

The Devonian Three Forks Formation: Manitoba's Newest Oil Play

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The Sinclair Field (Townships 7 to 8, Ranges 28 to 29W1) is the newest oil field discovery in Manitoba and has greatly expanded in size and production since its discovery in 2004. The oil field had been previously explored in the 1960's, but the pay was missed by early exploration efforts. Proven and probable reserves are estimated at 3.8 million m³.

The Devonian Three Forks Formation is a cyclical transgressive-regressive sequence of shaley, silty dolarenite, interbedded with shale and brecciated in many places. Deposition of the Three Forks was influenced by several weathering events due to transgressive and regressive cycles and basin tectonics. It is subdivided into four units. Unit 1 is the lowermost unit and the most widespread, and is the most oxidized and weathered of the units; this unit is productive as a secondary reservoir in small isolated pools. Unit 2 is an interbedded siltstone and shale, massive shale and occasionally brecciated, and is productive as a secondary reservoir at the Sinclair Field and Daly Field (Townships 9 to 10, Ranges 27 to 29W1). Unit 3 is a red-brown highly oxidized silty shale. Unit 4, the uppermost unit represented in Manitoba, is an interbedded siltstone and silty shale with thick subunits of highly distorted and brecciated siltstone beds. Unit 4 is the primary and most productive reservoir at Sinclair Field. Units 2 and 4 are productive at the unconformity surface as a subcrop-type play. In contrast, the production from Unit 1 is due to a stratigraphic-type play.

Thinning of the Three Forks Formation and truncation of the best reservoir units towards the east suggest the eastern expansion of the Sinclair Field may be limited. Mapping of these units towards the south along Range 29W1 indicates that Unit 4 is preserved up to the Manitoba-North Dakota international border, thereby extending the reservoir potential to the south. A recent successful Three Forks completion in Township 4 Range 29W1 provides hope for future exploration efforts south of Sinclair Field. North of Sinclair Field, the Three Forks has proven productive up to Kirkella Field (Township 12 Range 29W1) with two new Three Forks pools in 2006.

The sub-Paleozoic extension of the Precambrian Superior Boundary Zone (SBZ) runs north-south in the study area. The Birdtail-Waskada Axis (BWA) runs roughly through the middle of the southern extent of the SBZ. Isopach, structural and geophysical evidence suggest the presence of faults running parallel to the SBZ eastern and western margins; these faults were active at the end of the Devonian. Movements along these faults caused the preservation of the primary reservoir

(Unit 4) of the Three Forks Formation east and west of the SBZ margins, while secondary reservoir unit (Unit 2) was exposed as a plateau on the BWA. The preservation of Unit 4 in some wells east of the BWA margin, along the SBZ margin opens up the possibility that, under the right trapping conditions, there may be another Sinclair-type play yet to be discovered east of Range 24W1.