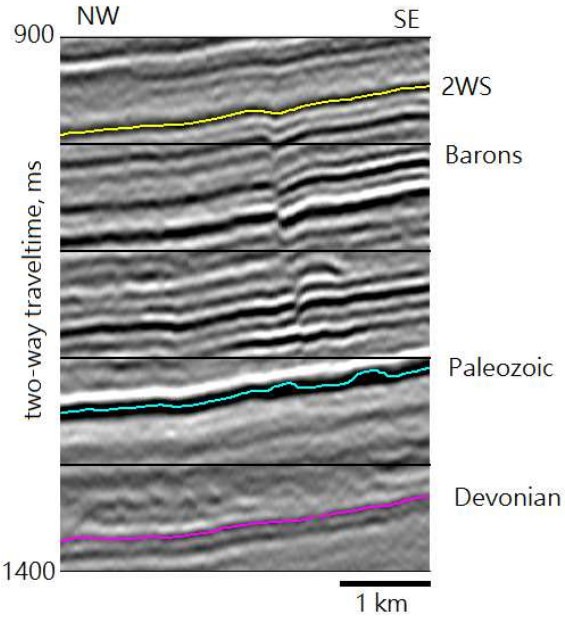
# Great Plains Seismogenic Study – revealing opportunities




Seismic line from southern Alberta showing a Barons sandstone anomaly. The faulting at the Barons level does not extend into the Paleozoic Formations.

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# Great Plains Seismogenic Study

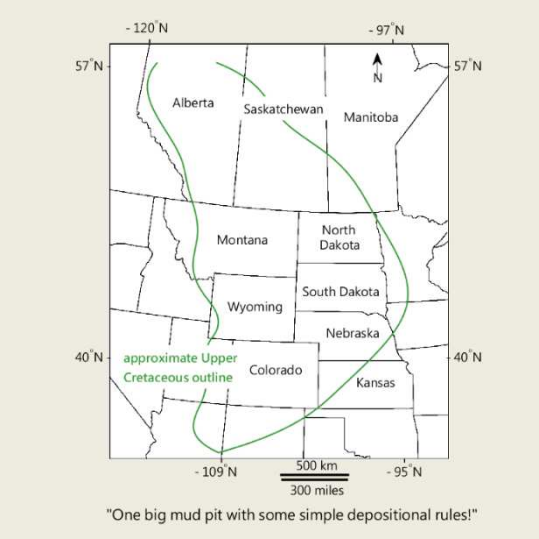
*Revealing large opportunities for Upper Cretaceous hydrocarbon reservoirs*

## Introduction

Seismogenic reservoirs – those with deposition affected by earthquakes – can be interpreted throughout the Western Canadian Sedimentary Basin. PFS Interpretations Ltd. (PFS) is pleased to announce a study based upon seismogenically affected Upper Cretaceous strata within the Great Plains area. Surface geology, borehole log data and seismic interpretations show that many reservoirs can be interpreted to have been precipitated and/or affected by earthquakes.

We have looked for and categorized subtle structural elements consistent with what could be expected within the strata for a depositional model affected by episodic earthquakes. We have some exciting results to present in the study. **Simple models** range from mass wasting at the surface to subsequent reservoir fracturing over large areas as well as deposition models for some Upper Cretaceous oil and gas reservoirs. The study consists of four research areas.

- **Surface engineering considerations** - evidence will be presented that suggest Cretaceous faults with as much as 80 m of vertical offset can be within 100 m of the surface within the Great Plains area.
- **Biogenic exploration** - an *in-situ* fracture model for biogenic reservoirs from ground surface to the Second White Speckled Shale. This is a shallow formation study up to gas found in glacial sediments. We use 3-D seismic data and well control to show causality between deposition and fracturing. This is a new tool to explore for these reservoirs!
- **Thermogenic exploration** - A depositional model for oil potential reservoirs in central Alberta is a work in progress, we hope to present a simple model to account for some potentially minor post-depositional structural variations in these reservoirs. For example, we will show how to estimate the "vertical adjustment range" to evaluate stepout drilling locations.
- **Current research** – Licensing the study will allow access to all current and future research topics listed on the next page.



"One big mud pit with some simple depositional rules!"

## Deliverables

The deliverables are the depositional and structural conceptual models supported by seismic data, well control, outcrop examples and peer-reviewed reports. Potential fairways for some Upper Cretaceous reservoir will be shown for Canada.

