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Open File 3109

**REGIONAL STRATIGRAPHIC PICKS FOR THE
MANNVILLE GROUP - SOUTHWEST SASKATCHEWAN
PHASE I**

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The Mannville Group in the Western Canada Sedimentary Basin contains large volumes of highly-economic light and medium oils and gas, in addition to billions of barrels of heavy oil. Because of the value of this resource and the relatively shallow drilling depths in many areas, the Mannville Group has been and remains a highly competitive and successful target. However, despite thousands of well penetrations, no consistent regional stratigraphic framework has emerged.

This study presents results of the first phase of a multi-year, regional stratigraphic study which will extend from southwestern Saskatchewan to the Foothills. The objectives are to 1) construct an integrated regional framework across the Western Canada Sedimentary Basin; 2) provide sedimentological and paleogeographical interpretations of the area; 3) to provide a sequence stratigraphic framework for the interval; and 4) to provide a suite of regional maps for each of the unconformity-bounded successions. The first phase of this study (Twps. 1 to 20, Rges. 13 to 22 W3), and the subject of this open file report is located in the producing trend of southwestern Saskatchewan (Fig. 1), an area characterized by a large number of wells with good core control. A total of 495 wells were used to generate the regional grid of stratigraphic cross-sections (Fig. 2) and 147 cores were examined and measured. The report documents the regional correlations resulting from the study.

In southern Saskatchewan, Mannville-equivalent sediments are termed the Pense, Cantuar and Success (S2) formations (Fig. 3). The strata range from Oxfordian/Kimmeridgian for the Success (S1) to middle Albian for the Pense Formation. The interval, which is up to 100 m thick, was deposited over 40 to 50 million years, and is

riddled with unconformities and weathered horizons. Stratigraphic correlations using well logs are difficult, imprecise and highly suspect unless corroborated by core control.

Jurassic Success S1 sediment was deposited in a restricted shallow-marine or lacustrine environment. The top of the S1 is extremely weathered indicating a long hiatus. The S2 was deposited as a sheet of quartzose, braided-fluvial sandstone that unconformably cuts into the S1. S2 sediments extended across the southern prairies. Contrary to existing thought, there was minimal relief at the base of the S2, which is the Sub-Cretaceous unconformity. The top of the S2 is commonly a deeply-weathered, thick paleosol overlain by coal and carbonaceous shale.

The Cantuar Formation consists of dominantly lithic sandstone, siltstone, and shale overlying a basal quartzose unit. The base of the Cantuar Formation has high local relief and in places has eroded long wide valleys into the Success and older Jurassic strata (Masfield, Roseray and Rush Lake formations). Regional maps show that the regional Cantuar valley system trended north–south with up to 74 m of relief. Remnants of Success sediment are preserved as isolated, buried cuestas on the margins of the valley walls. Cantuar valley fill is dominantly nonmarine, with the basal quartzose sediment of McCloud Member (equivalent to the lower Mannville in southern Alberta) overlain by lithic–feldspathic sediments of the Dimmock Creek and Atlas Members (equivalent to the Upper Mannville). Cantuar sediments represent the infill of the extensive valley system. The fill was from meandering streams with abundant paleosols, shallow lacustrine, and splay deposits.

In places, the top of the Cantuar Formation is represented by chert and quartzose sandstones deposited in a north–south trending estuarine system with several tributaries. Initially referred to as the Atlas Estuary facies, it has been designated as the Chokecherry Creek Member of the Cantuar Formation. The onset of Pense sedimentation is represented by a transgressive surface of erosion overlain by a distinctive thin shelfal sand referred to as the Cantuar Marker and a marine condensed section of the IHACM marker. The Pense Formation consists of up to seven upward-coarsening cycles deposited in a shallow-marine basin which thickened eastward. The Pense transgression variably overlies either Cantuar or Success sediments.

The study has important economic considerations because of the hydrocarbons produced from several of these stratigraphic units, most noticeably from the S2 and quartzose, estuarine sandstones of the Atlas Member. Play types (Fig. 4) are dominantly stratigraphic and include: 1) Pense shelfal sandstone; 2) Pense transgressive sandstone; 3) estuary sandstone of the Chokecherry Creek Member; 4) point bar sandstone of the Atlas Member; 5) preserved remnants of the S2 braid plain; and 6) thin-bedded marine/lacustrine? sandstone of the S1.

Important notes regarding the data set:

1. This open file report consists of one 3½" low density 720k disc containing the file "Mannsask.exe". This file is a self-extracting, compressed archive file containing the following files:

Mannsask.wks → Lotus 1-2-3 worksheet

Mannsask.dbf → D-base 3 Plus database file

Mannask.csv → Comma Separated Value ascii file

(See the structure of either of the previous two fields for field definitions.)

