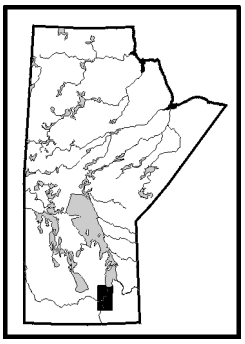
GS-30 CAPITAL REGION STUDY (WINNIPEG AND SURROUNDING AREAS) UPDATE AND STRATIGRAPHIC DRILLING 2002, MANITOBA

by R.K. Bezys, J.D. Bamburak and G.G. Conley



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SUMMARY

The distribution of crushed stone resources in Manitoba's Capital Region area, primarily within formations of Ordovician age, have been determined from the examination of quarries, outcrops, water-well and corehole data. As a result of the compilation of this data, new depth to bedrock, bedrock topography, geology and mineral potential maps (1:50 000 scale) are being released in final format, accompanying a geological report (NTS map sheets 62H10, 11, 14 and 15 and 62I2, 3, 6 and 7). Six areas of high crushed stone potential were identified in and around the Capital Region. One site was identified within the City of Winnipeg, after the Manitoba Geological Survey drilled the prospective area. Contour mapping had determined that it was an area of shallow overburden thickness. All six areas should be protected from conflicting development and land sterilization.

INTRODUCTION

The City of Winnipeg is fortunate in having access to ample resources of carbonate bedrock immediately north of the city in the Rural Municipality of Rockwood (Fig. GS-30-1). The bedrock is composed primarily of calcium and magnesium carbonate and has many uses in today's economy such as crushed stone aggregates, cement, lime, chemical and metallurgical stone, fillers and extenders, building stone and pulverized stone. Manitoba's construction and transportation infrastructure rely heavily upon these resources and the limestone industry will remain a vital segment of the province's economy well into the future.

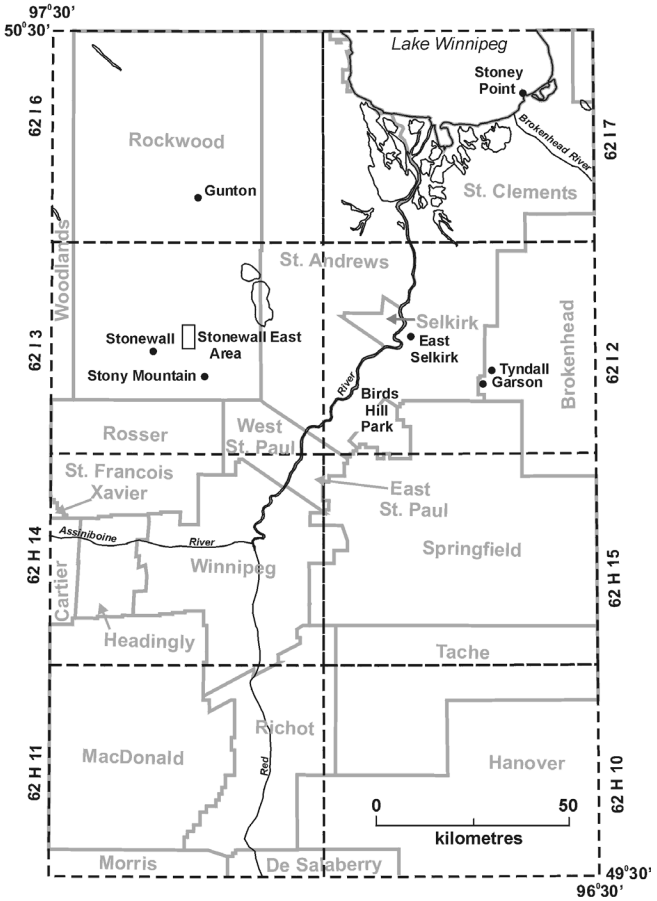

Figure GS-30-1: Capital Region Study area with rural municipality locations.

The Capital Region area (Winnipeg and surrounding municipalities) has exerted tremendous pressure on its resources in regard to land-use planning needs. In the Capital Region area, several localities, such as the towns of Stonewall and Stony Mountain (Fig. GS-30-1), possess areas of shallow bedrock exposures with high bedrock mineral potential. These sites have been, and continue to be, sources for crushed stone, primarily used in the City of Winnipeg.

Sand, gravel and crushed stone in the Capital Region are in high demand by the construction industry. Production of these commodities (including dimension stone) in the province was estimated at $44 million for 2001 (Table GS-30-1). This extraction forms the largest mining sector by volume produced and land acreage disturbed in Manitoba.

