

Slope-Channel Depositional Systems: Brushy Canyon Formation, SE New Mexico and West Texas (G091)



Tutor(s)

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Overview

This field course is designed for geoscientists and engineers exploring and developing deepwater clastic reservoirs anywhere in the world. The course examines excellent (classic) exposures showing depositional facies and stratal geometries developed in deepwater slope and channel environments and their controls on reservoir presence, quality and production. Outcrop description and exercises with subsurface data are integrated into the course. Analog fields from West Africa, Gulf of America/Mexico, southeast Asia and the Permian Basin are discussed on outcrops.

Duration and Logistics

A 6-day field course beginning and ending in El Paso, Texas. Most training will take place through observation and discussion in the field.

Level and Audience

Advanced. The course is aimed at geoscientists, petrophysicists, reservoir engineers and production engineers working deepwater siliciclastic reservoirs. Basic principles are presented on the first morning to bring participants to a common level of understanding. Outcrop viewing, description and exercises will give even advanced level participants improved understanding of these systems.

Exertion Level

This class requires a **DIFFICULT** exertion level. The outcrops are in west Texas and southeast New Mexico, where the weather is arid with hot summers and cool winters. This trip is run in spring or fall when temperatures are more moderate, although hot, cold or wet weather is possible. Daily temperatures can range from 5-30°C (40-90°F). The course includes a hike of around 6 km/4 miles with an ascent of 400m (1300 ft), and shorter hikes, frequently over very steep and uneven ground. Transport on the course will be by coach. Most of the driving is on black-top roads, with some driving on graded dirt roads.

Objectives

You will learn to:

1. Visualize the seismic-scale geometries of major slope channel systems including incised upper slope valleys, amalgamated mid-slope channel-complexes, and middle to lower slope channel-levee complexes for use in subsurface interpretation.
2. Assemble a predictive model for those different sand geometries relative to slope position.
3. Describe different deep-water (turbidite) facies and understand variations in their distribution and reservoir characteristics in different architectural elements (channel, levees, splays).
4. Relate outcrop and core scale variations of deepwater sands to wireline log characteristics within channel complexes to help interpret facies in logs.

5. Predict how turbidites and their characteristics change laterally which can be applied to static and dynamic reservoir models for appraisal and development.
6. Assess thin turbidite sand beds and understand where they occur deep-water systems and how their continuity can vary from relatively limited areal continuity in levees to sheets in thin-bedded basin floor fans.
7. Evaluate variation in grain size and lateral continuity of sand bodies, understand why they can cause large variations in permeability, production rates and oil recovery.
8. Relate characteristic of outcrops to analogous oil fields along the West African margin, Gulf of America/Mexico, southeast Asia and the Permian Basin

Course Content

Day 1: Arrive in El Paso

Participants arrive at El Paso Airport, transfer to Carlsbad, New Mexico.

Overnight Carlsbad.

Day 2: Introduction to deepwater depositional systems

Classroom:

- Course introduction and safety briefing

Fieldwork:

- Drive to a view of the western side of the Guadalupe Mountains for a spectacular view of the shelf to basin and see where deepwater systems fit in a basin-scale mountain exposure
- Exercise: Interpret analogous regional seismic line

Overnight Carlsbad.

Day 3: Brushy Bench Incised Channels

Fieldwork:

- Walk into and around Brushy Bench Channels.
- Describe a section from underlying incision (erosional) contact, through massive turbidites to the top of channel sand complex
- Walk around small plateau (the bench) viewing variations in turbidite facies and boundaries of the incised slope valley
- Review analogs from the western margin of Africa
- Stop at Rader Debris Flow outcrop on return drive to Carlsbad

Overnight Carlsbad.

Day 4: Mass transport complex and channel-levee deposits

Fieldwork:

- Overview of El Capitan and shelf to slope from the roadside rest stop
- Hike down into Rest Stop Gulley to view (1) mass transport complexes in the Cutoff Fm, (2) basin floor sediments of the lowest Brushy Canyon Formation
- Channel-levee roadcut: classic view of massive sands in a channel and adjacent levee deposits
- Discuss importance of grain size, permeability and continuity of turbidite sand beds for oil and gas production in analogs from Gulf of America/Mexico and southeast Asia

Overnight Carlsbad.

Day 5: Guadalupe Canyon

Fieldwork:

- Guadalupe Canyon amalgamated lower slope channels: detailed examination and characterization of amalgamated channels in slope valleys and their heterogeneous fills followed by viewing their large geometries from the opposite side of the canyon.
- McKittrick Canyon, view turbidite sands onlapping against toe-of slope

Overnight Carlsbad.

Day 6: Last Chance Canyon

Fieldwork:

- Classic sequence stratigraphic locality showing shelf margin prograding over onlapping sands
- Carlsbad Caverns, drive to El Paso
- Course wrap-up and summary

Overnight in El Paso.