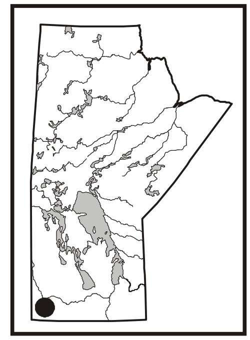
GS-35 AGGREGATE RESOURCES IN THE RURAL MUNICIPALITY OF CAMERON

by H. D. Groom

Groom, H.D. 2000: Aggregate resources in the Rural Municipality of Cameron; *in* Report of Activities 2000, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 217-219.



SUMMARY

The Rural Municipality (R.M.) of Cameron covers eight townships in southern Manitoba. Most of the municipality was inundated by glacial Lake Hind and much of the surface material is lacustrine sand. Gravel reserves are in two delta deposits. These deposits consist of 3 m to more than 6 m of sand and gravel, with most of the reserves being below the watertable. Shale content varies quite widely within the deposits.

There are six active gravel pits and three shale quarries in the area. Most of the aggregate produced is for use within the municipality. The municipality is the greatest consumer of aggregate, mostly for road maintenance.

INTRODUCTION

The R.M. of Cameron recently joined with the R.M.s of Pipestone and Sifton to form the Denis County Planning District. The aggregate resources in the R.M.s of Pipestone and Sifton were mapped previously (Groom, 1994; UMA, 1977). The aggregate deposits in the R.M. of Cameron, however, had never been mapped at a scale suitable for submission to the district planning board. A sand and gravel inventory was conducted this summer in order to provide aggregate information at 1:50 000 scale for resource management and land-use planning.

LOCATION AND PHYSIOGRAPHY

The municipality covers eight townships (twp. 5 and 6, rge. 22 to 25W) in southwestern Manitoba. It is primarily a farming district and the town of Hartney is the major service centre. The Canadian Pacific Railway, Highway 21 and a network of gravel roads are the major transportation routes. Souris River runs northeastward through the centre of the municipality.

The area is divided into two physiographic regions: the Boissevain plain in the southeastern third of the municipality and the Souris basin in the remainder of the area.

Surficial sediments on the Boissevain plain have an average thickness of 5 m (Betcher, 1983). The plain has a gently rolling topography imparted by linear till ridges, except in the area of the Dand channel. The channel is up to 0.5 km. wide, 10 to 15 m deep and trends northeast for approximately 20 km before ending at a gravel deposit at the eastern edge of the municipality.

Surficial sediments in the municipality thicken westward, attaining thicknesses of more than 70 m in the northwestern part of the area (Klassen and Wyder, 1970). The sediments are primarily lacustrine silt and clay south of the river, and sand in the western and northwestern parts of the municipality. In the area of the Lauder Sand Hills, the sand has been blown into spectacular dunes that are now stabilized by vegetation. Deltaic gravel deposits are sparsely scattered throughout the area.

BEDROCK GEOLOGY

The municipality is underlain by the Odanah Member of the Pierre Shale Formation. The Odanah Member is a hard, grey, siliceous marine shale with thin interbeds of soft, olive-grey shale. Bentonite beds occur throughout the unit. Bannatyne (1970) assigned this unit to the Riding Mountain Formation, but work by McNeil and Caldwell (1981) resulted in a revised nomenclature that abandoned the use of the term ‘Riding Mountain Formation’ and assigned its members to the Pierre Shale Formation.

Bedrock topography maps show the gentle swale of the buried Pierson valley, an early Pleistocene channel eroded into the bedrock (Klassen and Wyder, 1970). Glacial sediments thicken westward as they infill the valley. For this reason, bedrock is rarely exposed in the municipality. It does outcrop in the Dand channel where glacial sediments have been eroded away. The quarry in SW18-5-22W is situated on the east edge of the channel and provides a good exposure of the Odanah shale.

PREVIOUS WORK

The bedrock geology was mapped by Wickenden (1945) and Bannatyne (1970), and the units were further described by McNeil and Caldwell (1981). A map of the regional bedrock topography, at a scale of 1:500 000, has been produced by Klassen et al. (1970). Klassen and Wyder (1970) discussed the location and fill of buried valleys; the bedrock topography map that accompanies their report is at a scale of 1:250 000.

