






N291: Geological Reservoir Characteristics of Siliciclastic Unconventional Light Oil Plays, Western Canada Sedimentary Basin (Alberta, Canada)

Instructor(s): Per Kent Pedersen, Paul MacKay and Guest

5 Days	Competence Level: Skilled
 Field Course	
 Classroom Elements	
 MODERATE Moderate Physical Demand	

Summary

The course presents an overview of siliciclastic unconventional light oil play types, including their different reservoir characteristics, play fairways and depositional environments. Examples from the Western Canada Sedimentary Basin are contrasted through examination of cores and well logs. Topics include porosity, permeability, reservoir architecture and heterogeneity from pore to field scale, fracability, sweet spots, hydrocarbon source and migration and fairway orientations and widths.

Learning Outcomes

Participants will learn to:

1. Characterize tight, light oil play types and apply appropriate analogs.
2. Evaluate and describe reservoir characteristics.
3. Assess depositional processes to better predict reservoir heterogeneity from bed to pool scale.
4. Perform sequence stratigraphic evaluations of unconventional fine-grained successions for correlation and mapping.
5. Evaluate the different parameters that together form a successful tight, light oil play.
6. Evaluate the position of light oil plays with hydrocarbon systems to better understand fluids and pressure distribution.
7. Assess the various risks of light oil plays.
8. Assess fracture characteristics of reservoir facies and enveloping strata, both for natural and hydraulically induced fractures.
9. Estimate net pay and reserves for different categories of light oil plays.

Duration and Training Method

This is a five-day course, comprising four days of lectures, core and well log workshops, and a one-day field trip to outcrops in the Foothills and Front Ranges of the Rocky Mountains west of Calgary to view some of the units examined in the core workshop.




Physical Demand

The physical demands for this class are MODERATE according to the Nautilus field course grading system. For the day in the field examining outcrops a fair level of fitness is required. Participants will spend several hours away from vehicles on day 3 with walks of up to 3 km (2.4 miles) along generally easy terrain with modest vertical relief (up to 100 m (300 ft)). The field area is at elevations between 1500-2000 m (5000-6500 ft) and participants may experience shortness of breath or fatigue due to the altitude. Temperatures can be cold-hot and the weather can be changeable from sunny, rain to snow. Travel will be by bus on black-top roads.



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Who Should Attend

The course is appropriate for all exploration and development geologists, geophysicists, reservoir engineers, reservoir modelers and/or geoscience and engineering managers that are engaged in evaluating or exploiting unconventional siliciclastic reservoirs. The course is primarily designed for people with a basic understanding of unconventional clastic reservoirs, but experienced participants should also benefit from this course.

Prerequisites and Linking Courses

Participants would benefit from a basic understanding of clastic sedimentology, sequence stratigraphy, and petroleum geology, as offered in N155 (Introduction to Clastic Depositional Systems: a Petroleum Perspective); and a familiarity with resource plays, as offered in N313 (Evaluating Resource Plays) and N184 (Unconventional Resources: Survey of the Main Oil Systems, Core Workshop, Denver).

A number of Skilled Application Level field courses treat the sequence stratigraphy and geological modeling of fluvial through shallow marine clastic settings, though none focus on the resource play aspect. These include N264 (Prediction of Changes in Reservoir Architecture in Mixed-Process Marginal Marine Systems: An Outcrop and Core Perspective, Alberta), and N259 (From Outcrop to Subsurface: Understanding and Evaluating Shale Resource Plays, Alberta, Canada).

Course Content

Participants will gain an understanding of the diversity and some of the critical factors that influence successful Unconventional Light Oil Plays through presentation and examination of several active plays within the Western Canada Sedimentary Basin.




The lectures provide participants with an overview of the broad range of Unconventional Light Oil plays in three main categories:

1. “Halo Oil” – light oil plays where the source \neq the reservoir, and matrix permeability is relatively high (> 0.1 md) compared to the other play type categories. Halo Oil plays represent portions of conventional light oil pools that do not meet traditional petrophysical cutoffs and pay criteria. They may be clastics or carbonates (e.g. Cardium, Viking).
2. “Tight Oil” – light oil plays where the source \neq the reservoir, and matrix permeability is low (< 0.1 md). These plays are analogous to tight gas plays and may be clastics or carbonates (e.g. Bakken (Viewfield), Montney).
3. “Shale Oil” – light oil plays where the source = the reservoir, matrix permeability is very low, and organic matter content may be high. These plays are analogous to shale gas plays (e.g. Second



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White Speckled Shale, Duvernay, Muskwa).

The core workshop will include examples of each of the three categories of plays and each will be discussed in terms of: geological setting, location within the hydrocarbon system, trapping mechanisms, depositional environments, facies continuity, reservoir characteristics, porosity and permeability, fluid sensitivity, production characteristics, etc. Core, well logs, and production data will form the basis for discussions of the key parameters that make each of these plays successful.

The core workshop will be complemented with a day in field examining outcrops of several of the stratigraphic units discussed during the core workshop. The outcrops are located in the Foothills and Front Ranges of the Rocky Mountains, a 1-hour drive west of Calgary. These outcrops, located within thrust sheets, allow for examination of lateral reservoir heterogeneity and flow paths, and the relationship between sedimentary facies and fracture characteristics.

Itinerary (subject to revision)

Day 0

Travel to Calgary.

Days 1-2 and 4-5

Classroom lectures and core workshop at the Alberta Energy Resources Conservation Board Core Research Centre in Calgary.

Overnights in Calgary.

Day 3

Field stops to examine outcrop exposures in the Canmore and Kananaskis areas of Alberta.

Overnight in Calgary.

The course will end at 3.30 pm on Day 5. Participants may depart for home that evening or the following morning.