ECONOMIC GEOLOGY REPORT ER85-1

Dolomite Resources of Southern Manitoba

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REGIONAL SETTING

The outcrop belt of Paleozoic rocks is within Manitoba Lowland, or 'First Prairie Level', and extends from Winnipeg and Garson, through the Interlake and Dawson Bay regions, to the Precambrian Shield from Lake Athapapuskow to Ponton (Fig. 1).

Topographic relief is usually low, and altitudes range from 217 m at Lake Winnipeg to 320 m south of Lake St. Martin. Locally, escarpments occur within the outcrop belt, but some rock ridges have been partially or completely buried beneath glacial overburden. Known outcrop areas are shown on regional maps accompanying this report (Maps ER85-1-1,2,3 and 4); also shown are localities where dolomite is present beneath a thin cover of drift, some of which are potential sites for quarries. As noted on the maps, these areas of near-surface bedrock are based on interpretations of various sources of data; it should be expected that other areas of near-surface bedrock exist in each area, and that thick overburden is probably present in some parts of the outlined areas. Delineation of specific sites for quarrying would require detailed exploration.

TABLE 1

LOWER PALEOZOIC STRATIGRAPHY, SOUTHERN MANITOBA

AGE	GROUP/FORMATION/MEMBER	LITHOLOGY
Devonian	Souris River Fm.	Limestone, calcitic, dolomite, red beds
	Dawson Bay Fm.	Limestone, dolomite
	Winnipegosis Fm.	Dolomite, limestone
	Elm Point Fm.	Limestone
	Ashern Fm.	Argillaceous dolomite, dolomitic shale
Silurian	Interlake Group:	
	Cedar Lake Fm. (including Chemahawin Member)	Dolomite
	East Arm Fm.	Dolomite
	Atikameg Fm.	Dolomite
	Moose Lake Fm.	Dolomite, micritic
	Inwood Fm.	Dolomite, micritic, rounded blebs
	Fisher Branch Fm.	Dolomite, fossiliferous
Silurian/ Ordovician	Stonewall Fm.	Dolomite, marker beds
Ordovician	Stony Mountain Fm.	
	Williams Member	Dolomite, argillaceous, arenaceous
	Gunton	Dolomite
	Penitentiary	Argillaceous dolomite
	Gunn	Calcareous shale, to argillaceous dolomite
	Red River Fm.	
	Fort Garry	Dolomite; limestone
	Selkirk	Dolomitic limestone; cherty, limestone
	Cat Head	Dolomite
	Dog Head	Dolomitic limestone
	Winnipeg Fm.	Sandstone, shale

A simplified stratigraphy of the region is listed in Table1. A useful cross-section illustrating the relationships and variations in thickness of Ordovician and Silurian strata along the outcrop belt from Winnipeg to Wekusko Lake has been compiled by McCabe (l980), and is reproduced as Figure 2.

REGIONAL GEOLOGY

The predominantly carbonate rocks of southwestern Manitoba were deposited in shallow epeiric tropical seas that inundated weathered Precambrian basement: Several cycles of transgression and regression have been interpreted from variations in texture, composition and fauna of lower Paleozoic rocks.

During the first transgression of Ordovician seas, sandstone and interbedded sand and shale of the Winnipeg Formation were deposited. Cambrian strata were deposited earlier but occur only in subsurface.

Carbonate deposition began with rocks of the Red River Formation, divided into the following members: Dog Head dolomitic mottled limestone; Cat Head dolomite and dolomitic limestone with chert nodules; Selkirk dolomitic limestone with abundant megafauna and an upper cherty limestone; and Fort Garry lower micritic dolomite, a central shaly layer, and upper dolomite with two limestone interlayers.

An increase in clastics initiated deposition of the Stony Mountain Formation that consists of: Gunn Member red shale with thin limestone interbeds; Penitentiary Member argillaceous dolomite; Gunton Member dolomite with minor variable argillaceous content; and Williams Member argillaceous and sandy dolomite.

