

N073: Integration of Sedimentology, Petrophysics and Seismic Interpretation for Exploration and Production of Carbonate Systems

Format and Duration
Classroom - 4 Days
Virtual - 8 Sessions

Instructor(s): Gregor Eberli / Gene Rankey

Summary

Business Impact: Participants of this course will have the necessary knowledge for **assessing different plays in carbonates** as they will be familiar with a wide range of carbonate depositional environments. The course outlines what aspects are different from clastics and thus **improves success in exploration and reservoir characterization of carbonates**. The petrophysical portion will give the participants the expertise to **better assess uncertainties in predicting reservoir properties with geophysical methods such as saturation using AVO and porosity from seismic inversion**.

This course provides a comprehensive overview of necessary concepts for seismic interpretation in carbonate systems for successful exploration and production. The newest concepts in depositional and microbial processes in shallow and deep water carbonate environments, rock physics, and sequence stratigraphy are presented through a combination of lectures, case studies and exercises. The participants will be exposed to many aspects of seismic stratigraphic interpretation related to carbonate reservoirs in traditional, unconventional and lacustrine environments.

Learning Outcomes

Participants will learn how to:

1. Appraise common carbonate seismic facies and geometries.
2. Assess the diagenetic influence on porosity, permeability, and sonic velocity of carbonate reservoirs.
3. Evaluate possible carbonate depositional environments on seismic data and predict the facies within the various environments.
4. Evaluate the usage of seismic attributes in interpreting carbonates.
5. Examine potential reservoirs in carbonate contourite systems.
6. Appreciate the difficulty of distinguishing carbonate buildups from volcanic edifices.
7. Perform seismic stratigraphic interpretations to predict, map and quantify carbonate reservoirs.
8. Integrate stratigraphic principles into a carbonate interpretation.
9. Evaluate seismic data for an integrated carbonate reservoir characterization.
10. Evaluate the controlling factors for variations of carbonates in unconventional reservoirs.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, exercises and case studies. Participants are encouraged to bring relevant material that can contribute to the discussion.

Who Should Attend

This course is aimed at motivated geoscientists working on carbonate plays, prospects and fields, who are seeking to share and build upon their knowledge. Managers and team leaders working on carbonate assets are also welcome. This workshop format would benefit multi-disciplinary asset teams.

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Prerequisites and Linking Courses

While there are no formal prerequisites for this course, participants should have a basic understanding of carbonate systems, such as acquired on N020 (Carbonate Depositional Systems: Reservoir Sedimentology and Diagenesis).

Course Content

Carbonate Depositional Systems: morphologies of shelf, isolated platform, ramp:

- Unique aspects of carbonates
- Modern examples of ramp, shelf and isolated platforms
 - Exercise
- Oligo - Miocene Carbonate Ramp Systems
 - Apulia and elsewhere

Seismic Geometry and Facies in Carbonate Systems:

- Seismic facies analysis of carbonate systems
 - Exercise

Carbonate Depositional Systems: slope and basin:

- Modern carbonate slopes: morphology, processes and facies
- Carbonate contourite drift systems - overview
- Carbonate contourites and the petroleum system
 - Examples and case studies

Carbonate Petrophysics:

- Carbonate diagenesis and its influence on petrophysical properties
- Control on sonic velocity and resistivity in carbonates
 - Exercise
- Rock physics models explaining velocity variations in carbonates
- Porosity types and porosity models for carbonates
- Effect of Saturation on Velocity in Carbonates

Carbonate Microbialites:

- Modern stromatolites and associated facies
- Microbial processes influence on reservoir quality
- Petrophysical properties of microbialites

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- Lessons from the modern carbonates for the exploration in the Presalt

Carbonate Sequence Stratigraphy:

- Introduction to carbonate sequence stratigraphy
- Comparison of sequence stratigraphic models
- Exercise: Sequence analysis

(Seismic) Carbonate Reservoir Characterization:

- Carbonate depositional cycles as building blocks for reservoirs
 - Exercise
- Fractures within depositional cycles and flow units
- Workflow in seismic reservoir characterization illustrated on Giant field in Abu Dhabi

Challenges in Carbonate Exploration:

- Distinguishing carbonates buildups from volcanic edifices in seismic data
 - Exercise

Mixing of Carbonate and Siliciclastics

- Mixed systems in conventional reservoirs
- Mixing in unconventional reservoirs
 - Depositional and diagenetic processes of fine-grained carbonates
 - Case study: Vaca Muerta Neuquén Basin