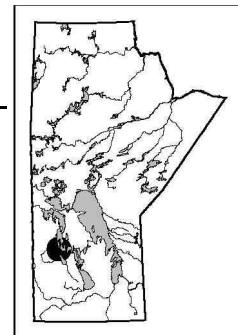


**GS-24 SOLUTION-COLLAPSE BRECCIA OF THE UPPER DEVONIAN SAGEMACE MEMBER, SOURIS RIVER FORMATION, WINNIPEGOSIS AREA: PROGRESS REPORT**

by L. Friedrich<sup>1</sup> and N. Chow<sup>1</sup>



Friedrich, L. and Chow, N. 2001: Solution-collapse breccia of the Upper Devonian Sagemace Member, Souris River Formation, Winnipegosis area: progress report; in Report of Activities 2001, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 156-158.

**INTRODUCTION**

The Devonian succession in Manitoba is characterized by three large-scale carbonate-evaporite cycles (Norris et al., 1982; Fig. GS-24-1). The oldest, thickest and best-defined depositional cycle comprises the Elk Point Group, which includes the Prairie Evaporite. The second cycle comprises the Dawson Bay Formation, which is topped by the Hubbard Evaporite, and the youngest cycle comprises the Souris River Formation, which includes the Sagemace and Point Wilkins members and the Davidson Evaporite. Dissolution of the evaporite units has resulted in the collapse of post-evaporite strata into voids, creating single- or multiple-event, salt-collapse structures (Bezys and McCabe, 1996). Uniform collapse of strata has produced no obvious structural deformation, whereas catastrophic collapse has formed a chaotic megabreccia.

Similar salt-collapse features have been identified in bedrock quarries near Winnipegosis. Quarry faces expose the Upper Devonian Sagemace Member of the Souris River Formation. These collapse features have been interpreted as solution-collapse breccia units (Bezys and McCabe, 1996). However, no extensive work has been done in this area to determine the origin and timing of these breccia units.

**STUDY AREA**

The two crushed stone quarries being studied for this project are located in the northeast quadrant of sec. 9, twp. 31, rge. 18, W 1<sup>st</sup> mer., 1.6 km north of the town of Winnipegosis, immediately south of Highway 20 (Fig. GS-24-2). Quarry walls of up to 5 m expose the Devonian Sagemace Member of the Souris River Formation. The walls show 1) buff to pink and purple, medium- to thick-bedded, fine-grained limestone, which is locally fossiliferous and burrow mottled, and (2) dark pink to yellow, poorly consolidated breccia of limited lateral extent.

**OBJECTIVES**

The primary objectives of this research are to interpret the depositional origin of the Sagemace Member and to determine the timing and origin of the breccia units in the Winnipegosis quarries. This work will involve 1) characterizing lithofacies in the two quarries and in cores from the quarries and adjacent areas, 2) describing the texture and composition of the breccia units, 3) determining the mineralogy and elemental geochemistry of the fine-grained breccia matrix, and 4) examining the stratigraphy of underlying Devonian strata.

**METHODOLOGY**

Fieldwork was completed during one week in July 2001. Detailed geologic maps were created of both the eastern and western Winnipegosis quarries by pace and compass (eastern quarry shown in Fig. GS-24-3), five stratigraphic sections were described and measured, and preliminary detailed lithofacies descriptions were documented. Representative samples were collected and key features were recorded photographically. Four coreholes (M-06-80, M-10-81, M-16-81 and M-5-2000), drilled by Manitoba Industry, Trade and Mines in the area of the Winnipegosis quarries, were logged and sampled in August 2001.

Thin sections are being made from the samples and will be stained with Alizarin Red S and potassium ferricyanide for

		<i>GROUP / FORMATION / MEMBER</i>	<i>Thick-ness (m)</i>
<b>DEVONIAN</b>	<b>SOURIS RIVER FORMATION</b>	Sagemace Member	20+
		basal shale	2-14
		<i>Davidson Evap. (dissolved)</i>	
		Point Wilkins Member	33-46
		First Red Beds	3-14
	<b>ELK POINT GROUP</b>	<i>Hubbard Evap. (dissolved)</i>	
		DAWSON BAY FORMATION	26-60
		Second Red Beds	6-15
		Prairie Evaporite (partly dissolved)	0-129
		WINNIPEGOSIS FORMATION	45-110
	Elm Point Fm.	10-20	
	ASHERN FORMATION	3-18	

Figure GS-24-1: Generalized stratigraphic section of the Devonian succession in the Manitoba outcrop belt (modified from Norris et al., 1982).

