total	101.0	100.2	100.0	99.9	100.1	99.6	100.1

Mesh Size	Per cent Retained						
+20	3.15	0.2	1.3	0.4	4.5	0.3	0.0
-20 + 40	5.15	0.3	1.9	0.6	3.4	5.0	9.0
-40 + 50	20.8	3.7	4.6	6.5	8.8	14.6	10.2
-50 + 70	42.5	35.0	39.5	42.8	29.6	45.3	26.7
-70 + 100	24.2	44.5	34.6	36.7	34.9	27.7	35.0
-100 + 200	3.7	15.4	16.4	12.0	16.8	6.7	15.8
Pan	0.6	1.0	1.7	0.9	2.0	0.5	3.4

TABLE 1 (cont'd)

CHEMICAL AND SIEVE ANALYSES OF 1984 MARS HILL SAMPLING PROGRAM

Hole No.	MH-16	MH-18	MH-20	MH-22	MH-24	MH-26	MH-28
Oxide, %							
SiO_2	37.2	83.2	76.9	76.6	77.2	81.9	82.9
Al_2O_3	5.9	6.4	5.7	6.1	5.9	6.3	5.7
Fe_2O_3	1.9	1.6	1.2	1.1	1.1	0.9	1.3
CaO	22.6	2.7	6.4	6.9	6.7	3.7	3.0
MgO	4.4	0.8	1.6	0.8	0.8	0.5	0.5
Na_2O	0.9	1.6	1.5	1.6	1.6	1.7	1.5
K_2O	1.0	1.1	1.0	1.2	1.1	1.3	1.1
LOI	26.1	2.9	6.3	6.0	5.7	3.4	3.1
Total	100.0	100.3	100.6	100.3	100.1	99.7	99.1

Mesh Size	Per cent Retained						
+20	0.0	0.0	0.0	17.7	4.9	2.5	0.3
-20 + 40	26.3	2.9	8.5	32.7	22.8	15.7	4.2
-40 + 50	14.2	4.4	8.0	26.6	19.9	40.1	15.9
-50 + 70	14.2	19.5	20.0	16.8	17.0	30.6	32.7
-70 + 100	12.0	55.8	50.0	4.1	21.2	8.3	21.4
-100 + 200	15.6	15.9	12.5	1.2	12.7	1.8	17.6
Pan	17.7	1.6	1.1	0.8	1.9	1.0	8.1

TABLE 1 (cont'd)

CHEMICAL AND SIEVE ANALYSES OF 1984 MARS HILL SAMPLING PROGRAM

Hole No.	MH-30	MH-32	MH-34	MH-36	MH-38	MH-40	MH-42
Oxide, %							
SiO_2	86.0	85.0	81.9	84.4	82.9	76.9	88.0
Al_2O_3	5.5	4.7	4.7	4.7	4.8	5.2	5.8
Fe_2O_3	1.0	0.8	0.9	0.7	1.1	0.7	0.8
CaO	1.5	3.0	4.5	3.9	4.4	7.4	1.1
MgO	0.3	0.5	0.7	0.6	0.9	1.0	0.2
Na_2O	1.5	1.3	1.3	1.3	1.2	1.4	1.6
K_2O	1.1	0.8	0.9	0.9	0.9	1.0	1.0
LOI	1.9	3.0	4.0	3.6	4.1	6.6	1.0
Total	98.8	99.1	98.9	100.1	100.3	100.2	99.5

Mesh Size	Per cent Retained						
+20	9.01	0.0	4.1	0.0	0.0	0.0	5.2
-20 + 40	9.9	3.0	5.0	6.3	3.6	40.3	15.7
-40 + 50	13.6	8.6	9.8	26.6	11.0	22.9	32.7
-50 + 70	31.0	29.3	30.2	44.9	37.8	16.0	31.2
-70 + 100	28.4	40.8	34.0	17.6	35.7	12.4	12.11
-100 + 200	6.9	16.8	16.0	3.8	10.6	6.6	2.6
Pan	1.3	1.4	0.9	0.8	1.3	1.8	6.5

TABLE 1 (cont'd)