2. To use the data set(s), copy Mannask.exe from the disc to the directory in which you want it to reside. Then in that directory, type "Mannask.exe" to extract the three versions of the data set.
3. The table below lists the stratigraphic picks made and their abbreviations. Refer to Figure 3 for the southwest Saskatchewan stratigraphic nomenclature.

Full name	Abbreviation	Full name	Abbreviation
Viking Top	VKT	Success Top	ST
Joli Fou Top	JFT	S2 Top	S2T
Joli Fou Mkr1	MKR1	S2 Base	S2B
Joli Fou Mkr2	MKR2	Mannville Base	MNB
Joli Fou Base	JFB	Base of Cretaceous	BC
Mannville Top	MNT	Jurassic Top	JT
Pense Top	PT	Vanguard Top	VT
IHACM	I	S1 Top	S1T
Cantuar Mkr	CM	S1 Base	S1B
Pense Base	PB	Success Base	SB
Cantuar Top	CT	Masefield Top	MT
Chokecherry Ck Top	CCT	Masefield Base	MB
Chokecherry Ck Base	CCB	Rierdon Top	RT
Atlas Top	AT	Rosera Top	RST
Atlas Base	AB	Rosera Base	RSB
Dimmock Ck Top	DT	Rush Lake Top	RLT
Dimmock Ck Base	DB	Rush Lake Base	RLB
Glauconite Top	GLT	Vanguard Base	VB
Glauconite Base	GLB	Upper Shaunavon Top	UST
McCloud Top	MCT	Upper Shaunavon Base	USB
McCloud Base	MCB	Lower Shaunavon Top	LST
Cantuar Base	CB		

4. When manipulating this data set to produce the various isopach maps and structural maps it is important to note the following:

- if a zero value for a unit is followed by zeros for all units below it, then the unit was **NOT PICKED**.
- if a zero value for a unit is followed by values >zero for any unit below it then the unit was **NOT PRESENT**.

5. Finally, it is important to note that this open file report is a data dump based on our understanding at the time of publication. Our ideas and interpretations have been evolving with each successive phase of this Mannville study. Therefore, our interpretations may change slightly over time. We have tried to correct minor data busts that may be present due to input errors during the data entry process, however, a few may have been missed.