Deposition of carbonates continued across the Ordovician-Silurian boundary, within the Stonewall Formation of dolomite. Carbonates, now completely altered to dolomite, continued to be deposited in the Silurian period. The Fisher Branch, Inwood, Moose Lake, Atikameg, East Arm and Cedar Lake formations of the Interlake Group were deposited. All are dolomites, but variations in texture and composition occur, including micritic, argillaceous, fossiliferous, reefoid, stromatolitic and crystalline dolomites; the sequence includes several prominent marker beds.

Withdrawal of the seas resulted in an erosional period until Middle to Upper Devonian. The next transgression occurred when the Elk Point Basin was established. The basal Middle Devonian Ashern Formation consists of shaly beds and argillaceous dolomite. It is overlain by Elm Point Formation limestone and Winnipegosis Formation dolomite. Prairie Evaporite salt deposits occur only in subsurface; their solution in the area of the Devonian outcrop belt has affected distribution of overlying strata. Cyclic sedimentation of shale, dolomite, limestone and evaporite units followed, and these are preserved in the basin area in Saskatchewan; incomplete cycles that make up both Dawson Bay and Souris River formations are exposed from The Narrows of Lake Manitoba to Dawson Bay, Lake Winnipegosis.

The carbonate rocks of the Paleozoic outcrop belt were subjected to erosion in the post-Devonian to Mesozoic interval and considerable evidence indicates extensive karsting and channeling occurred. Jurassic sediments are present in channels in southern Manitoba (Fig.1) and the Charleswood-Headingley area (Map ER85-1-4). Sinkholes and/or channels, infilled with sandy kaolinitic shale of Lower Cretaceous age, and locally low grade lignite, are known to occur throughout the area; some sinkholes are indicated on Map ER85-1-4, and a channel-like deposit occurs north of Arborg (Map ER85-1-1). Recently, numerous caves in Paleozoic carbonates have been located and investigated in the Hodgson, Williams Lake and other areas in the Interlake (W.D. McRitchie, pers. comm., 1988).