Maps of drift thickness are included in groundwater studies prepared by Betcher (1983).

Elson (1956, 1961) mapped the surficial geology of the area at a scale of 1:126 720 and outlined the glacial history as part of a regional study of southwestern Manitoba and southeastern Saskatchewan. A portion of this area, the east half of the Virden map sheet (NTS 62F), has recently been remapped at a scale of 1:100 000 (Sun and Fulton, 1995) as part of the Prairie NATMAP Project of the Geological Survey of Canada. The R.M. of Cameron falls within this map area.

Sun (1996) reconstructed the late glacial history of the area, with special emphasis on the levels of glacial Lake Hind over the course of its existence. Much recent work has focused on the effects of catastrophic flooding as glacial lakes in eastern Saskatchewan burst their ice dams (Kehew, 1982; Kehew and Clayton, 1983; Kehew and Teller, 1994). Several of the deltas in Lake Hind are related to flood waters originating in Saskatchewan (Sun, 1996; Sun and Teller, 1997).

LATE GLACIAL HISTORY

A generalized map of the surficial sediments in the region is shown in Figure GS-35-1. The sequence of late Wisconsinan events, particularly the deglacial history of the area, is outlined in Elson (1956) and Sun (1996). The following brief history of events is taken primarily from Sun (1996) and Sun and Teller (1997).

The surface till was deposited by the southeast-flowing Assiniboine Lobe during the Late Wisconsinan. The Red River Lobe flowed to a position just east of the R.M. of Cameron. These two ice masses blocked the regional drainage and caused glacial lakes to form at the ice fronts: glacial Lake Souris formed at the south margin of the Assiniboine Lobe and a precursor to glacial Lake Hind ponded between the Red River Lobe and the north margin of Assiniboine Lobe. The Dand channel was cut when water from glacial Lake Souris flowed overland to this lake. The deltaic deposit in twp. 6, rge. 22 was formed at this time. As the Assiniboine Lobe retreated, the two lakes merged. Falling water levels caused the emergence of a height of land near Melita that separated the lake into two basins: glacial Lake Hind in Manitoba and the main body of glacial Lake Souris in North Dakota. Several deltas formed along the west edge of glacial Lake Hind during this period, but none occur in the R.M. of Cameron. Two catastrophic floods from glacial lakes in Saskatchewan affected glacial Lake Hind. The first deposited the delta at

