

Facies, Sequence Stratigraphy and Reservoir Characteristics of Cretaceous Resource Plays, Powder River Basin, Wyoming (G031)



Tutor(s)

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Overview

This course examines two world-class Cretaceous source rock intervals and their interfingering clastic wedges around the margins of Wyoming's Powder River Basin to illustrate how accurate outcrop descriptions provide the best opportunity to improve our ability to make realistic reservoir interpretations. Outcrop observations are important to incorporate into core descriptions and then into correlating and mapping in the subsurface. Resultant modeling can reduce uncertainty and improve our understanding of facies associations, as well as the controls on porosity and permeability. Integration of the techniques described has consistently provided new interpretations that have led to new field discoveries and/or identification of stratigraphic compartments within existing fields.

Duration and Logistics

6 days; field time (90%) supported by classroom lectures (10%). A printed manual will be provided for each participant.

Level and Audience

Advanced. This course is intended for geoscientists, reservoir and production engineers, and petrophysicists who work unconventional plays in the Powder River Basin. The learnings and workflows are applicable to individuals working other resource plays.

This field course compliments GeoLogica course [Core Facies Analysis of Conventional and Resource Plays: Lessons from the Mowry and Niobrara Petroleum Systems, Powder River Basin \(G011\)](#). Although, taking G011 is not a prerequisite for attending G031.

Exertion Level

This class requires a **MODERATE** exertion level. Hikes are 4.8–8km (3–5 miles) across irregular terrain, scrambling up shale slopes and ledges of sandstone outcrops. The elevation of the Powder River Basin outcrops ranges from 1500–1800m (5000–6000 ft) and the climate is considered semi-arid. Temperatures in August range from 13–32°C (55–90°F). Most driving is on black-top roads, but some outcrops are reached via well-marked dirt roads.

Objectives

You will learn to:

1. Examine outcrops of alluvial plain, coastal plain, delta plain, offshore, shelf and distal basin hemipelagic source rocks within a sequence stratigraphic framework of Cretaceous strata along the margins of the Powder River Basin.
2. Describe grain size, composition, sedimentary structures and biogenic structures of fine-grained source rocks of the Mowry Shale and Niobrara Formation.
3. Evaluate physical parameters (e.g. TOC, porosity, PhiH, permeability, stiffness or brittleness, fractures, etc.) that define a successful tight oil play within the Mowry Shale and Niobrara Formation.
4. Describe facies, facies architecture (grain size, composition, sedimentary structures and biogenic structures), facies associations of coastal plain, strand plain, delta plain, nearshore and shelf deposits of two major clastic wedges that prograded into the Cretaceous Western Interior Seaway: Frontier (Wall Creek and Turner) and Mesaverde (Shannon, Sussex, Parkman, and Teapot).
5. Define and correlate parasequences, parasequence sets and sequences across the Powder River Basin (using outcrop sections and well logs) and predict where continuous oil accumulations or resource plays may occur within the basin.

Course Content

Course Details

The course begins and ends in Casper, Wyoming. The outcrops will allow participants to observe facies, facies architecture, lateral continuity of facies and the nature of their bounding surfaces.

Day 1: Arrive in Casper

Classroom:

- Course introduction and safety briefing

Overnight in Casper.

Day 2: Alcova area

Fieldwork:

- Visit outcrops of the Lower Cretaceous Mowry Shale and Upper Cretaceous Niobrara Formation in Alcova area.

Overnight in Casper.

Day 3: Casper Arch

Fieldwork:

- Visit outcrops of the Upper Cretaceous Frontier Formation in the Casper Arch.

Overnight in Casper.

Day 4: Teapot Dome area

Fieldwork:

- Visit outcrops of the Upper Cretaceous Shannon Sandstone and Sussex Sandstone, Parkman Sandstone and Teapot Sandstone, Salt Creek Anticline and Teapot Dome area

Overnight in Casper.

Day 5: Douglas area

- Visit outcrops of Frontier (Wall Creek-Turner), Niobrara Formation and lower Pierre Shale in the Douglas and Old Woman Anticline areas.

Overnight in Newcastle, Wyoming.

Day 6: Powder River Basin

Fieldwork:

- Visit outcrops of the Mowry Shale, Belle Fourche Shale (distal Frontier clastic wedge), Turner Sandy Member of the Carlile Shale, Niobrara Formation and lower Pierre Shale (distal Mesaverde clastic wedge), along the eastern margin of the Powder River Basin (Black Hills).

Classroom:

- Course summary and wrap up.

Return to Casper and travel home.