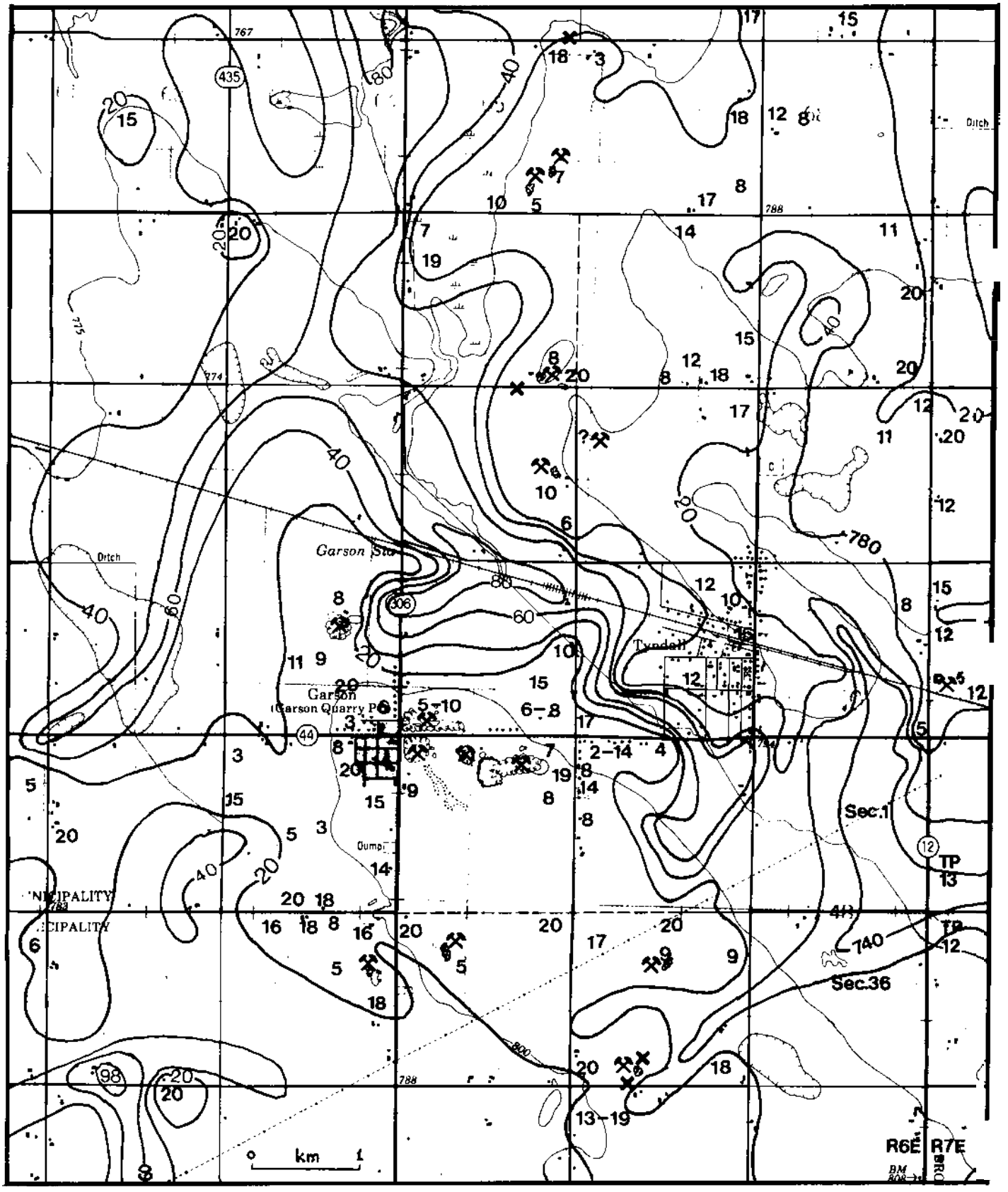

Figure 8a: *Location of quarries and drift thickness in the Garson-Tyndall area. Bold figures are reported depths to bedrock in feet, at selected locations; contour interval is 20 feet (about 6 m). Modified from Preliminary Map 1979 DR-3, Bannatyne and Jones (1979).*

TABLE 14

CHEMICAL AND PHYSICAL PROPERTIES OF STONY MOUNTAIN FM., MINAGO RIVER

Sample: 3 m thin bedded dolomite, 2.2 km south of Minago River, 0.9 km east of Highway 6

SiO_2	0.94%	Los Angeles Abrasion	Bulk Specific Gravity
Al_2O_3	0.20	Loss: 36.1%	2.59
Fe_2O_{3T}	0.18		
CaO	30.30	Soundness Loss	Apparent Specific Gravity
MgO	21.30	1.50''-0.75'': 7.9%	2.79
Na_2O	0.01	0.75''-0.50'': 9.1	
K_2O	0.07	0.5''-0.375'': 11.5	
TiO_2	0.02		Absorption
P_2O_5	0.01		2.71%
MnO	0.00		
LOI	47.17		Porosity
Total	100.20		7.02%

Potential Uses: Suitable for base course A and B, and for surface gravel.

Additional Tests: None.

Sources: Chemical analyses: Energy and Mines Analytical Laboratory; Physical tests and potential uses: UMA Group.