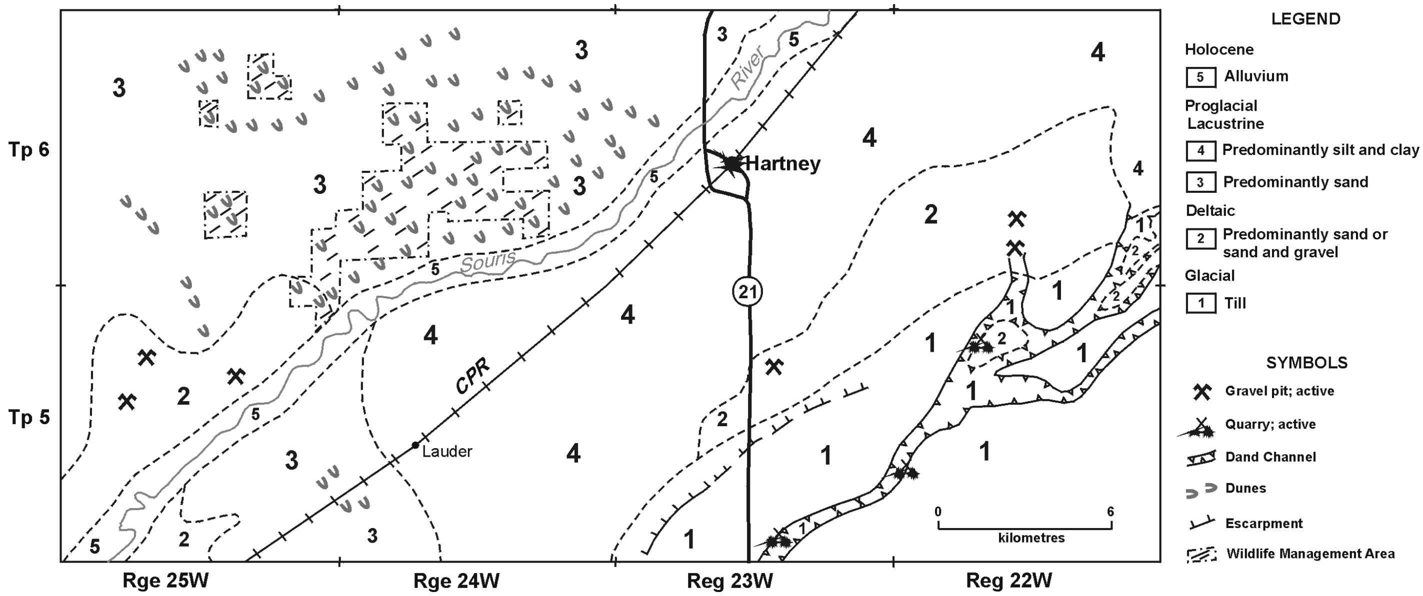


*Figure GS-35-1: Surficial geology of the Rural Municipality of Cameron (*after *Sun and Fulton, 1995).*

Melita outside the municipality and the second created the deltaic deposit west of Lauder in twp. 5, rge. 25 in the R.M. of Cameron. Later floods along the Assiniboine River valley deepened the Pembina trench, resulting in final drainage of glacial Lake Hind.

METHODOLOGY

Surficial deposits were delineated on 1:20 000 scale township photomosaics. Deposit delineation was based on surficial units outlined by Sun and Fulton (1995). The township mosaics were also used as a base on which to compile aggregate information from several sources:

- Active pit locations – Mines Branch quarry database
- Quarry lease and withdrawn locations – Mines Branch plat books
- Crown versus private ownership – Manitoba Crown Lands Branch database
- Pit and sample locations – Department of Highways block files
- Water-well records from Manitoba Conservation (GWDrill)

Gravel pits, roadcuts and natural exposures were examined during the first part of the field examination. Pits were examined for type of material, degree of depletion and active/inactive/depleted status. Unopened portions of deposits were inspected and land uses that would limit aggregate extraction noted.

Aggregate samples were processed in two stages. In the field, samples that weighed between 75 and 100 kg were passed through 6-inch (15.2 cm), 3-inch (7.5 cm), 1½-inch (3.8 cm) and ¾-inch (1.9 cm) screens. The weights of the 3-, 1½-, ¾- and less than ¾-inch fractions were recorded. In addition, the relative abundance of less than 6-inch material, as well as deleterious material (e.g. shale, concretions), was noted. Pebble counts on the 1½- to 3-inch fraction were done in the field. A representative sample of the less than ¾-inch fraction was taken for processing by the Material and Research Branch of the Department of Highways, under the terms of the cooperative agreement initiated in 1998.

The second stage is a backhoe program designed to test the extent, depth and quality of deposits identified earlier. Eight quarter-sections were scheduled to be tested during the last week of September.

AGGREGATE RESOURCES

Much of the municipality, especially north of Souris River, is underlain by lacustrine sand deposited into glacial Lake Hind. The sand ranges from coarse to fine and, in many places, has been blown into dunes. The sand has little economic value and, despite the abundance of sand, aggregate is actually scarce. There is little crown land in the area and most of the aggregate, including shale bedrock, is privately owned.

There are six active gravel pits and three shale quarries. The municipality is the largest user of aggregate, owning two pits and operating in several others. Most of the aggregate produced in the municipality is for municipal consumption.

Shale

The three shale quarries are all associated with the Dand channel (Fig. GS-35-1). Two of them are actual quarries, being excavated out of Odanah shale bedrock. These are roadside excavations, with 1 to 5 m of till overburden. The third is technically a gravel deposit. The material is 99% shale cobbles with medium sand fill. The material from all three sites is used by the municipality.

Sand and Gravel

Gravel in the municipality is located in two deltaic deposits: the Dand delta in rge. 22 and 23 and the Lauder delta in rge. 25 (names taken from Sun, 1996).

Water-well records show that the Dand deposit consists of 3 to 6 m of sand and gravel over till. In pit exposures, the material ranges from fine pebble gravel to cobble gravel. Shale content varies but seems to be higher in the eastern part of the delta. The deposit has three active pits. One (NE3-6-22W) is new but the others have been in use for many years. Most of the remaining reserves are below the water table.

