

GS-23 Summary of investigations for the Sedimentary and Industrial Minerals Section, Manitoba Geological Survey

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Summary

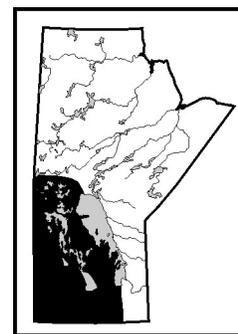
The Sedimentary and Industrial Minerals Section of the Manitoba Geological Survey engaged in limited field-work in 2006, although numerous office-based projects continued or were initiated. Some projects, such as the Williston Basin TGI (Targeted Geoscience Initiative) project, had some minor achievements, while others, such as the surficial geology compilation of Manitoba and the Phanerozoic lineament study, have made great progress. This year's summary will include an update on stratigraphic corehole drilling carried out late last summer (2005). Staff has also been responsible for responding to numerous requests for information on industrial minerals and aggregate deposits, as well as leading field trips. Support was also provided for the new mineral deposit database and the St-Lazare potash study.

Introduction

The main focus of study for projects in the Sedimentary and Industrial Minerals Section included

- Phanerozoic lineament study;
- surficial geology compilation of Manitoba;
- Williston Basin TGI project;
- stratigraphic corehole drilling, 2005; and
- miscellaneous studies.

Limited progress was made on the Williston Basin TGI project, but progress was made on the Phanerozoic lineament study, which is a co-operative study between the Manitoba Geological Survey, Saskatchewan Industry Resources and the Alberta Geological Survey. Significant progress has been made on the surficial geology compilation of Manitoba. Thirty-seven 1:250 000 scale maps, four 1:500 000 scale maps and a prototype of the 1:1 000 000 scale map are to be released this year. Two coreholes were drilled in 2005 for the Manitoba Stratigraphic Database, both in the Grand Rapids area and a further two holes were drilled in west-central Manitoba in 2006 to assist in the understanding of Devonian stratigraphy (Bamburak, GS-24, this volume). The section is also assisting with the compilation of the mineral deposit database, which will be based on the MGS Mineral Deposit Series, with additional information from recently opened, cancelled assessment files (Heine, GS-26, this volume). Aggregate studies were conducted in the Rural Municipality of Ste. Rose as part of an ongoing project to update aggregate information in the province (Groom, GS-22, this volume).



Also, GIS assistance is being provided to the Mines Branch for the digitization of all land and mineral rights, along with surface ownership, for the St-Lazare potash project area.

Phanerozoic lineament study

As indicated in Bezys (2005), a start has been made on the Phanerozoic lineament study, the compilation of a database of Phanerozoic structural information for the Western Canada Sedimentary Basin (WCSB) by the Alberta, Saskatchewan and Manitoba geological surveys. The joint prototype structural database has been designed to document structures that may have localized hydrocarbon and metal-bearing fluids in traps within the Phanerozoic stratigraphic package. A two-pronged approach to collecting the lineament data is being taken in Manitoba. The first objective is to compile an inventory of published maps and figures of lineaments. This is followed by digitizing the lineaments into ArcView® layers (i.e., shapefiles) and individually tagging them with attribute data. The second objective is to obtain GIS digital shapefiles from published sources, such as Manitoba's Integrated Anomaly Map (Manitoba Geological Survey, 2006; Figure GS-23-1) and the printed NATMAP Shield Margin Project Area map (NATMAP Shield Margin Project Working Group, 1998). The respective attribute tables from these sources are then modified to fit the format of the joint provincial database. Additional details of the project are discussed by Pana et al. (in press) in an extended abstract released at the Saskatchewan and Northern Plains Oil and Gas Symposium in Regina, Saskatchewan (October, 2006).

Surficial geology compilation of Manitoba

A significant portion of the surficial maps of Manitoba are now available in a digital form. Last year, sixteen 1:250 000 scale and one 1:500 000 scale maps of southern Manitoba were released in digital form and this year, thirty-seven 1:250 000 scale maps, four 1:500 000 scale maps and a prototype of the 1:1 000 000 scale map are available, covering the remainder of the province. The original paper maps were published in 1981 and had become outdated. The present maps will be in digital and queryable formats and will be an important tool for mineral exploration in Manitoba, as well as for land-use planning.