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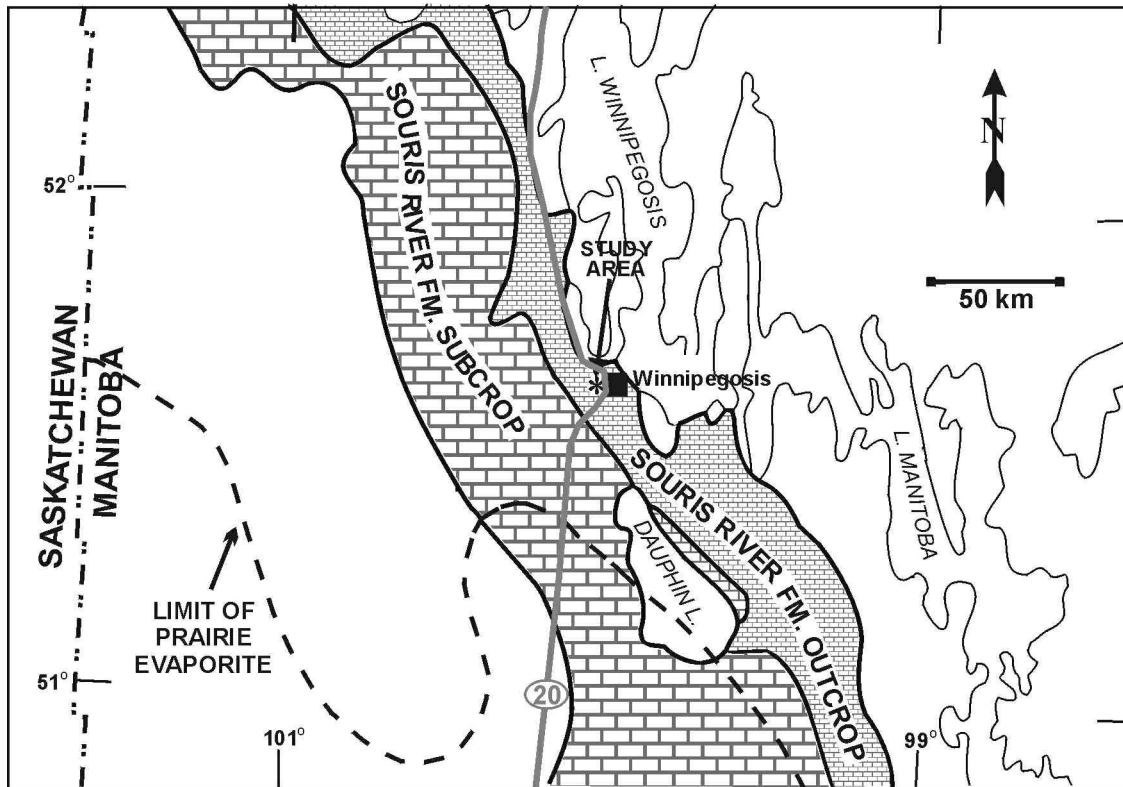
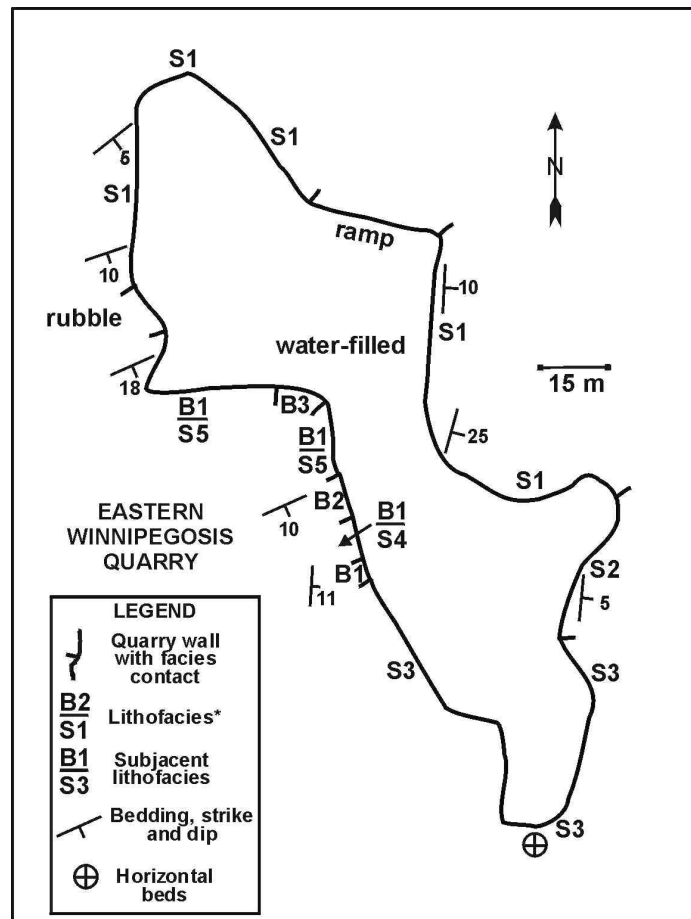