The Lauder deposit has more than 6 m of sand and gravel, once again with most of the reserves below the water table. Two of the active pits are long established and both are water floored. The municipal pit in 20-5-25W has a reported 4 m of aggregate below the water table. Extraction is normally by dragline, but this year the pit was being expanded southward above the waterline. Shale content is low in this pit. The active pit in 22-5-25W seems to have coarser material and more shale, but good exposure in this pit was very limited. The crown gravel in NE20-5-25W has been extensively mined. Two of the pits have recently been rehabilitated and dune sand covers much of the remaining area.

CONCLUSIONS

The municipality utilizes both bedrock and gravel for its aggregate needs. The two delta deposits are a good source of aggregate. However, most of the remaining reserves are below the water table. The added cost of production and the shale content in parts of the deposits decrease their economic value.

REFERENCES

Bannatyne, B.B. 1970: The clay and shales of Manitoba; Manitoba Department of Mines and Natural Resources, Mines Branch, Publication 67-1, 107 p.

Betcher, R.N. 1983: Groundwater availability map series, Virden area (62F); Manitoba Department of Natural Resources, Water Resources Branch, scale 1:250 000.

Elson, J.A. 1956: Surficial geology of the Tiger Hills region, Manitoba, Canada; Ph.D. thesis, Yale University, Cambridge, Massachusetts, 316 p.

Elson, J.A. 1961: Surficial geology, Virden, Manitoba and Saskatchewan; Geological Survey of Canada, Map 39-1961, scale 1:126 720.

Groom, H.D. 1994: Aggregate resources in the rural municipalities of Albert and Pipestone; Manitoba Energy and Mines, AR93-1, 59 p.

Kehew A.E. 1982: Catastrophic flood hypothesis for the Souris Spillway, Saskatchewan and North Dakota; Geological Society of America Bulletin, v. 93, p. 1051–1058.

Kehew A.E. and Clayton, L. 1983: Late Wisconsinan floods and development of the Souris–Pembina spillway system in Saskatchewan, North Dakota and Manitoba; *in* Glacial Lake Agassiz, (ed.) J.T. Teller and L. Clayton; Geological Association of Canada, Special Paper 26, p.187–209.

Kehew A.E. and Teller, J.T. 1994: History of late glacial runoff along the southwestern margin of the Laurentide ice sheet; Quaternary Science Review, v. 13, p. 859–877.

Klassen, R.W. and Wyder, J.E. 1970: Bedrock topography, buried valleys and nature of the drift, Virden map-area, Manitoba: Geological Survey of Canada, Paper 70-56, 11 p.

Klassen, R.W., Wyder, J.E. and Bannatyne, B.B. 1970: Bedrock topography and geology of southern Manitoba; Geological Survey of Canada, Paper 70-51, scale 1:500 000.

McNeil, D.H. and Caldwell, W.G.E 1981: Cretaceous rocks and their foraminifera in the Manitoba escarpment; Geological Association of Canada, Special Paper 21, 439 p.

Sun, S. 1996: Sedimentology and geomorphology of the glacial Lake Hind area, southwestern Manitoba, Canada; Ph.D. thesis, University of Manitoba, Winnipeg, Manitoba, 215 p.

Sun, S. and Fulton, R.J. 1995: Surficial geology, Whitewater Lake area, Manitoba (62F/SE); Geological Survey of Canada, Open File 3056, scale 1:100 000.

Sun, S. and Teller, J.T. 1997: Reconstruction of glacial Lake Hind in southwestern Manitoba, Canada; Journal of Paleolimnology, v. 17, p. 9–21.

Sun, S. 1993: Preliminary study of the surficial geology of Virden area, southwestern Manitoba; *in* Current Research, Part B; Geological Survey of Canada, Paper 93-1B, p. 57–61.

Sun, S. and Teller, J.T. 1995: Reconstruction of paleo-lake level of Glacial Lake Hind based on perched deltas and fine lacustrine deposits; *in* Geological Society of America, 29th Annual Meeting, North-Central Section, South-Central Section, Abstract with Programs, v. 27, no. 3, p. 88.

Underwood, McLellan and Associates 1977: Sand and gravel resources of the Brandon region; Manitoba Department of Mines, Resources and Environmental Management, Open File Report OF77-8, 2 volumes.