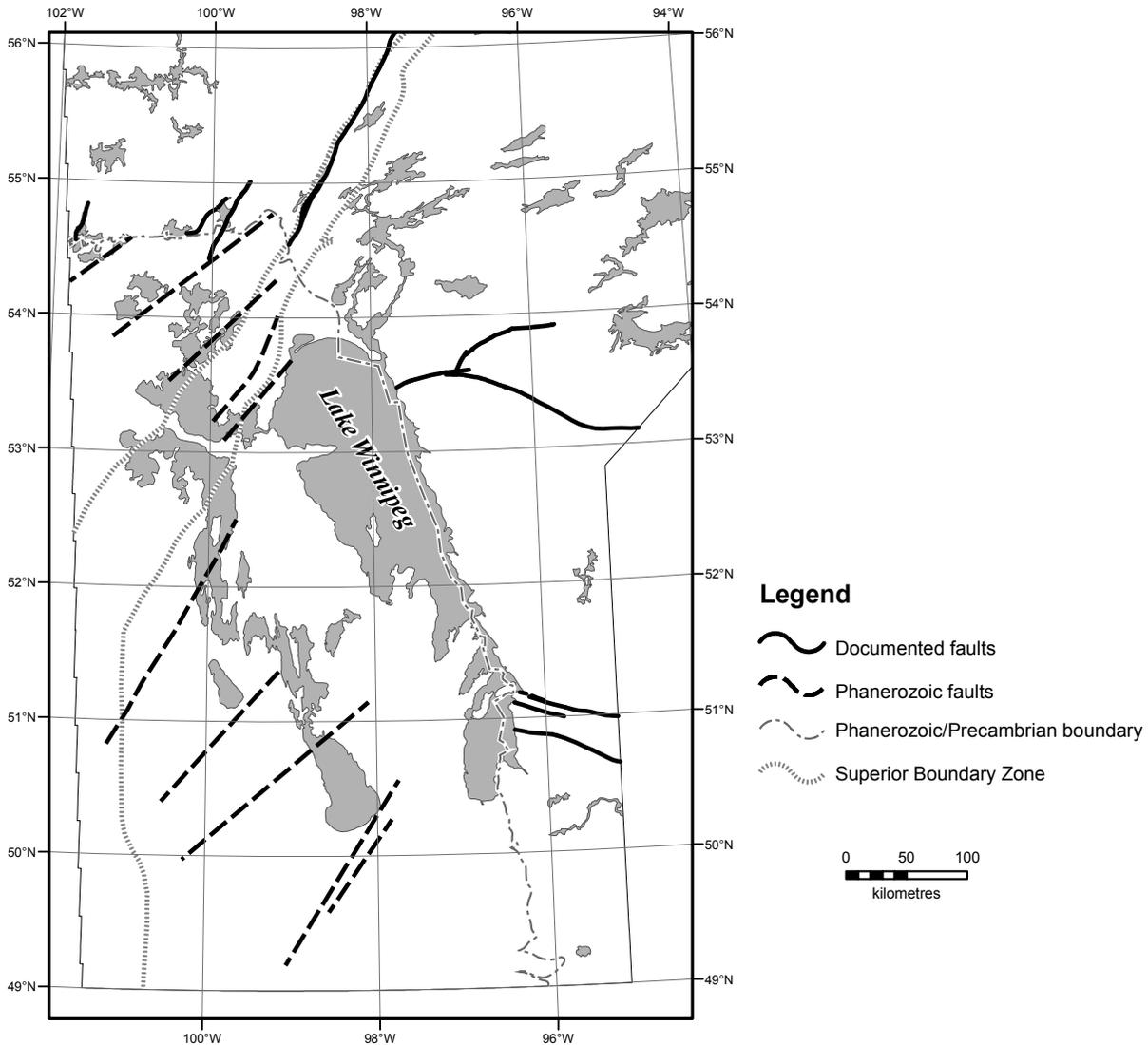


Figure GS-23-1: Location of fault lineaments in southwestern Manitoba (Precambrian and Phanerozoic) from Manitoba's Integrated Anomaly Map (Manitoba Geological Survey, 2006).

Williston Basin TGI project

Interprovincial subsurface stratigraphic correlations for the entire Phanerozoic section have been completed, which has been a significant accomplishment. This was most invaluable for the Mesozoic section, where correlations had not been done to any major extent or with much success. A better understanding of the geological setting and erosional events that affected the Cretaceous shale units in the provinces has resulted in the renaming of a portion of Manitoba's stratigraphic column. This work is significant for shallow gas exploration in the province.

