Reservoir Characterization of Deepwater Systems, San Diego, California (G046)

Tutor(s)

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Overview

Submarine canyons and deepwater channels are the primary conduits for the transfer of coarse sediments from the shelf to deep-water fans and they are today major targets for petroleum exploration. Southern California has had a long and complex geologic history that has involved many episodes of deepwater sedimentation in a variety of settings ranging from the Paleozoic passive margin of the North American craton to Mesozoic forearc and arc settings to Cenozoic transform, pull-apart, and continental borderland basins. These settings feature deep-water deposits in which both large and small submarine channels and fans played major roles as sediment transport routes and sites of sedimentation.

Duration and Logistics

6 days; a mix of outcrop examination and discussion (70%) and supporting classroom lectures (30%). The field course is conducted in southern California along the coastline north of San Diego.

Level and Audience

Advanced. Geologists, geophysicists, and petroleum engineers working on deep water reservoirs from exploration to production.

Exertion Level

This class requires a **MODERATE** exertion level. Access to the coastal cliff outcrops is via sandy beaches, with most walks under 2 km. Some shallow wading on a sandy beach is also necessary in order to visit some outcrops.

Objectives

You will learn to:

1. Review deepwater lithofacies nomenclature and definitions, common lithofacies associations, and interpret lithofacies in outcrops and cores.
2. Interpret environments of deposition (EoD's) and related reservoir architecture, lithofacies associations, and diversity.
3. Interpret sequence stratigraphic surfaces in outcrop, logs, and seismic in DW settings and related to vertical stacking of facies.
4. Use core and well-logs to interpret EoD's.
5. Evaluate reservoir geometry and connectivity in different EoD's.
6. Recognise the Do's and Don'ts of using outcrops as reservoir analogs
7. Apply outcrop information as analog for reservoir model building
8. Evaluate seismic response, including geometry, facies, and acoustic response in deepwater EoD's
9. Apply the criteria for the identification of Composite Sequences, Sequence Sets, and Depositional Sequences and their components in outcrops, cores, well logs, and seismic

10. Use interpretation and mapping techniques for cores, well-logs, and seismic lines in deepwater settings, from Exploration to Production business scales
11. Apply criteria and mapping strategies for play elements in deepwater depositional settings
12. Identify and map play fairways in deepwater settings.

Course Content

Course Details

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.

This course combines field activities with in-class lectures and exercises. Exercises in the field will focus on description of DW lithofacies, stratal geometries and recognizing key stratigraphic surfaces, emphasizing practical applications. Participants will also learn to describe cores, integrate core and well-log information with seismic to generate high-resolution EoD maps of reservoirs in different settings. Engineering data is 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 2-D outcrop information to 3-D views of reservoir scale depositional systems.

Day 1: Arrive in San Diego

Classroom:

- Course introduction and safety brief
- Deepwater lithofacies and depositional models

Overnight in La Jolla.

Day 2: Deepwater Distributive Systems

Classroom:

- Deepwater distributive systems.

Fieldwork:

- Submarine lobe deposits (Cabrillo National Monument)

Overnight in La Jolla.

Day 3: Canyon and Channel Architectures

Classroom:

- Deepwater channel systems I

Fieldwork:

- Large-scale submarine canyon/channel architecture (Black’s Beach)

Overnight La Jolla.

Day 4: Channel Architectures

Classroom:

- Deepwater channel systems II

Fieldwork:

- Channelized reservoir analogs at San Clemente State Beach and Dana Point

Overnight in La Jolla.

Day 5: Deepwater Depositional Processes

Classroom:

- Deepwater depositional processes

Fieldwork:

- La Jolla
- Tourmaline Beach

Overnight La Jolla.

Day 6: Departure

Classroom:

- Course summary and wrap up

Departure and travel home.