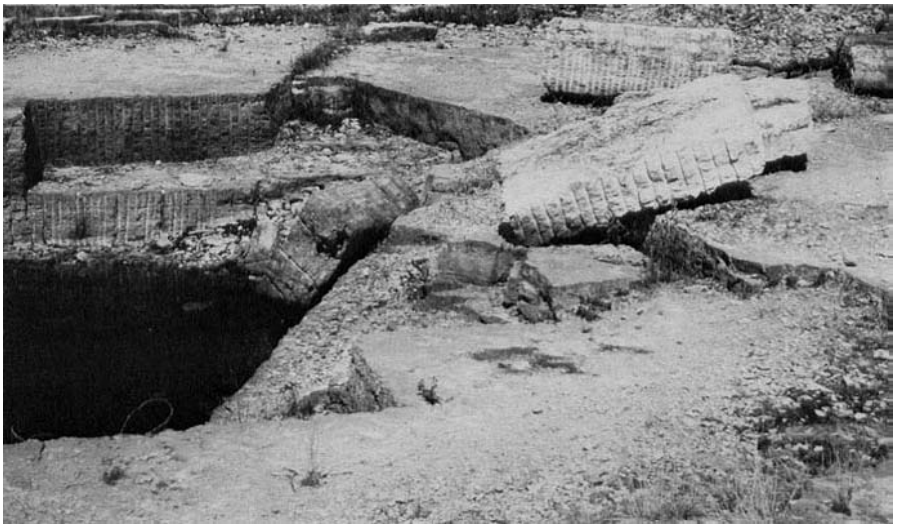

Figure 25: *The southwest pit at the stone quarries south of Hodgson, formerly worked by Manitoba Marble Quarries, Limited; Stony Mountain Formation varicoloured dolomite in mixed shades of rose, purplish orange and buff.*

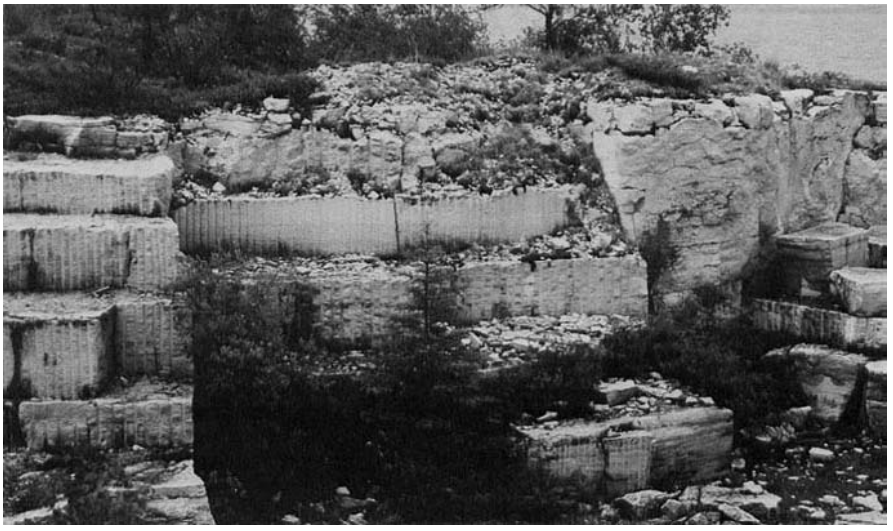

Figure 26: *Thick bedded (up to 0.9 m) dolomite quarried as 'marble' from 1929 to 1936 by Manitoba Marble Quarries, Limited; Mile '39' of Hudson Bay Railway, near shore of Cormorant Lake, in Stony Mountain Formation.*

TABLE 18

CHEMICAL AND PHYSICAL PROPERTIES OF MOOSE LAKE FORMATION

Sample: 6.0 m of finely crystalline to micritic dolomite, south end of Grand Rapids quarry.

SiO_2	0.64%	Los Angeles Abrasion	Bulk Specific Gravity
Al_2O_3	0.12	Loss: 30.4%	2.73
Fe_2O_3	0.19		
CaO.	30.30	Soundness Loss	Apparent Specific Gravity
MgO	21.00	1.50''-0.75'': 15.6%	2.82
Na_2O	0.02	0.75''-0.50'': 15.9	
K_2O	0.09	0.5''-0.375'': 26.6	
TiO_2	0.01		Absorption
P_2O_5	0.01		1.18%
MnO	0.00		
LOI	47.18		Porosity
Total	99.60		3.23%

Potential Uses: Base course A and B; surface gravel. Crushed stone from elsewhere in the quarry has been used as concrete aggregate (see text).

Additional Tests: None.

Sources: Chemical analyses: Energy and Mines Analytical Laboratory; Physical tests and potential uses: UMA Group.

