

N027: Reservoir Sedimentology and Stratigraphy of Continental Clastic Systems (*Wyoming, USA*)

Instructor(s): Lee Krystinik and Beverley Blakeney DeJarnett or Randi Martinsen

Format and Duration

Field - 6 Days
Moderate Physical Demand

Summary

Continental clastic reservoir systems (aeolian, alluvial, fluvial, and lacustrine) account for at least 30% of the total known global hydrocarbon resource. Participants will be exposed to critical exploration and exploitation concepts for continental clastic reservoirs through a combination of outcrop exercises, classroom lectures, and core examination, all placed within an applied sequence stratigraphic context.

Learning Outcomes

Participants will learn to:

1. Compare successions in low accommodation settings to those in high accommodation settings.
2. Evaluate the economic application of key concepts to predict play fairways, reservoir occurrence and behaviour, within a sequence stratigraphic model.
3. Assess trapping styles and exploration strategies within continental clastic systems.
4. Predict typical reservoir spatial relationships and lateral continuity for a broad spectrum of continental clastic sedimentary systems.
5. Predict anticipated locales of most likely occurrences of major sediment conduits, based upon the sedimentary system and synsedimentary tectonic setting.
6. Evaluate strategies for designing a geologically driven plan of depletion within a continental clastic reservoir.
7. Compare the stratigraphic architecture and lateral variability of fluvial deposits resulting from variability in climate, tectonics, accommodation space and sediment supply.
8. Compare fluvial, alluvial fan, aeolian and lacustrine facies both in core and outcrop.

Training Method

This is a six-day field course in NE Utah and SW Wyoming with classroom instruction (10%), core examination (10%) and outcrop visits (80%). Exercises link outcrops with well log and seismic data. Each day begins with lectures, followed by field visits. Participants will visit the Utah Geological Survey core repository, Dinosaur National Monument and Museum, and the world famous Ulrich's Fossil Fish Quarry.

Physical Demand

The physical demands for this class are MODERATE according to the Nautilus Training Alliance field course grading system. The longest walk on the class is approximately 3 km (2 miles) with an ascent (and descent) of 100 m (300 ft). There will be walks of up to 0.8 km (0.5 mile) most days over rocky trails, outcrops, loose ground and some steep ground. The field area is at an elevation of approximately 1800 m (5500 ft), and when combined with hot temperatures, may lead to unexpected fatigue or shortness of breath for some participants.

Who Should Attend

All geologists and geophysicists seeking training in applied clastic sedimentary geoscience as well as engineers who wish to broaden their geological knowledge with actual exposure to the reservoir styles

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they are analyzing. Valuable for asset team members working on continental clastic reservoirs and provides the opportunity to observe many examples of reservoir depositional features. The course is also suitable for asset managers with responsibility for the exploitation of continental clastic reservoirs, in addition to technical support staff developing into the Geology and Geophysics disciplines.

Prerequisites and Linking Courses

It is recommended, though not required, that participants have a basic knowledge of the fundamental processes and terminology of clastic sedimentology, as is offered in N155 (Introduction to Clastic Depositional Systems: a Petroleum Perspective).

Upon completion of N027, participants may wish to consider these Skilled Application Level classes visiting similar settings:

Reservoir Modeling N012 (Reservoir Modelling Field Class, Utah, USA), N215 (Advanced Techniques for Modelling Fluvial and Deltaic Architecture using Petrel, Utah, USA) and N108 (Exploration and Geological Model Development in Fluvial Reservoirs, Ebro Basin, Spain)

Sequence stratigraphy N011 (High Resolution Sequence Stratigraphy: Reservoir Applications, Utah, USA), N035 (Sedimentology, Sequence Stratigraphy and Reservoir Architecture of Paralic Deposits, Utah, USA), N042 (Reservoir Sedimentology and Stratigraphy of Coastal and Shelfal Successions: Deltas, Shorelines and Origins of Isolated Sandstones, NW Colorado, USA), N117 (Shoreline and Shelf Reservoir Systems: Outcrop Lessons for Exploration and Production, NW Colorado, USA) and N244 (Clastic Reservoir Prediction Using Advanced Sequence Stratigraphic Interpretation, Wyoming, USA).

Modern to recent systems N096 (Recent Depositional and Stratigraphic Analogues for Fluvial and Shallow Marine Reservoirs, South Carolina, USA), N309 (Fluvial Reservoir Architecture From Modern and Ancient Systems, Nebraska, USA).

Course Content

This course provides the tools and approaches needed to identify and differentiate the diverse depositional environments encountered in continental clastic reservoir systems. Emphasis is placed on economic application of key concepts to predict play fairways, reservoir occurrence and probable reservoir behavior, all placed within the predictive power of the sequence stratigraphic model.

Itinerary

Day 0

- Participants arrive in Salt Lake City

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Day 1

- Introductory Lecture and Core workshop at the Utah Geological Survey
- Field Stops: Proximal to Basinal Transect in alluvial systems: Cretaceous-Tertiary outcrop
 - Mountain-front alluvial fans; syn-tectonic conglomerates
 - Braided river systems (high net to gross succession)
 - Low net-to gross meandering river systems

Day 2: High Accommodation Settings in Continental Systems

- Major components of Continental Clastic Depositional Systems
- Visit to the Adaville Coal Mine – opportunity to observe and examine spectacular three-dimensional exposures within a high accommodation fluvial/coastal plain setting; lateral variability of channel sands, coal seams, and fine-grained fluvial deposits
- Blazon Gap- excellent exposures of a fine-grained fluvial succession deposited in a high accommodation, tectonic foredeep setting

Day 3: Moderate to low accommodation continental settings

- Incised valley-fill and distributary channels in the Cretaceous Rock Springs Formation – compare and contrast.
- Effects of variations in accommodation space on fluvial architecture within the Cretaceous Ericson Formation

Day 4: Successions in low accommodation continental settings

- Fluvial field exercises in the Lower Cretaceous Dakota and Muddy Formations.
- Group exercise across a lateral transect within the upper Cretaceous Frontier Formation.
- Scenic drive across Uinta Mountain Range and the spectacular Sheep Creek Geologic Loop.

Day 5: Aeolian and Arid River successions – Dinosaur National Monument and surrounding area

- Aeolian
 - Intercontinental
 - Coastal
 - Sabkhas
 - Stratigraphic character vs. climate and sediment supply
 - Mixed Systems
- This day will include a stop at the Dinosaur National Monument Museum and Dinosaur Quarry

Day 6: Lacustrine settings

- Fluvial-deltaic feeder systems

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- Conceptual models for lake formation (resulting from variability in climate, tectonic setting, and sediment supply)
- Visit to Ulrich's Fossil Fish Gallery - participants will have the opportunity to quarry for their own Fossil Fish from the famous Eocene Green River Formation
- Synthesis – Reservoir prediction and exploration techniques
 - Prediction of continental clastic reservoir systems
 - Trapping styles
 - Exploration strategies
 - Strategies for designing a geologically driven plan of depletion
- Course summation and discussion

Day 7

- Participants travel home