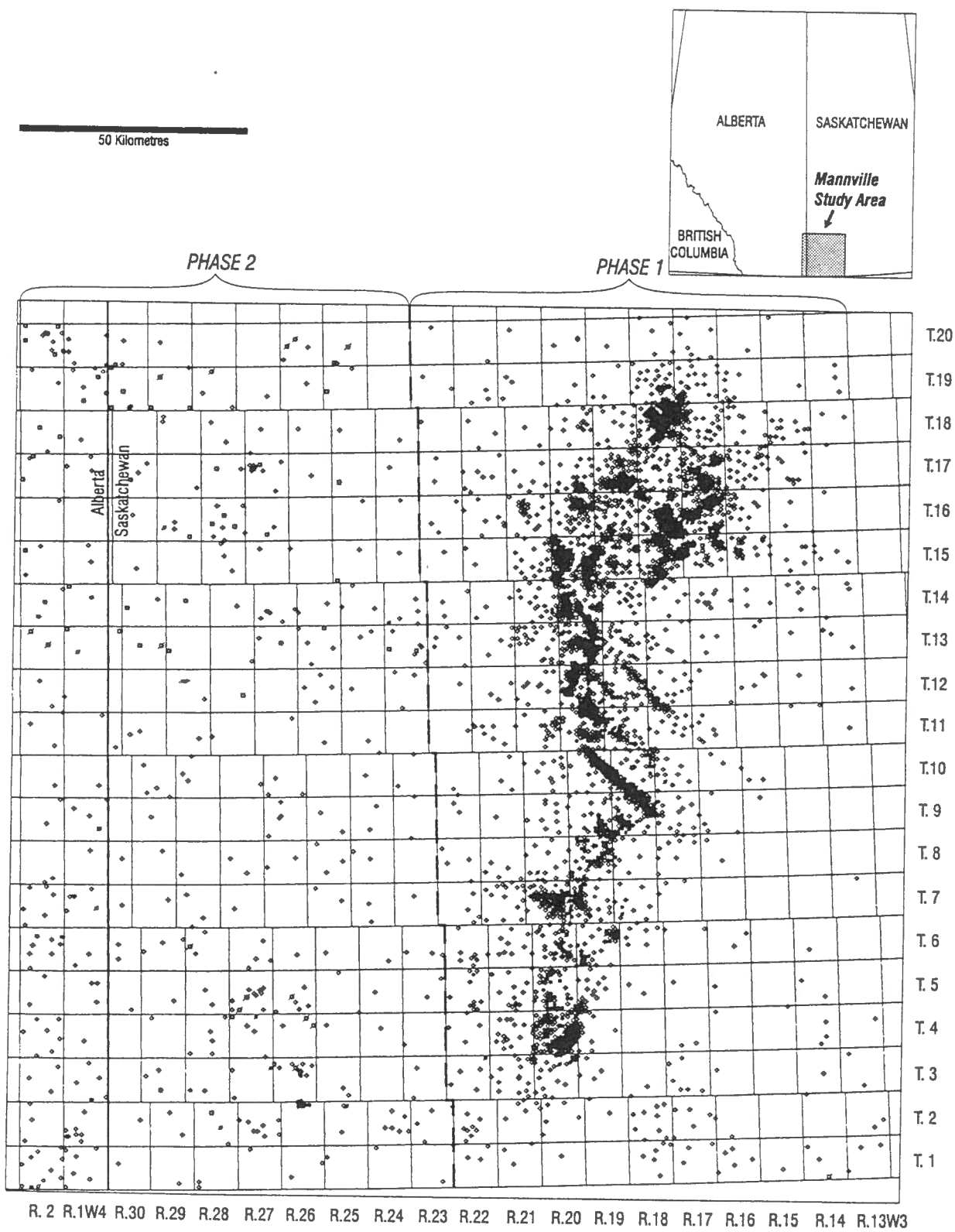


Figure 1. Location of study area, Phase I and II.

