



N526: Sequence Stratigraphic Controls on Deepwater Reservoirs Architecture: Brushy Canyon Formation, Permian Basin (*West Texas and New Mexico, USA*)

Instructor(s): Vitor Abreu

Format and Duration

Field - 5 Days
Moderate Physical Demand

Summary

The Guadalupe and Delaware mountains in west Texas and New Mexico show unique, world-class exposures of shelfal to slope and basinal settings with seismic-scale, continuous exposures. These exceptional outcrops are ideal to learn about depositional systems, lateral and vertical variations in facies and sequence stratigraphic architecture and surfaces. Coeval shelfal to deepwater environments are exposed both downdip and along strike, with clear stratigraphic relationships from a carbonate shelf margin incised by canyons, feeding confined to weakly confined channel systems, connected to distributive lobe complexes and distal fan fringe sandstones that thin and pinch out onto a basin margin far removed from siliciclastic sediment sources. At the end of this course, participants should have improved abilities to recognize deepwater depositional facies and reservoir architecture, as well as how to use sequence stratigraphy to identify and map key surfaces for deepwater exploration.

Business impact: Participation in this course will aid in the **de-risking** of costly **exploration projects**, for example by assessing **reservoir presence risk**, **net-to-gross predictions** and **reservoir connectivity**. Since vertical scales of 10 to 20 meters are often below **seismic resolution**, it is difficult to predict **facies variations** occurring in distances of 1 to 2 kilometers, which are common **well-spacings** in **deepwater reservoir production**. Seismic-scale outcrops like the ones from the Brushy Canyon Formation help fill this gap in showing **lateral and vertical variations in facies** at scales that are not represented by data using conventional, industry seismic and wells.

Learning Outcomes

Participants will learn to:

1. Understand the sequence stratigraphic controls on deepwater reservoirs
2. Define the architecture of the main archetypes of deepwater reservoirs.
3. Discuss how to explore for, develop and produce deepwater reservoirs.
4. Relate depositional facies from outcrop to seismic-scale geometries and the overall sequence stratigraphy framework.
5. Apply Walter's Law and chronostratigraphic principles in core, well-log and seismic interpretation, and relate these principles to prediction of play elements and the best productive intervals for conventional and unconventional resources.
6. Analyze outcrop exposures of carbonate shelf, ramp, and siliciclastic basinal systems.
7. Establish similarities between world-class outcrop exposures to productive intervals in the Permian Basin.
8. Analyze sequence stratigraphy for carbonates and mixed carbonate-clastic depositional systems.
9. Assess changes in carbonate facies and relate these changes to depositional environments.

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Training Method

This is a field course, supported by classroom lectures. Almost every field stop includes exercises that illustrate and reinforce the key concepts and methods discussed in lectures and documented in the course notes.

Physical Demand

The physical demands for this course are MODERATE according to the Tetra Tech RPS field course grading system; the course requires good general fitness levels. Participants should anticipate field days with an average of 8-10 hours away from lodging facilities. The field area is at an elevation of approximately 1500 m (5000 ft). This fairly high elevation in combination with hot temperatures and dusty conditions may lead to unexpected fatigue or shortness of breath for some participants.

Transport will be by SUVs, mainly on black-top roads, with some driving on graded dirt roads. One day includes a long 17-mile off-road track driving on rough, rocky trails.

Who Should Attend

This field course is designed for geoscientists and engineers exploring, appraising, and developing deepwater reservoirs globally, and particularly in the Permian Basin.

Course Content

Day 0: Introductory Meeting

- Arrive El Paso, Texas
- Introductions, field safety discussion, and overview of the school
- Overnight: Van Horn, Texas

Day 1: Overview of Permian Basin Geology & Petroleum System

- Lectures on sequence stratigraphy
- Distal Delaware
- West Face - Basin Overview
- Overnight: Carlsbad, New Mexico

Day 2: Outcrop Examples of Seismic-Scale Geologic Features, Stratal Geometries, and Sequence Stratigraphic Frameworks



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- Morning Lecture
- Williams Ranch
- Overnight: Carlsbad, New Mexico

Day 3: Sedimentology of Mixed Carbonate-Clastic Depositional Systems

- Morning Lecture
- Last Chance Canyon
- Overnight: Carlsbad, New Mexico

Day 4: Implications for How Seismic and Outcrop Datasets Influence Depositional Models

- Morning Lecture
- Slaughter Canyon
- Walnut Canyon
- Carlsbad Cavern
- Overnight: Carlsbad, New Mexico

Day 5: Diagenesis, Dolomitization, and How Diagenetic Changes Impact Reservoir Quality

- Morning Lecture
- Channel Road Cut
- Salt Flat Overview
- Return to El Paso