Figure GS-24-2: Location map showing the study area and areas of Souris River Formation outcrop and subcrop (modified from Martiniuk, 1992).



\*Lithofacies descriptions in Table GS-24-1

Figure GS-24-3: Geologic map of the eastern Winnipegosis quarry showing the preliminary lithofacies units.

subsequent transmitted-light and cathodoluminescence microscopy. Analyses by X-ray diffraction will be done to determine the mineralogy of the breccia matrix, and the scanning electron microscope will be used to determine the clast textures of the breccia samples. An inductively coupled plasma atomic optical spectroscope will be used for characterizing minor- and trace-element concentrations in the matrix of the breccia samples.

## PROGRESS TO DATE

Geologic mapping of the quarries and descriptions of stratigraphic sections have highlighted the lateral lithological variability of the Sagemace Member exposed in the Winnipegosis quarries. In the east quarry, detailed examination has resulted in preliminary division of the Sagemace Member into eight lithofacies (Fig. GS-24-3; Table GS-24-1). Five lithofacies (units S1 to S5) are relatively unaltered host limestone units, classified using Dunham's (1962) classification scheme. The remaining three units (B1 to B3) are breccia units, characterized based on percent of ultrastables and matrix versus clast supported.

Table GS-24-1: Preliminary lithofacies units in the eastern Winnipegosis quarry.

Unit	Classification	Occurrence
S1	Burrowed, skeletal mudstone to wackestone	Unaltered host rock
S2	Mottled mudstone	Unaltered host rock
S3	Skeletal wackestone to packstone	Unaltered host rock
S4	Skeletal mudstone to packstone	Unaltered host rock
S5	Prominently bedded mudstone	Unaltered host rock
B1	Petromict diamictite to conglomerate	Collapse breccia
B2	Clay-rich petromict diamictite	Collapse breccia
B3	Megaclastic petromict diamictite	Collapse breccia

The host limestone units, which show no obvious deformation, range from burrowed, skeletal mudstone to wackestone (S1) to prominently bedded mudstone (S5). All limestone units have horizontal or gently dipping, medium to thick beds and gradational to interfingering lateral contacts. Skeletal fragments are mainly crinoid ossicles and brachiopod and gastropod shells, with local bulbous stromatoporoids in units S1 and S2. Concentrations of sulfide concretions with iron oxide haloes are found locally in units S1 and S3 and calcite-filled, 2- to 10-cm vugs are common in all units.

The breccia units extend laterally for 67 m and are either petromict diamictites or petromict conglomerates, but vary greatly in clast lithology, clast size and matrix type. Clasts are generally very angular to subangular and range in size from 1 to 200 mm. Based on field observations, some clast lithologies, such as burrowed skeletal mudstone to wackestone and strongly bedded mudstone, are similar to lithologies in the host limestone units elsewhere in the quarry (units S1 and S5). All breccia units are variably weathered, and obvious skeletal fragments are rare to absent.

## ACKNOWLEDGMENTS

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