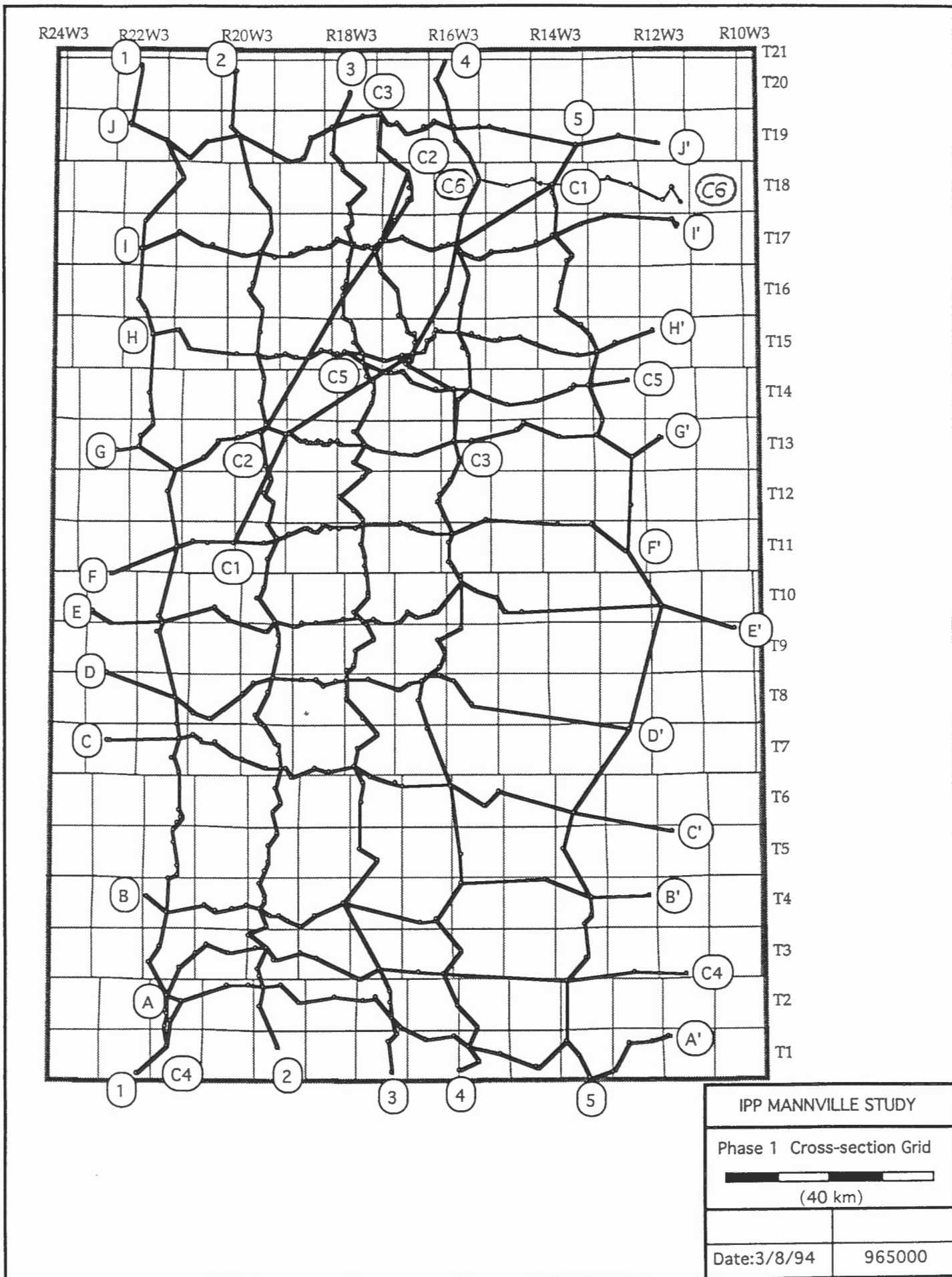


Figure 2. Database for Phase I study area.

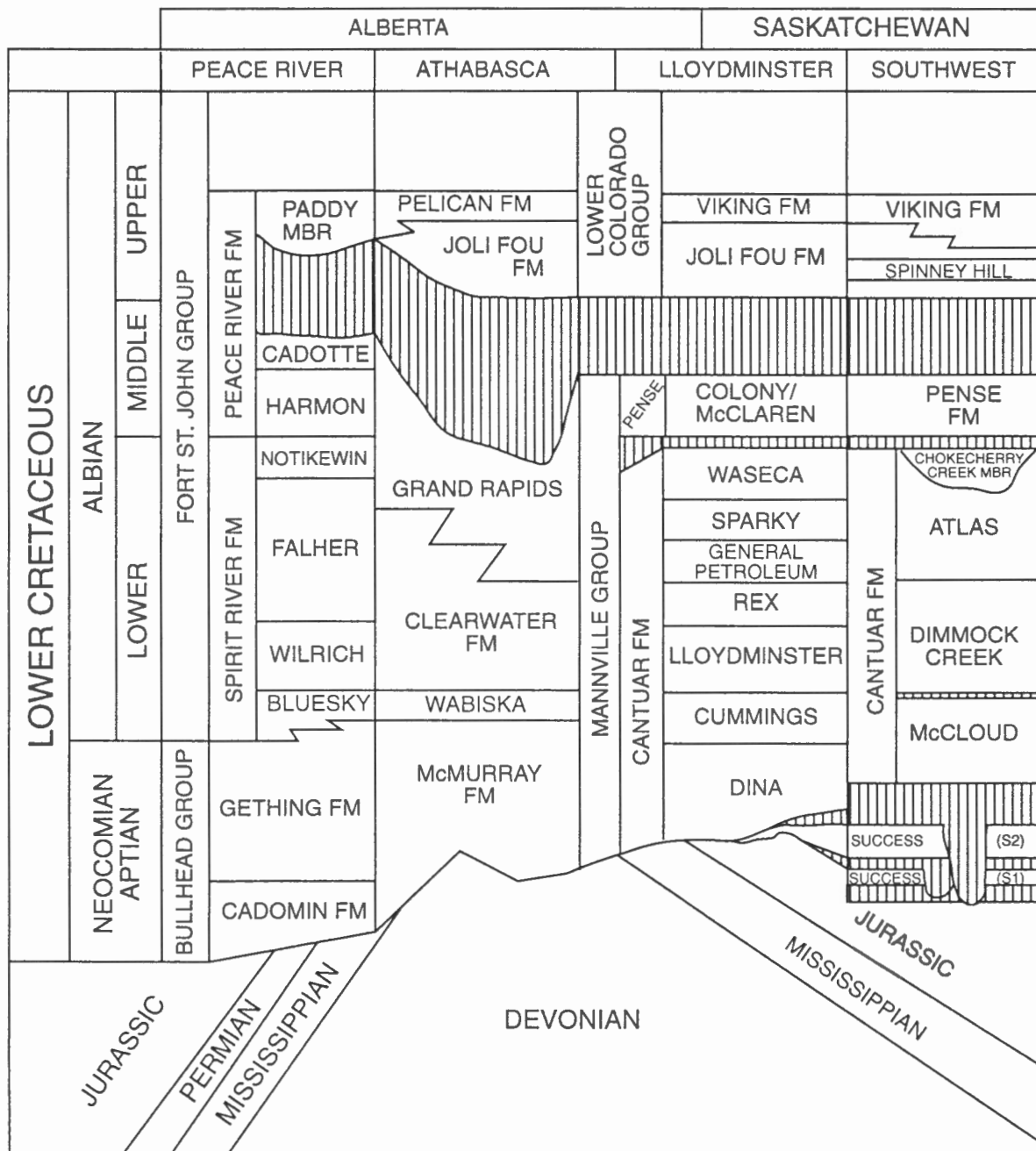


Figure 3. Stratigraphic nomenclature (modified from Christopher, pers. comm., 1994).

