TETRA TECH

N442: Reservoir Architecture of Deepwater Systems *(California, USA)*

Instructor(s): Rene Jonk

Format and Duration

Field - 5 Days
Moderate Physical Demand

Summary

The evolution of southern California included many episodes of deep water sedimentation in settings ranging from a Paleozoic cratonic passive margin to Mesozoic forearc and arc settings to Cenozoic transform, pull-apart, and continental borderland basins.

Participants will learn to describe cores, integrate core and well-log information with seismic to generate high-resolution environment of deposition maps of reservoirs in different settings. Engineering data are used to demonstrate how to improve prediction of reservoir performance.

Cores, well-logs and seismic examples are compared to and contrasted with outcrops to help participants to extrapolate 2D outcrop information to 3D views of reservoir scale depositional systems.

Business impact: Submarine canyons and deepwater channels are the primary conduits for the transfer of coarse sediments from the shelf to deepwater fans and are major E&P targets.

Learning Outcomes

Participants will learn to;

1. Assess sedimentological processes of deepwater deposition and erosion and their impact on reservoir architecture.
2. Interpret cores, well logs and outcrops using appropriate deep water lithofacies nomenclature and definitions.
3. Describe deep water lithofacies in cores and relate them to stratal geometries.
4. Interpret key stratigraphic surfaces based on changes in lithofacies stacking and associations.
5. Interpret deep water environments of deposition based on lithofacies associations, stacking and diversity.
6. Use outcrop analogues and depositional models to better understand 3D distribution of reservoir facies.
7. Tie rock properties to facies in building geologic models.
8. Perform environment of deposition mapping, emphasizing impact on reservoir performance and behavior.
9. Evaluate core, well-logs and seismic data to describe the reservoir in 3 dimensions.

Training Method

This is a field course, supported by classroom sessions in a 80:20 ratio. Exercises in the field will focus on description of deep water lithofacies, stratal geometries and recognizing key stratigraphic surfaces, emphasizing practical applications.

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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. The field areas are at sea level in and around San Diego and La Jolla, California, where temperatures range from cool and damp to warm and humid. There will be walks of up to 1 km (0.6 miles) most days, with some wading on a sandy beach required to visit some outcrops. The longest walk on the class is 4.5 km (3 miles) with an ascent of 100 m (300 ft). Transport is by coach on paved roads.

Who Should Attend

Geologists, geophysicists, petrophysicists, and reservoir engineers working on deepwater reservoirs from exploration to production. The course is also suitable for managers seeking an understanding of these reservoirs.

Course Content

Six deepwater systems will be examined in this field course. These include in the order that we will examine them: (1) Miocene-Pliocene Capistrano Formation at San Clemente State Beach, (2) Capistrano and Monterey sediments cropping out at Dana Point Harbor, (3) Cretaceous strata in coastal exposures in La Jolla, (4) Eocene strata in sea cliffs north of Scripps Institute of Oceanography, (5) Point Loma and Cabrillo Formations in the Tourmaline Surfing Beach and (6) Cretaceous Point Loma Formation exposed at the Point Loma Peninsula.

Course activity will include:

- Review of deepwater lithofacies nomenclature and definitions, common lithofacies associations, and interpret lithofacies in outcrops and cores
- Interpretation of environment of deposition (EoD) and related reservoir architecture, lithofacies associations, and diversity
- Interpretation of sequence stratigraphic surfaces in outcrop, logs, and seismic in deepwater settings and related to vertical stacking of facies
- Use of core and well-logs to interpret EoD
- Evaluation of reservoir geometry and connectivity in different EoD
- The do's and don'ts of using outcrops as reservoir analogs
- Use of outcrop information as analog for reservoir model building
- Evaluating seismic response, including geometry, facies, and acoustic response in deep water EoD
- Recognizing criteria for the identification of composite sequences, sequence sets, and depositional sequences and their components in outcrops, cores, well logs, and seismic
- Interpretation and mapping techniques for cores, well-logs, and seismic lines in deep water settings, from exploration to production business scales

- Recognition criteria and mapping strategies for play elements in deepwater depositional settings
- Play fairway identification and mapping

Itinerary

Day 0 Arrival in San Diego and Introduction

- Late afternoon classroom session: Field course introduction and safety presentation
- Overnight La Jolla

Day 1

- Short classroom session: Discussion on deepwater depositional models,lithofacies, stacking patterns, and seismic geometries respone in confined depositional systems
- Field: Distributive systesm at Point Loma sea cliffs
- Overnight La Jolla

Day 2

- Short classroom session: Discussion on deepwater channalized systems, relationship of facies to seismic response in confined depositional systems, safety briefing
- Field: Confined systems at Black Beach sea cliffs and La Jolla Cove
- Overnight La Jolla

Day 3

- Short classroom session: Discussion on lower N/G parts of systems, seal considerations, source rock considerations, safety briefing
- Field: Tourmaline Surf Beach Park
- Overnight La Jolla

Day 4

- Short classroom session: Discussions on static and dynamic connectivity as a function of hierarchy, safety briefing
- Field: Wealky confined systems at the San Clemente sea cliffs
- Overnight La Jolla

Day 5

- Check out from the hotel
- Field: Full Shelf-to-basin-floor depositional system and placing outcrops in such an updip-downdip

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system at Dana Point Harbor outcrops
- Late afternoon flights home