Cross-border correlations of the Bakken Formation, Three Forks Group coincided with the discovery of the Sinclair field, which is being explored for conventional oil. Co-operative maps of and discussions between Manitoba and Saskatchewan have helped in the understanding of the dynamics of this new play, which in turn

has helped industry. The compilation of all oil and gas shows throughout the Phanerozoic section has been a useful exploration tool for the industry, especially the compilation of Mesozoic oil and gas shows, which did not exist prior to the start of this project. A detailed and accurate basin-wide model of the geohydrological dynamics of the Williston Basin system has been constructed and will be a valuable tool to study oil-water migration pathways through the Phanerozoic section (particularly the Paleozoic section).

Final map production for the project is to be completed by fiscal year-end (March 2007).

Stratigraphic corehole drilling, 2005

Late in the summer of 2005, two coreholes were drilled in the Grand Rapids area for stratigraphic purposes (Table GS-23-1). Corehole M-1-05 was drilled through

Table GS-23-1: Summary of stratigraphic corehole data, 2005.

Hole No.	Location and elevation (m asl)	SYSTEM/Formation/(Member)	Interval (m)	Lithology summary
M-1-05	02-06-51-14W	SILURIAN INTERLAKE GROUP/ Atikameg	0.0–3.4	Buff yellow dolowackestone, very fine grained, 20% porosity
Ochre Lake	5913325N 466311E	U ₂ -Marker	3.4–5.3	Grey dolomudstone
		Moose Lake	5.3–17.0	Grey-brown dolomudstone, laminated to massive
	265.2	U ₁ -Marker	17.0–17.4	Grey-brown dolomudstone, laminated, no sand
		Fisher Branch	17.4–29.8	Light brown to tan dolowackestone to packstone, <i>Virgiana decussata</i> at 29.3 m (20 cm bed)
		Stonewall	29.8–51.6	
		Stonewall/(Upper Stonewall Marker)	29.8–30.7	Light grey-beige dolomudstone
		Upper Stonewall	29.8–42.8	Tan dolowackestone
		Upper T-Marker	42.8–43.5	Grey dolomudstone, mottled, sand/shaly in places
		ORDOVICIAN/Lower Stonewall	43.5–51.6	Grey to brown dolomudstone and wackestone, Lower T-Marker not identified
		(Williams)	48.9–51.6	Grey dolomudstone
		Stony Mountain	51.6–85.7	Mottled brown dolowackestone
		Red River	85.7–145.9	
		Upper Red River (Fort Garry)	85.7–97.4	Interbedded massive dolomite, beige to brown to grey mottled, gradational upper contact
		Lower Red River	97.4–145.5	Beige dolowackestone, mottled, gradational upper contact
		(Hecla Beds)	145.5–145.9	Mottled sandy dolomite, pyritic mottling with possible brachiopod molds (1–2 cm across)
		Winnipeg	145.9–154.7	Green shale/siltstone between 145.9–148.5 m, bioturbated in places, fine- to medium-grained sand between 148.5–154.7 m, white to light beige, consolidated, quartzose
	Weathered PRECAMBRIAN	154.7–158.7	Pale green to white, severely kaolinized, friable, unconsolidated, lithology unrecognizable	
	PRECAMBRIAN	158.7–161.9	Light grey, fine- to medium-grained, massive, homogenous, nonmagnetic tonalite	
M-2-05	14-16-58-12W	ORDOVICIAN/Lower Stonewall	0.0–12.3	Very broken and rubbly core, tan dolowackestone
William Tower	5985262N	Lower T-Marker	3.1–4.6	Grey to brown dolomudstone
	488007E	(Williams)	9.0–12.3	Grey dolomudstone
	281.9	Stony Mountain	12.3–40.8	Mottled tan dolowackestone
		Red River	40.8–84.4	
		Upper Red River (Fort Garry)	40.8–51.0	Mainly grey, mottled, dolomudstone
		Lower Red River	51.0–83.2	Tan dolowackestone
		(Hecla Beds)	83.2–84.4	Very sandy dolomite, mottled, pyritized
	Winnipeg	84.4–90.6	Dark mottled brown sandstone, no shale	

the Silurian Interlake Group to the Precambrian, for a depth of 161.9 m. Corehole M-2-05 was drilled through Ordovician strata, starting with the Stonewall Formation, but was terminated above the Precambrian in the Ordovician Winnipeg Formation at a depth of 90.6 m. To view this year's drilling results see Bamburak (GS-24, this volume).