MANNVILLE PLAY TYPES SOUTHWEST SASKATCHEWAN

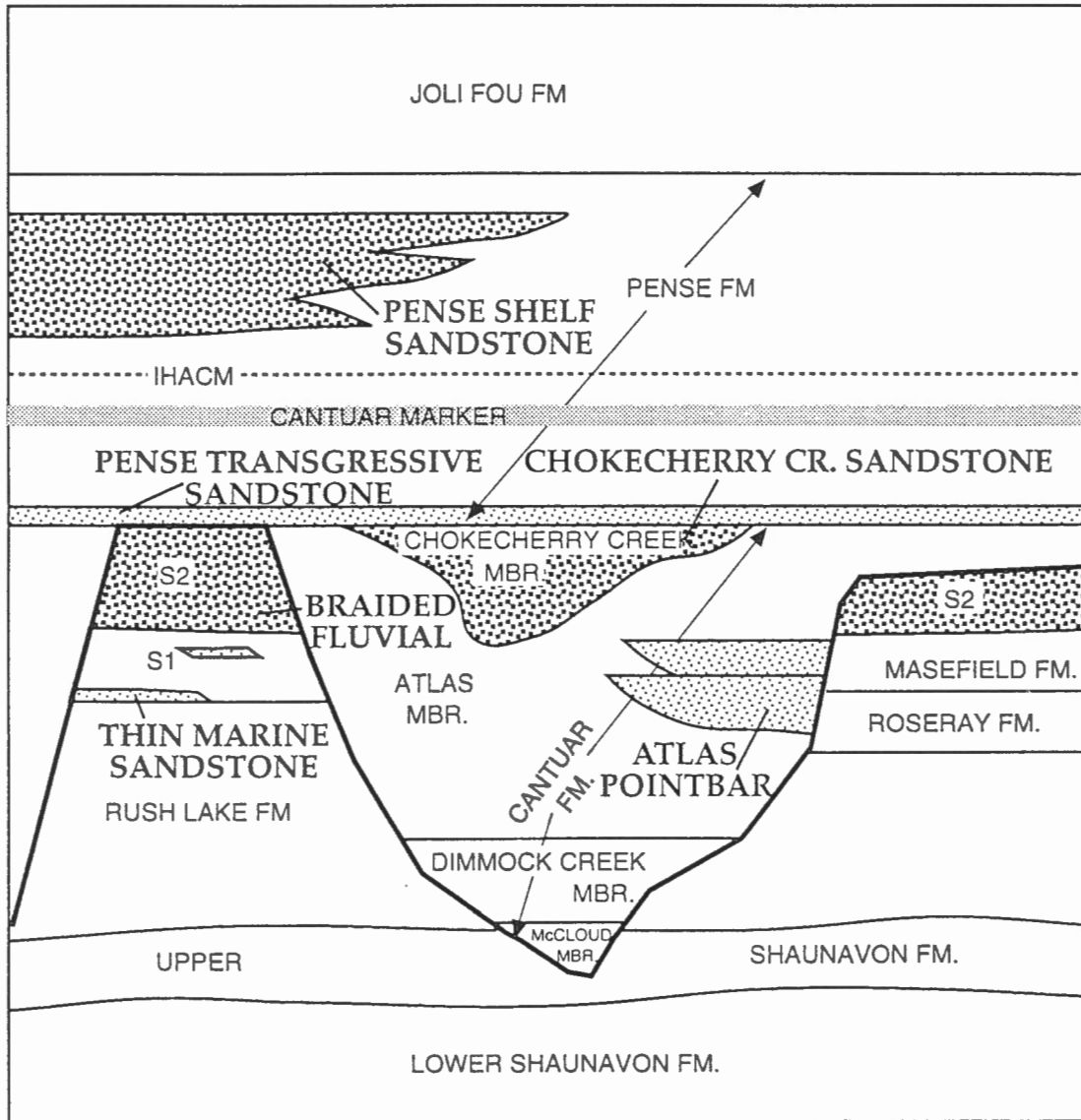


Figure 4. Play types of the Mannville Group in southwest Saskatchewan.