
N189: Fundamental Concepts of Carbonate Depositional Systems and Reservoirs

Format and Duration
Classroom - 5 Days

Instructor(s): Dan Bosence

Summary

The application of modern facies models and sequence stratigraphy to subsurface carbonate systems allows some predictions to be made about the occurrence of different potential reservoir facies. Some basic principles can be used to predict the diagenetic changes that limestones and dolomites undergo with burial and how this affects their quality as hydrocarbon reservoirs. Global scale variations in carbonates can be understood through an understanding of the different climatic, biotic, oceanographic, and sedimentary controls on carbonate sedimentary systems and how these have varied through geological time.

This course also categorises the processes of carbonate sediment accumulation in carbonate platforms in different tectonic settings and identifies target facies that commonly form reservoirs. In particular, the carbonate platforms of the Gulf of Suez and Red Sea rift basins are reviewed based on extensive field-based research by the instructor.

Learning Outcomes

Participants will learn to:

1. Identify a range of carbonate rocks, minerals and their pore systems.
2. Determine the formation of limestones and dolomites.
3. Contrast carbonate facies from rimmed shelves and ramps.
4. Analyse the diagenetic changes that affect carbonate rocks; mineralogy, textures and porosity.
5. Interpret the evolution of porosity and permeability as carbonate sediments evolve into rocks.
6. Apply sequence stratigraphic principles to carbonate successions and appreciate how these can be used to predict facies occurrence.
7. Evaluate the global controls on carbonate systems and how these have varied through geological time.

Training Method

This is a classroom course comprising a mixture of lectures, discussion, case studies, and practical exercises.

Who Should Attend

This course is aimed at geoscientists who require a fundamental understanding of carbonate depositional systems, facies and sequence stratigraphic models, and diagenesis.

Course Content

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1. Introduction and rimmed carbonate shelves

- Introduction; carbonate sediments, carbonate factories.
- Carbonate sedimentation in a modern, humid climate setting; south Florida attached shelf
- Unattached carbonate platforms and slopes; Bahamas and facies models
- Exercises; carbonate grains and mineralogy and facies (south Florida).

2. Ramps and near surface diagenesis

- Depositional environments, facies and facies models for carbonate ramps and arid climate setting, Arabian Gulf.
- Near surface diagenetic environments of limestones and dolomites.
- Exercises; Graphic log, Walther's law and cross-section paper exercise, unravelling diagenetic textures from thin sections.

3. Burial diagenesis and sequence stratigraphy

- Burial diagenetic environments of limestones and dolomites. Diagenetic trends with burial and possible uplift .
- Principles of carbonate sequence stratigraphy and comparison with mixed clastic and evaporite systems.
- Exercises; Diagenesis and porosity evolution (interpretation of thin sections), Interpretation of carbonate sequence stratigraphy (paper exercises).

4. Sequence stratigraphy and changes in carbonates through space and time

- Application of carbonate sequence stratigraphy. Case studies.
- Spatial and temporal controls on carbonate sediments and carbonate platforms.
- Tectonic controls on carbonate platforms
- Exercises; Seismic sequence stratigraphy (paper exercise), Landsat image interpretation (paper exercise).

5. Rift Basin carbonates

- Introduction and major features/trends
- Case studies on syn-rift carbonates and carbonate-clastic systems from marine Gulf of Suez and Gulf of Aden.
- Rift basin, non-marine carbonates from SW and NE Atlantic margins.
- Exercise; Correlation of syn-rift facies and lithostratigraphy.
- Proposed discussion/presentation session on Woodside data.