Historically, the population of rural Manitoba has been concentrated in urban centres, such as Winnipeg. However since the early 1970s, there has been a reverse migration from Winnipeg to outlying towns and municipalities. This movement has resulted in land-use patterns within these municipalities changing from rural agricultural to semi-urban and urban. This change has been accompanied by increased pressure by local residents and environmentalists to restrict quarrying of sand, gravel and crushed stone.

Housing subdivisions in the vicinity of active pits and quarries have been a source of public complaints. Quarrying is a heavy industrial land use, which can involve blasting, crushing, screening, operation of heavy equipment and local truck traffic, that may be disruptive to local residents. Rural municipalities within the Capital Region should discourage construction of dwellings in the vicinity of existing quarries or on near-surface bedrock with industrial mineral potential.

PREVIOUS WORK

The Capital Region Study (Fig. GS-30-1) consists of eight maps from the northern region (bedrock geology, bedrock topography, overburden thickness and mineral potential of NTS 62I2, 3, 6 and 7; at a scale of 1:50 000) and eight maps from the southern region (NTS 62H10, 11, 14 and 15; at a scale of 1:50 000). Preliminary, black and white versions of the first eight maps have been released (Bezys et al.,1999a–h). Colour versions of all maps accompany the final report, as well as extensive appendices with quarry descriptions.

The present Capital Region Study initially relied on previous work conducted by Bannatyne and Jones (1979) who produced geology, bedrock topography and overburden thickness maps for NTS 62I2, 3, 6 and 7 (1:50 000 scale). Mineral resource and engineering studies were carried out by Underwood McLellan and Associates Limited (1976) and Kjartanson (1983) for the Winnipeg area, and by James F. MacLaren Limited (1980) for the southern Interlake region. Jones (1986) studied the aggregate potential of bedrock exposures in the Capital Region. A geological and economic investigation was carried out by Bannatyne (1988) who examined the dolomite resources of southern Manitoba.

Table GS-30-1: Value of Manitoba stone and sand and gravel production, 1992–2001.[1]

Commodity	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)	($000s)
Sand and gravel	35,239	33,679	35,486	35,340	26,379	33,283	30,405*	29,989	26,968	26,855p
Stone									19,688	17,092p
limestone	6,243	8,318	10,170	13,058	11,315	15,487	16,675	15,614		
granite	1,510	2,597	1,775	1,851	2,993	3,106	8,196	4,376*		
shale	17	33	87	111	114	123	99	99		
Total	**43,009**	**44,627**	**47,518**	**50,360**	**40,801**	**51,999**	**55,375***	**50,078**	**46,656**	**43,947p**

Notes:

p = preliminary

* = estimated

[1] In Western Canada, the largest use of sand and gravel is for roadbed surfaces, followed by concrete aggregate, asphalt aggregate, and fill. However, production values shown in the table do not include shipments of stone and sand and gravel to Canadian cement and lime plants, but do include natural silica sand and crushed quartz or silica rock.

Source: Canadian Minerals Yearbook, 1992 to 1999 and http://www.nrcan.gc.ca/mms/ms-e.htm for 2000 and 2001.

METHODOLOGY

The rural municipalities of Rockwood, St. Andrews and St. Clements (Fig. GS-30-1) (NTS 62I2, 3, 6 and 7), in the northern part of the Capital Region, were selected as the first municipalities to be assessed and mapped because shallow bedrock was known to be present. To provide the required information in sufficient detail for land-use purposes, it was necessary to produce a computerized subsurface database consisting primarily of water-well records. These water-well records were used to map depth to bedrock, bedrock topography, bedrock geology and mineral potential. Water-well data was augmented with detailed examination of quarries, bedrock exposures and use of corehole information from the Manitoba Stratigraphic Database (MSD) (Bezys and Conley, 1999).

Geological mapping in the map sheet NTS 62I3 (containing the Rural Municipality of Rockwood) (Bezys et al., 1999c, d) (Fig. GS-30-1), using quarry inventories and water-well records, began in 1995. This map area was selected as the initial target for assessment because of the economically important crushed stone production in the Stonewall East and Stony Mountain areas.