Corehole M-1-05 was drilled at Ochre Lake and corehole M-2-05 was drilled at William Tower (near William Lake) (Figure GS-23-2). The Ochre Lake corehole, M-1-05, was drilled to follow up the anomalous occurrence of disturbed Silurian outcrop that was first reported in 1996 by Bezys (1996a). The area of disturbance follows an outcrop ridge that appears to be lineament controlled, trending 15°. The Reedy Lake Lineament (Bezys, 1996b), 33 km to the north of Ochre Lake, trends in a similar direction (18–20°), which is parallel to the basement trend of the Superior Boundary Zone. Corehole M-1-05 was sited near to the trend of the Ochre Lake lineament to target the Precambrian and determine if the basement rock was disturbed in anyway. The drilling intersected normal Silurian and Ordovician dolomites, with no disturbances found within the Precambrian.

The second corehole, M-2-05, was drilled at William Tower alongside Provincial Highway 6. This corehole was drilled to provide stratigraphic control for The Manitoba Museum staff who is investigating unique paleontological assemblages in the Stonewall Formation (Williams Member) found in nearby outcrop. Work is still progressing on this project and detailed core logging will be conducted.

Miscellaneous studies

Numerous other studies and projects are carried out by the section and are detailed below.

Mineral deposit database

The section is assisting with the compilation of the mineral deposit database, which will be based on the MGS Mineral Deposit Series. Additional information is being provided from recently opened, cancelled assessment files. To date, the section has provided information from over 700 assessment files, including company name, year of work, type of work done and UTM location (Heine, GS-26, this volume).

Aggregate studies

This summer, gravel deposits in the Rural Municipality (RM) of Ste. Rose were mapped as part of an ongoing project to update aggregate information in the province (Groom, GS-22, this volume). The last update of this municipality was done in 1978. Aggregate information is used in municipal development plans, resource management within the MGS, and is available to other

government departments and outside clients on request. Also, a pit and quarry inventory of the Icelandic River–Washow Bay watershed area was completed to provide information to the Water Stewardship Department for inclusion in their planning document.

Potash study

Land and mineral rights, as well as surface ownership information, were acquired and compiled into a database for the St-Lazare potash project area. The area of compilation includes the RM of Archie and the RM of Ellice, townships 15 to 18. In addition, digital 1:20 000 data was acquired for both of the rural municipalities and used for GIS mapping and analysis purposes. Thirty-seven road and railway plans were digitized and added to the GIS database. This project is near completion.

Field trips

The Sedimentary and Industrial Minerals Section hosted the 'Lower to Middle Paleozoic Stratigraphy of Southwestern Manitoba' field trip for the MGS this spring. This three-day trip targeted portions of Manitoba's Interlake Silurian and Ordovician stratigraphy and the Devonian in the Lake Winnipegosis area. The highlights of the trip were the salt springs and Mafeking quarry chimneys exposed in the Dawson Bay area (Lake Winnipegosis). Field trips were also conducted for The Manitoba Museum, Brandon University, two petroleum companies and one diamond exploration company. Sites visited included the Mesozoic escarpment, the Paleozoic–Precambrian boundary in southwestern Manitoba and the Cormorant Lake outlier (Silurian–Ordovician). The section also provided advice and staff support to the EdGEO (education geology) program for science teachers at the University of Manitoba Field School at Star Lake in Whiteshell Provincial Park. The program was partially assisted by the Manitoba Geological Survey.

Economic considerations

Large regional syntheses, such as the Williston Basin TGI and lineament compilation projects, are the framework upon which subsequent exploration will be based. The TGI project has shown that interprovincial subsurface correlations are invaluable and represent a significant accomplishment. This is best reflected in the Mesozoic section where cross-border correlations had not previously been attempted. This work is significant for the exploration of shallow gas in southwestern Manitoba.