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# Great Plains Seismogenic Study reservoir models

*Analyzed areas for the Great Plains Seismogenic Reservoir Study papers:*

## Introduction

The study is peer-reviewed papers that will be provided to subscribers. Analyzed areas are:

1. Generic seismogenic reservoir model.
2. The following reservoirs and zones as seismogenic in nature:
    a. Milk River and Medicine Hat fracturing
    b. Bad Heart Reservoir
    c. Cardium Formation
    d. Second White Speckled Shale Fm.
    e. Barons sandstone
3. The seismogenic nature of the initiation of polygonal fault systems.
4. Reactivation (?) of the Dawson Creek Graben Complex during the Late Cretaceous is currently being investigated.
5. Flow to surface problems where the caprock is the Westgate Shale Formation are examined.
6. Glacial strata and how there can be hydrocarbon traps throughout glaciated areas.
7. Seismic data processing flow and data interpretation tools to image the Great Plains Polygonal Fault System (GPPFS).
8. Can GPPFS fault alignment be used for paleostress estimations?
9. How to quickly find reservoirs that may have been affected by pervasive PFS faulting using borehole logs.

Most Upper Cretaceous strata within the Western Interior Seaway (WIS) can be interpreted as containing seismogenic features, especially within the Great Plains Polygonal Fault System. The generic model for PFS formation is aided by the vast well control within the GPPFS, where over one million wells have been drilled. This is the first PFS in the world to be drilled extensively and to have many outcrop examples. The study presents a heuristic model for PFS generation throughout the WIS.

## Area Applicability

Although the data in the study is from Alberta, Saskatchewan and Manitoba, it is interpreted that the entire Upper Cretaceous in the WIS could host many faulted intervals such as the Eagle Ford Shale Formation in Texas and the Niobrara Formation in the United States (not studied in this report).

## Study price: $67,000 Cdn

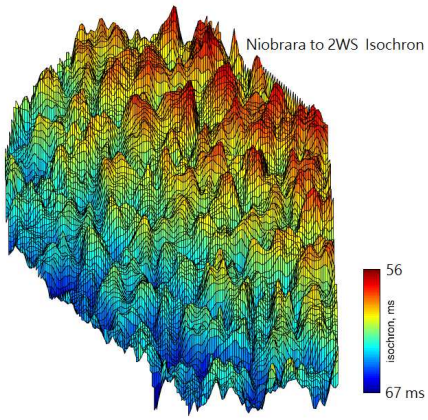
The study price includes a one-day core workshop in Calgary, a one-day seismic interpretation session with Andy St-Onge and possibly a one-day field trip (location to be determined from either Alberta, Manitoba, South Dakota or Nebraska).

# Great Plains Seismogenic Study – current research

Licensing the study will allow access to all current and future research topics that include:

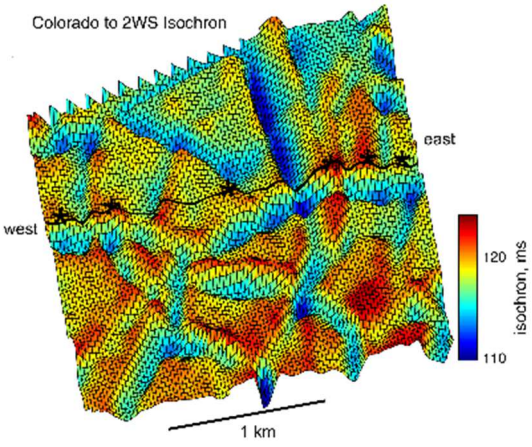
## Reservoir geomechanics

We are looking at the timing of faulting within the Great Plains area. We can show how to find the timing of faults that have affected the Second White Speckled Formation, for example.



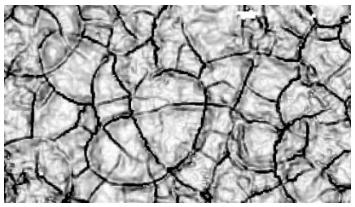

## Growth faulting

We can show numerous examples of growth faulting within the Upper Cretaceous. The faulting has been attributed (by others) to Laramide deformation or forebulge movement. We can show that growth faulting has been prevalent throughout the Upper Cretaceous.




## PFS patterns and stress determination

The map below implies an isotropic stress field for the Milk River reflection amplitude fault traces as imaged on 3-D seismic data from ~400 m depth in western Manitoba. We have examined other areas where the Milk River fault traces are aligned, implying a contemporaneous or subsequent external stress field.



## PFS formation

We contend that seismically induced P wave energy could impart energy into a colloidal to mud transitional sediment that could induce changes to the system, subsequently initiating where faults in a PFS may initiate.

## Study price: $67,000 Cdn

## For more information: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