



N259: From Outcrop to Subsurface: Understanding and Evaluating Shale Resource Plays (*Alberta, Canada*)

Instructor(s): Per Kent Pedersen and Co-Instructor

Format and Duration

Field - 6 Days

High Physical Demand

Summary

Outcrops, cores, well logs, field studies and exercises are used to introduce techniques for identifying, understanding and evaluating fractured shale reservoirs. Appreciable time is spent on outcrops examining the geology of shale, with an emphasis on how shale fabric influences natural fracture systems. The roles of geophysics, petrophysics, geochemistry and reservoir engineering in developing interpretations of shale resources are examined.

Learning Outcomes

Participants will learn to:

1. Demonstrate the fundamental characteristics of shale geology.
2. Examine shale depositional processes and the influence of basinal setting on facies distribution.
3. Demonstrate the application of sequence stratigraphic principles to shale dominated successions in different depositional settings for correlation and mapping.
4. Examine the lithological variables that distinguish different shale plays.
5. Analyze shale sections on well logs and in core.
6. Correlate shale sections on well logs and compare traditional lithostratigraphic vs. sequence stratigraphic based correlations.
7. Determine the stress regime for a shale section.
8. Determine fracture intensity from cores.
9. Determine key factors that contribute to a successful shale resource play.

Training Method

A field course in the foothills of the Canadian Rockies, Alberta, Canada. There will be outcrop visits, a half-day core workshop, and classroom lectures. Lectures introduce the techniques employed to understand and evaluate these fine-grained deposits, and exercises reinforce the learnings. The ratio of field to classroom time is approximately 70:30.

Physical Demand

The physical demands for this class are **HIGH** according to the Tetra Tech RPS field course grading system. A good level of fitness is required. Participants will spend several hours away from vehicles on most days with walks of up to 4.8 km (3 miles) along generally easy terrain with modest vertical relief. Several stops require walking down (and up) a short (100 m (300 ft)), steep path to reach outcrops along a riverbank. One field stop requires a 1.6 km (1 mile) hike with a 500 m (1500 ft) elevation gain up a cobble/boulder filled valley. The field area is at elevations between 2000-2500 m (6000-7500 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. Travel will be by SUV on black-top roads.



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Who Should Attend

The course is appropriate for all geoscientists, petrophysicists and engineers who are engaged in the evaluation and development of shale resources. It is primarily designed for participants who are new to working resource plays, but experienced staff should also benefit from this course.

Course Content

Participants will learn to use outcrop observations and subsurface data to identify and evaluate shale reservoirs. Two broad themes will be developed:

1. The geology of shales: their sedimentology, stratigraphy, mineralogy and geochemistry as determined from outcrop, core and well log data. Exercises will get participants comfortable with analyzing and correlating shale sections on well logs.
2. Fracturing in shales: the mechanics of failure, how rocks break and how to recognize fractured intervals in the subsurface. Discussions will focus on the natural fracture systems as well as the techniques that can be used to improve access to the reservoirs and improve the communication of the reservoir to the well bore.

Additional topics that will be covered include quantifying fracture intensity, the use of core in understanding the reservoir system and shale reservoir engineering. Other data sets that may aid in fracture detection will be discussed (such as potential field data). Examples of integrated interpretations of producing fractured shale reservoirs will be presented.

The principle outcrops to be studied are in the hills near Kananaskis and along the Highwood River and Jura Creek south and west of Calgary. The excellent shale outcrops are representative of resource plays that are under active exploration in the Western Canadian Sedimentary Basin and are relevant to Bakken, Niobrara and other resource plays elsewhere in North America.

Itinerary

Day 1

- **Lectures:**
 - Introduction/Safety
 - Introduction to Shale Reservoirs
 - What is a Fracture
- **Core workshop at AER**
 - Jurassic Nikanassin fractured tight gas sandstones
 - Devonian-Mississippian Bakken/Exshaw/Banff shales



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- Turonian Second White Specks (Greenhorn) shales
- Drive to and overnight in Kananaskis

Day 2

- Lectures
 - Alberta Plays -Bakken/Exshaw
 - Seismic Anisotropy
- Field
 - Goat Creek Exshaw
 - Canmore off-leash Dog Park (optional)
 - Overnight in Kananaskis

Day 3

- Lectures
 - Shale Facies
 - Seismic
 - Scan Line analysis
- Field
 - Triassic at Hood Creek

Day 4

- Field
 - Highwood River/Fish Scales
 - 2WS to Cardium
 - 2WS duplex
 - Niobrara to Chungo

Day 5

- Lectures
 - Syria/Kurdistan
 - Shale Sequence Stratigraphy and Exercise
- Field
 - Seebe
 - Ghost Dam
 - Niobrara facies
 - Belly River fracture



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Day 6

- **Lectures**
 - Second White Specks
 - Cardium
- **Field**
 - Cardium at Horseshoe dam

Day 7

- Depart for home