The discovery of the new Sinclair field (conventional oil) in southwestern Manitoba coincided with the cross-border correlations of the Bakken Formation, Three Forks Group. Industry has benefited from the co-operative mapping project and discussions between Manitoba and Saskatchewan in understanding the dynamics of this

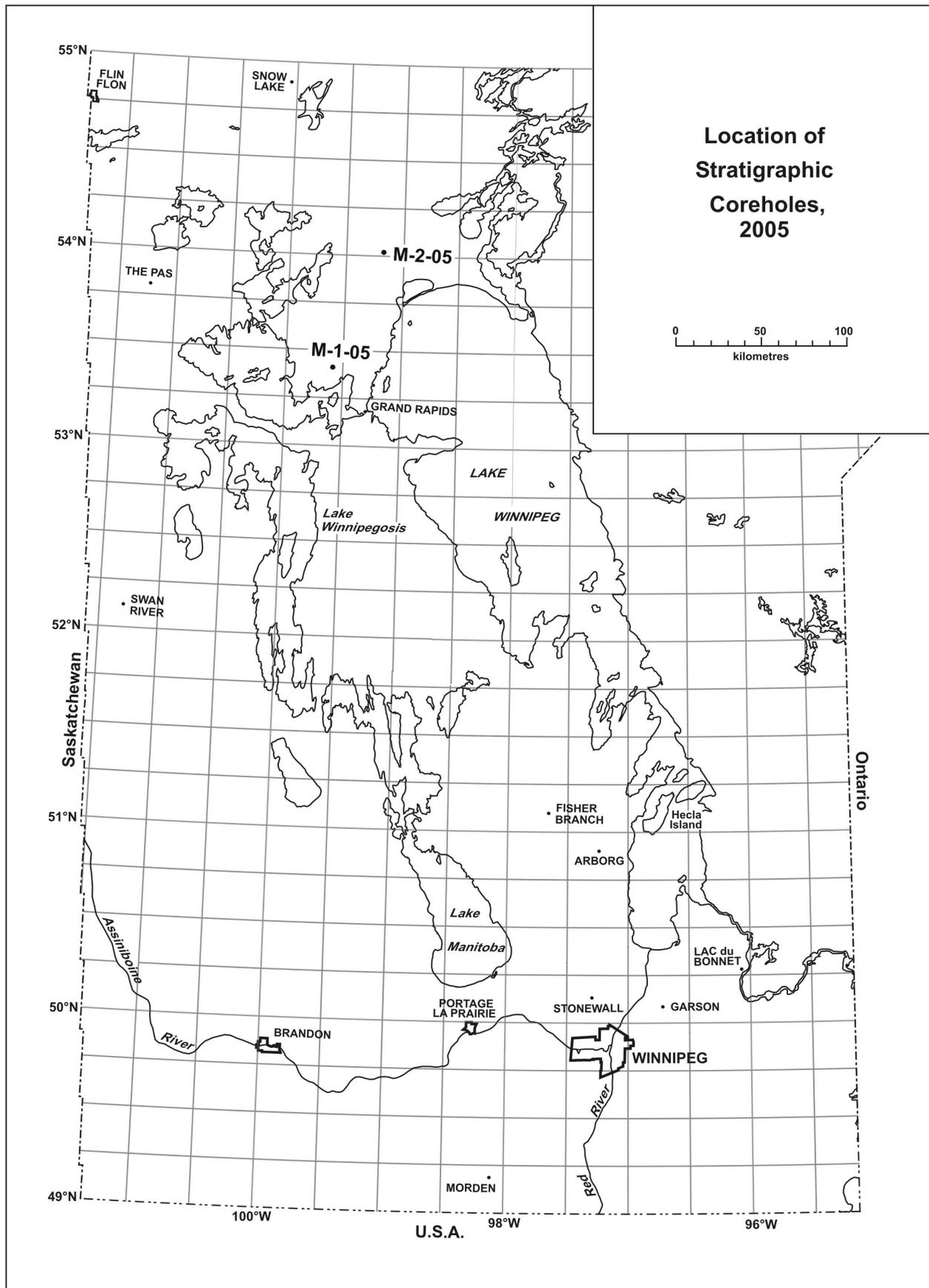


Figure GS-23-2: Location of stratigraphic coreholes, 2005.

exciting new play. Also, the compilation of all oil and gas shows for the TGI project will help the oil and gas industry.

It is hoped that further hydrocarbon and mineral exploration will be conducted in Manitoba as a result of the lineament compilation study and mineral deposit database. Surficial mapping and aggregate studies are important for effective land-use planning, and hydrocarbon, groundwater and industrial minerals development. The potash study is an excellent example of the application of land-use planning to directly assist the industrial minerals industry.

Acknowledgments

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