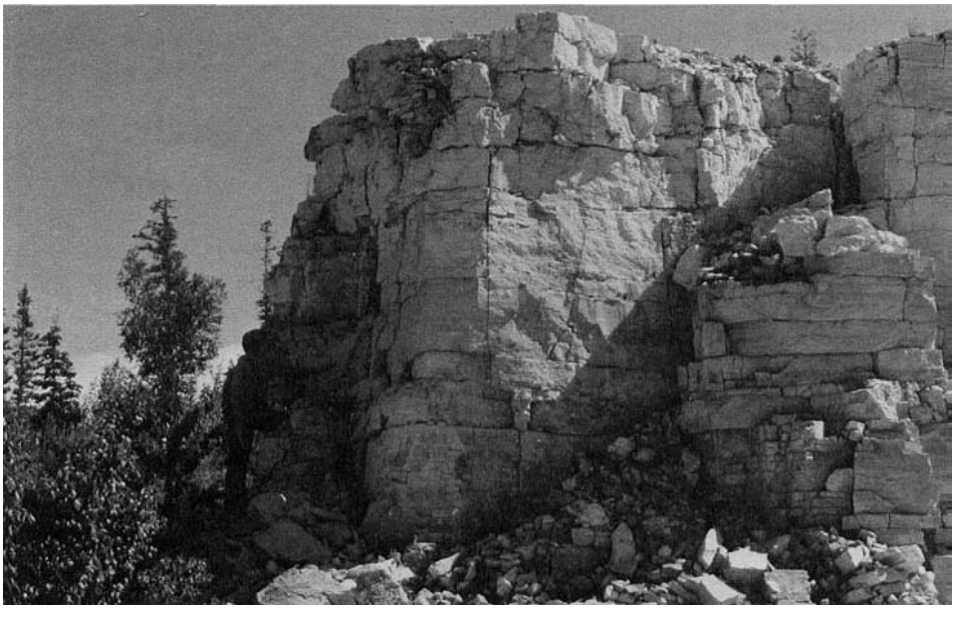

Figure 33: Cliff of micritic dolomite of the Moose Lake Formation, at the entrance to the Grand Rapids aggregate quarry.

rock must have been obtained from the other parts of the quarry, or else the very fine grained to micritic dolomite deteriorates after exposure. The chemical analysis indicates the carbonate content of the tested sample is about 99%.

The Moose Lake Formation is 8.5 m thick in the Grand Rapids area. The lower 4.5 m is a greyish yellow micritic dolomite, with thin fossiliferous interbeds. The upper 4.0 m is stromatolitic, very fine grained to micritic, buff dolomite. Concentrically layered, mounded structures, 5 to 15 cm across, were noted in abundance along certain bedding planes near the entrance to the quarry (Fig. 34). Locally in the quarry a thin cap of Atikameg dolomite is present.

ATIKAMEG FORMATION

The overlying Atikameg Formation is exposed in the large roadcut on Highway 6 northwest of Grand Rapids, immediately south of the previously described quarry. The formation also outcrops south of Clearwater Lake, west of Atikameg station. A small test pit or quarry in l.s. 9-30-48-13W exposes abundant banded stromatolitic dolomite (Fig. 35) and dolomite breccia; although the ubiquitous orange stain in the dolomite suggests it is Atikameg, the formation has not been positively identified.

The Atikameg Formation is between 5.0 and 5.7 m thick, and is a fine grained, massively bedded dolomite characterized by abundant vuggy porosity. In outcrop, the vugs are lined in many places with brown clay that imparts a distinctive appearance to the formation. Stearn (1956) suggests that the dolomite was formed by reef-building organisms, but that its almost uniform thickness in outcrop indicates it is a biostrome rather than a bioherm.

EAST ARM FORMATION

The East Arm Formation, containing the diagnostic fossil *Leperditia hisingeri*, is between 13 and 15 m thick and consists of brecciated, arenaceous, oolitic and fossiliferous dolomite.

A quarry has been operated periodically by Manfor Limited, north of The Pas, in l.s. 6-35-56-26W (Fig. 36; M.I. card 63F/14:DOL-1). The dolo-