



N042: Reservoir Sedimentology and Stratigraphy of Coastal and Shelfal Successions: Deltas, Shorelines and Origins of Isolated Sandstones (*NW Colorado, USA*)

Instructor(s): Andy Pulham and Lee Krystinik

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

Summary

This course investigates outstanding Late Cretaceous outcrops of the Western Interior Seaway, focusing on models for exploration and exploitation within coastal through shelfal depositional settings. The sedimentology of deltaic, shoreline and shelfal siliciclastic depositional settings is studied in combination with the recognition of stratigraphic signatures in marginal marine and shallow marine settings, geometry and architecture of major sandstones, and origin of stratigraphic traps.

Participation on this course will allow participants to better predict reservoir potential, define development strategies, and create accurate exploration models for coastal and shallow marine depositional systems.

Learning Outcomes

Participants will learn to:

1. Appraise key aspects of clastic coastline and shelfal sedimentology to define reservoir potential, development strategies, and exploration models.
2. Manage depositional environment analysis to erect local and regional stratigraphic frameworks.
3. Evaluate the spectrum of stratigraphic surfaces and assess their importance in predicting two- and three-dimensional geometries.
4. Interpret the geometry and architecture of major coastal plain to shelf sandstones and determine their three-dimensional relationships.
5. Assess a variety of stratigraphic traps that can occur in coastal and shelfal settings.
6. Evaluate reservoir heterogeneities across a range of coastal and shelfal sandbodies.
7. Assess stratal relationships in marginal marine settings to generate exploration opportunities and to understand reservoir performance.

Duration and Training Method

This is a seven-day field seminar comprising field observations and discussions, keynote introductions, examples of analogue producing fields, and exercises. Participants will form small teams to make observations and present their findings to the group. These observations and the overall setting will be discussed to develop an understanding of the stratigraphy and reservoir architecture. The proportion of field to classroom time is approximately 90:10.

Physical Demand

The physical demands for this class are MODERATE according to the Nautilus Training Alliance field course grading system. Fieldwork is in western Colorado, where conditions can vary from cold and wet to warm and dry. Participants will be taking moderate walks of up to 1.6 km (1 mile) each day. The longest walk on the course is 3.2 km (2 miles) with an ascent of 100 m (300 ft). Most of the hikes will be on



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unimproved land and will include trails that are not maintained and often steep. The field area is at an elevation of 2100 m (7000 ft). This may lead to unexpected fatigue or shortness of breath for some participants. Transport is by SUVs. Most driving is on blacktop and well-marked dirt roads, with some outcrops being reached by dirt tracks.

Who Should Attend

Exploration and development geologists and geophysicists concerned with the exploration and exploitation of shallow marine and coastal systems. Reservoir engineers seeking a better understanding of reservoir architecture and the factors that influence them. Asset managers responsible for exploitation and exploration for shallow marine and coastal reservoirs.

Prerequisites and Linking Courses

Participants should have a basic knowledge of clastic sedimentology such as presented in the Basic Application Level class N155 (Introduction to Clastic Depositional Systems: a Petroleum Perspective), N251 (Well Log Sequence Stratigraphy: Applications to E&P), and N003 (Geological Interpretation of Well Logs).

N011 (High Resolution Sequence Stratigraphy: Reservoir Applications (Utah, USA)) and N451 (Practical Oil-Finders Guide to Siliciclastic Sequence Stratigraphy (Wyoming, USA)) would be complementary courses to take along with this course. Participants in this class who wish to expand their knowledge of these environments in a modelling context, may wish to take N012 (Reservoir Modelling Field Class (Utah, USA)).

Course Content

During the Cretaceous, depositional systems along the western margin of the Western Interior foreland basin were affected by the interplay of eustatic sea level fluctuations, variation in sediment supply, and tectonic-induced subsidence. This interaction resulted in deposition of a thick, complex wedge of siliciclastics influenced by significant lateral shifts of coastal and marine systems tracts. Subsequent uplift of the Rocky Mountains and their erosion has provided exceptional exposures to study the stratigraphic relationships of this clastic wedge. Characteristics of the full spectrum of coastal and marine facies will be examined, and their spatial and stratigraphic relationships discussed. The area studied in this field seminar includes laterally extensive, "seismic-scale" exposures of lowstand, transgressive, and highstand deposits.

The seminar will review concepts of process sedimentology. Component facies, and the reservoir characteristics of a spectrum of coastal and shallow water marine depositional systems will be discussed. Sequence stratigraphic settings will be considered as an aid to development of exploration plays.

Depositional systems to be examined include incised valley fills; lowstand deltas; transgressive barrier



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islands and associated facies; coastal plain fluvial and estuarine facies; highstand shorelines; enigmatic 'shelf bars'.

Recognition and characteristics of significant stratigraphic surfaces will also be examined and discussed. Consideration of the effect of these features on reservoir potential, development strategies, and exploration models will be explored as well as the recognition, interpretation, and factors controlling coastal and shallow marine depositional systems.

This class has some weather-dependent outcrops, therefore the daily schedule is subject to change.

Day 1

- Travel to Craig, CO
- Afternoon introductory lecture, safety brief, and field excursion

Day 2

- Introduction to the regional geology of NW Colorado
- Sedimentology and stratigraphy of deltas, strandplains, and barred shorelines
- Field examination of wave-dominated shorelines
- Overnight in Craig, CO

Day 3

- Log and outcrop correlation exercise in the hotel
- Continue field examination of wave-dominated shorelines
- Overnight in Craig, CO

Day 4

- Fieldwork: Shelf sandstones
- Overnight in Craig, CO

Day 5

- Depart Craig, CO
- Fieldwork after two hour drive to Rangely, CO
- Overview of Rangely area geology. Deltaic and shoreface settings.
- Overnight in Rangely, CO



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Day 6

- Fieldwork: Estuarine sedimentology and stratigraphy
- Overnight in Rangely, CO

Day 7

- Depart Rangely
- Fieldwork: unraveling stratigraphic complexity of shoreline and estuarine successions
- Overnight in Steamboat Springs, CO

Day 8

- Fly out of Steamboat Springs, CO