Sixteen quarries were inventoried in the rural municipality of Rockwood in 1995 (Bamburak and Bezys, 1995). Data sheets for this project were modelled after Goudge (1944) and Derry Michener Booth and Wahl and Ontario Geological Survey (1989a–c). A stratigraphic section was generated for each quarry. The areal extent of each quarry was sketched and selected quarry sections were described, sampled and photographed. All field information was combined with historical descriptions, mineral inventory cards, property ownership maps and mineral disposition maps.

During the 1996 field season, the work was expanded to include the rural municipalities of St. Clements and St. Andrews. Data pertaining to the quarries were entered into a computer database; stratigraphic sections were drafted in final form; and industrial mineral inventory cards were updated (Bamburak and Bezys, 1996; Bezys et al., 1999a, b, g, h).

From 1995 to 1997, all water wells within the Capital Region Study area that intersected bedrock and had an accompanying survey location, were downloaded from GWDrill (Water Branch digital water-well database, Manitoba Conservation). This also included wells within river lots. Using the survey information, wells were plotted onto 1:50 000 scale topographic maps and UTM locations and ground elevations were corrected from a digital elevation model constructed from 1:20 000 contour and spot elevations. Infill data came from water wells whose locations were only accurate to the centre of the nearest legal subdivision (L.S.). This posed a problem because even in lightly populated areas, two or more wells were mapped to the same coordinate. The procedure used to select the infill well was to examine the stratigraphy of each water well at the location and then select the most appropriate ones based on the stratigraphic characteristics of the nearest neighbours. Stratigraphic wells from the Manitoba Stratigraphic Database were used as key reference points.

STRATIGRAPHIC DRILLING

A three corehole drilling program north of Stonewall was conducted by the Manitoba Geological Survey in 1996 (M-4-96, M-5-96 and M-6-96) (Bezys, 1996) and extended the aggregate resources of the Gunton Member of the Stony Mountain Formation 6 km to the northwest of a hole drilled in 1980 (M-1-80) (McCabe, 1980; Bannatyne, 1980). A subsequent three corehole drilling program in the Garson area (M-7-96, M-8-96 and M-9-96) (Bezys, 1996) confirmed the presence of additional dimension stone (Selkirk Member of the Red River Formation; Tyndall Stone™), 3 km to the southeast of the operating Gillis quarry.

In 1997, a three corehole drilling program near Selkirk was conducted as an extension of the sub-Phanerozoic, shield margin studies in NTS 62I2, and to investigate the Paleozoic and Precambrian geology of the Capital Region area (M-1-97, M-2-97 and M-3-97) (Bezys and Bamburak, 1997). Two of these holes intersected the Precambrian. In coreholes M-1-97 and M-3-97, thicknesses of the Selkirk Member, Red River Formation, ranged from 73.4 to 76.1 m. In corehole M-2-97, 15.5 m of undifferentiated Red River Formation was encountered and the hole had to be abandoned due to karst infill. All new corehole data were added to MSD.

2002 Stratigraphic Drilling and Results

To test the interpreted bedrock high (based upon the evaluation of water-well logs in GWDrill) in the vicinity of Sturgeon Road (in the northwest part of Winnipeg), two coreholes were drilled in 2002 (M-1-02 and M-2-02) (Fig. GS-30-2, GS-30-3, Table GS-30-2). The Sturgeon Road shallow bedrock area, mostly within the City of Winnipeg and partly in the Rural Municipality of Rosser, offers potential for crushed stone extraction, due to the presence of the highly sought after Gunton Member (Stony Mountain Formation). In corehole M-1-02, the overburden thickness is 4.5 m and the Gunton Member thickness is estimated to be 10.3 m, but due to the rubbly nature of the rock this