CHEMICAL AND SIEVE ANALYSES OF 1984 MARS HILL SAMPLING PROGRAM

Hole No.	MH-46	MH-48
Oxide, %		
SiO_2	69.9	88.0
Al_2O_3	6.2	5.0
Fe_2O_3	1.3	0.5
CaO	8.1	2.4
MgO	1.9	0.3
Na_2O	1.5	1.4
K_2O	1.3	0.9
LOI	8.1	1.8
Total	98.3	100.3

Mesh Size	Per cent Retained	
+20	0.0	0.4
-20 + 40	4.8	0.6
-40 + 50	5.8	1.5
-50 + 70	9.4	33.3
-70 + 100	21.4	39.3
-100 + 200	43.5	18.7
Pan	15.2	6.2

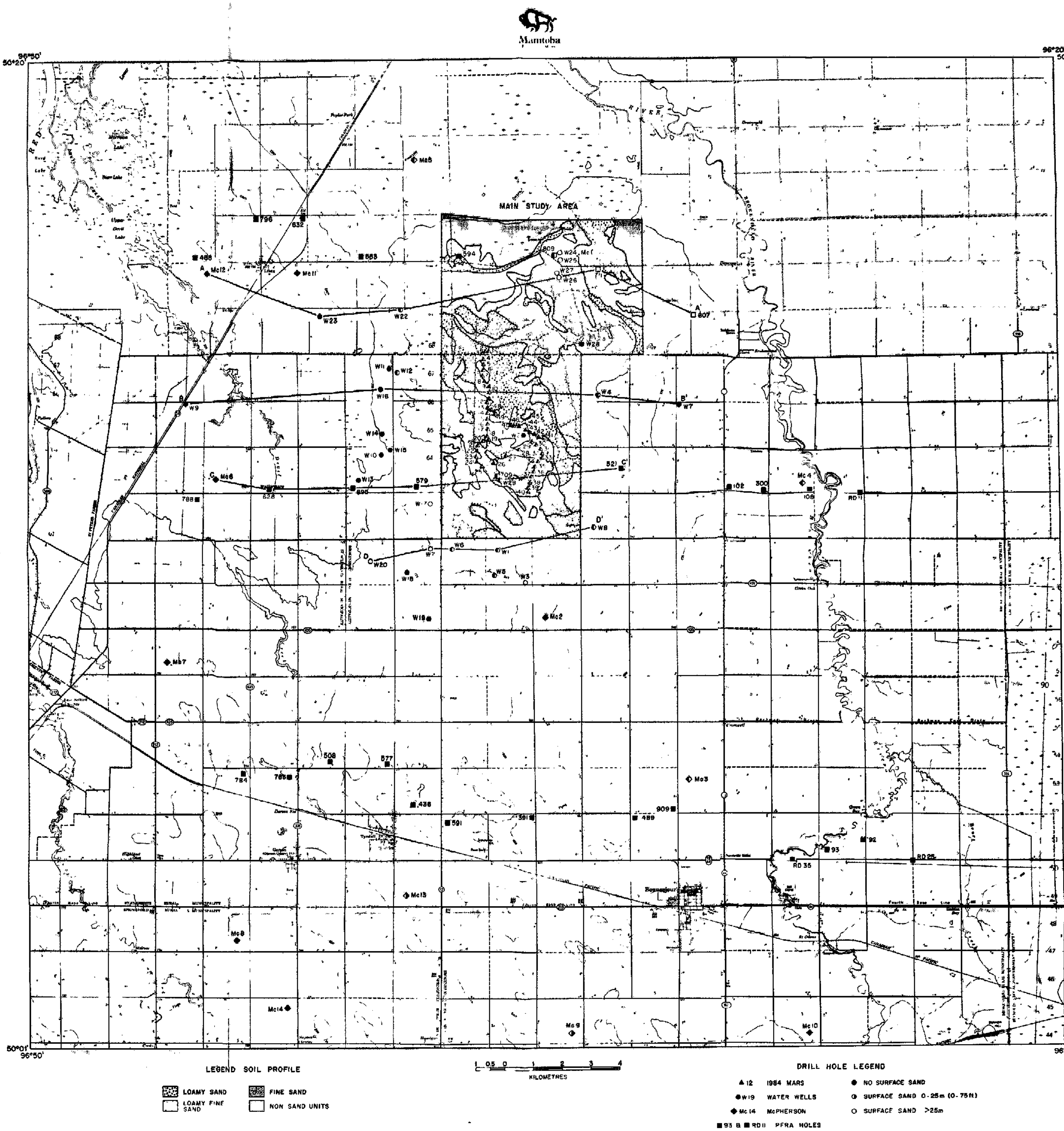

FIGURE I DRILL HOLES IN THE LIBAU-BEAUSEJOUR AREA

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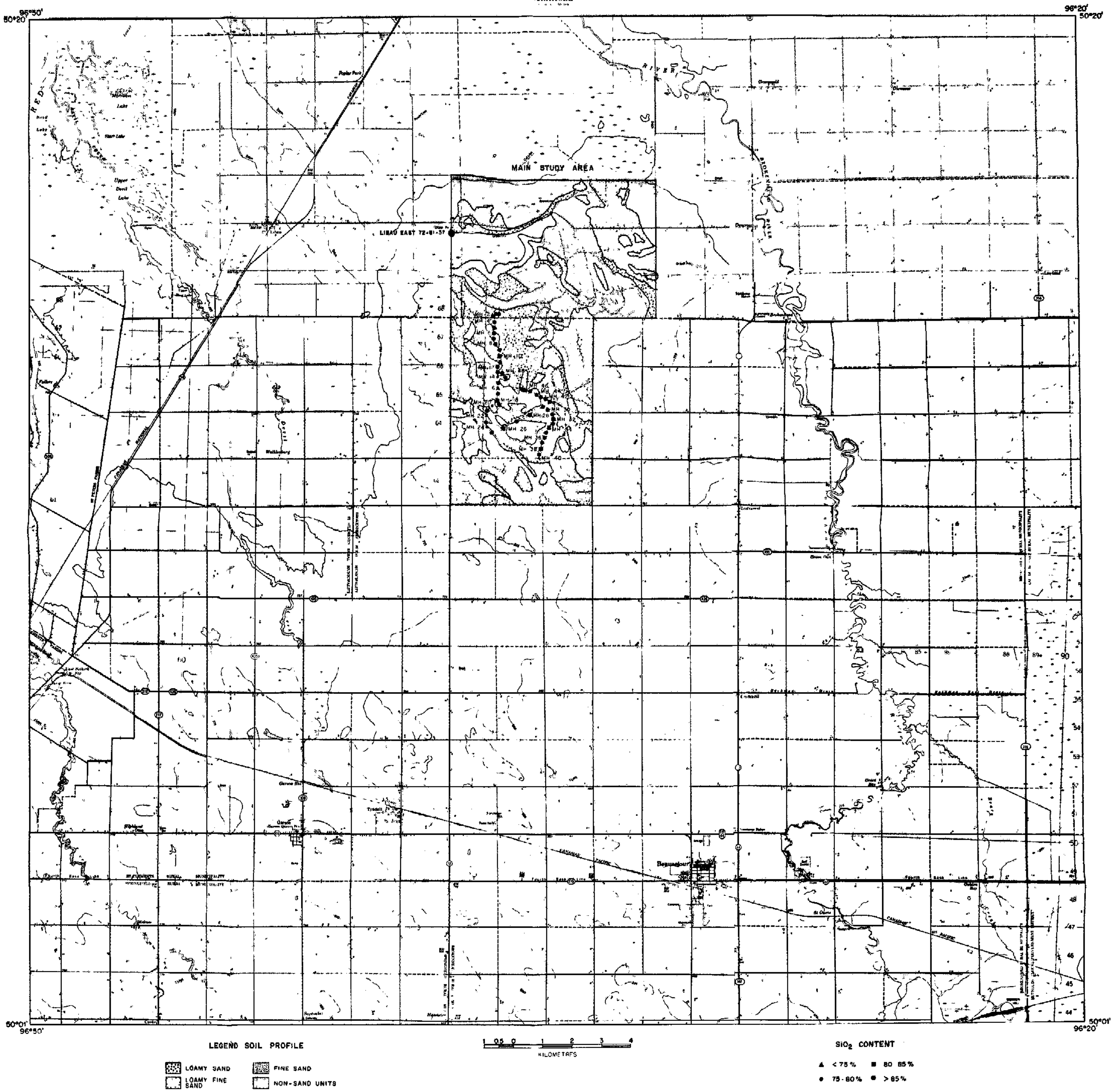

FIGURE 2 SILICA CONTENT IN DRILL HOLES