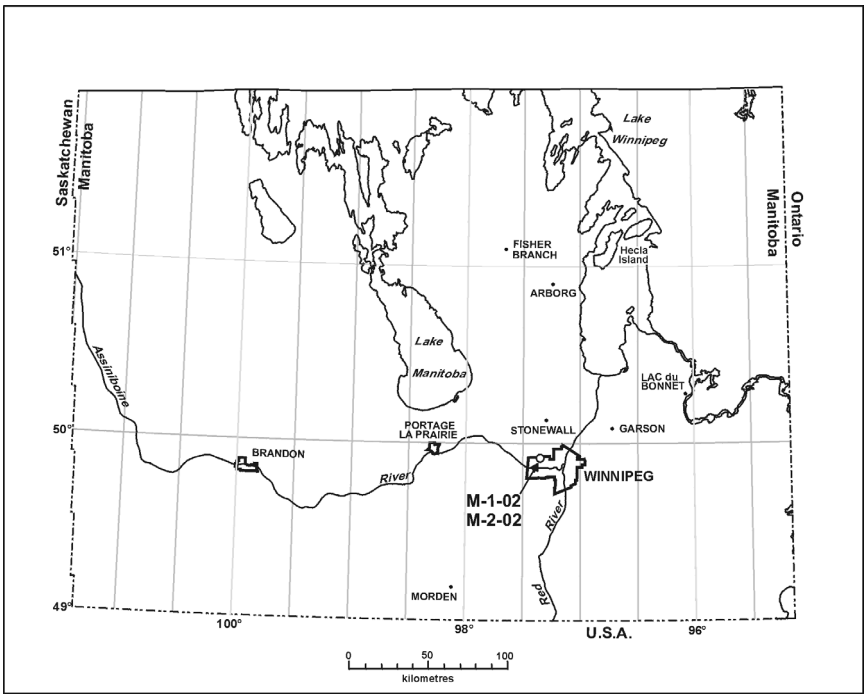

Figure GS-30-2: Location of stratigraphic coreholes, 2002.

measurement is not exact. In corehole M-2-02, the overburden thickness is 3.5 m and the Gunton Member thickness is 5.9 m. With this thickness, the Gunton Member is extractable as a crushed stone resource. Bannatyne (1988), in his dolomite report, indicated an area of shallow bedrock (thin overburden) in west Winnipeg, and based on GWDrill water wells and MGS drilling (Fig. GS-30-3), this claim has been substantiated. To reduce haulage costs and overall costs to the City of Winnipeg, some resource extraction should be permitted.

CONCLUSIONS

Areas of thin overburden (< 5 m thick) are areas that should be protected for potential future extraction of crushed or building stone. These include the towns of Stonewall (and northeast of the town) and Stony Mountain; the town of Garson (and Tyndall); the town of Gunton; east of the town of East Selkirk; and the Sturgeon Road area, Winnipeg (Fig. GS-30-1, Table GS-30-3). The protection of these regions from future land-use pressure will ensure a supply of bedrock resources (either as crushed stone or building stone) for the Capital Region area. These resources provide a tremendous amount of wealth to the economy of Manitoba, and sterilization of these areas by land-use pressure will cause considerable expense as other alternative sources are sought.

ACKNOWLEDGMENTS

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Figure GS-30-3: Detailed location map of stratigraphic coreholes, 2002 and nearby water wells (with stratigraphic logs). See Table GS-30-2 for the 2002 corehole stratigraphic logs.

Table GS-30-2: Summary of stratigraphic corehole data, 2002.

Hole no.	Location and elevation (m)	SYSTEM/Formation/ (Member)	Interval (m)	Lithology summary
M-1-02	01-20-11-2-E1	OVERBURDEN	0.0–4.5	
Sturgeon Rd.	5532402N			
	623546E			
	240.5			
		ORDOVICIAN/Stony Mountain/(Gunton)	4.5–14.8	Tan dolomite, very rubbly
M-2-02	01-20-11-2-E1	OVERBURDEN	0.0–3.5	
Sturgeon Rd.	5532403N			
	623446E			
	240.5			
		ORDOVICIAN/Stony Mountain/(Gunton)	3.5–9.0	Mottled buff and yellow dolomite with pinpoint and vuggy porosity, rubbly in places, poor core
			9.0–9.4	As above, becoming bluish green downward, gradational into below
		(Penitentiary)	9.4–14.2	Mottled blue-green to grey dolomite, argillaceous, yellow in places, minor steel grey sulphides
		(Gunn)	14.2–31.0	Mottled grey, rounded clasts surrounded by red tendrils; limestone interbeds and calcareous shale (3–5 cm thick)
		Red River (Fort Garry)	31.0–32.6	Buff, very fine-grained dolomite

Table GS-30-3: Areas of high potential for crushed stone or building stone in the Capital Region.

Location	Formation (Member)
Town of Stonewall (and northeast of town)	Stony Mountain Fm. (Gunton Member)
Town of Stony Mountain	Stony Mountain Fm. (Gunton Member)
Town of Gunton	Stony Mountain Fm. (Gunton Member)
Town of Garson (and Tyndall)	Red River Fm. (Selkirk Member)
Town of East Selkirk (east of town)	Red River Fm. (Selkirk Member)
City of Winnipeg (Sturgeon Road)	Stony Mountain Fm. (Gunton Member)

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