N020: Carbonate Depositional Systems: Reservoir Sedimentology and Diagenesis

Instructor(s): Paul Wright

Format and Duration

Classroom - 5 Days
Virtual - 10 Sessions

Summary

Business Impact: Success depends on getting the basics right the first time, and this course is designed to **provide the frameworks** for practitioners in the industry to **develop new**, **and critically evaluate existing**, **geological models for carbonate reservoirs**, based on the latest ideas and techniques. This enables meaningful assessments of risk and uncertainty to be made as well as the best decision making regarding **well planning** and **reservoir modelling**, all with clear business implications.

Carbonate rocks contain over 40% of the world's hydrocarbon reserves. Most earth science specialists have only had a rudimentary introduction to the topic at the first degree level and there seems to be a mystique in the oil industry that carbonates are "too complicated". The aim of this course is to provide an up-to-date introduction to practical carbonate sedimentology. Carbonate rocks are complex and there are many gaps in our understanding, but there are basic principles taught in this course that provide a framework in which the complexity may be made understandable, improving exploration success and reducing the risk of inappropriate strategies being devised during appraisal and development of the reservoir.

The course provides a thorough grounding in the concepts, terminology and models used to interpret, assess and predict carbonate reservoirs. It will take the student from the seismic scale through to reservoir issues relating to dynamic simulations.

Learning Outcomes

Participants will learn to:

1. Distinguish the principal carbonate sediment components, textures and systems of carbonate classification.
2. Examine the primary controls on carbonate deposition temporally and spatially. Compare and contrast with siliciclastic deposition.
3. Differentiate the main types of carbonate platform, their variability, scale and distribution of likely reservoir units.
4. Demonstrate sequence stratigraphic aspects of carbonate build-ups, their differing response to sea level change compared to clastic sediments and discuss their seismic characters.
5. Categorise the principal types of reservoir facies (platform interior, carbonate sands, reefs, slope systems and chalks), their recognition, architecture, sequence stratigraphy and porosity types.
6. Differentiate the development of primary and secondary porosity through the combination of sedimentological, chemical and diagenetic processes.
7. Compare and contrast carbonate pore systems and their reservoir characteristics with those developed in clastic sediments.
8. Compare how the variety of diagenetic environments affect primary porosity in carbonate rocks and understand the implications for reservoir quality.
9. Distinguish the principal modes of formation of dolomites and compare their reservoir properties with other carbonates.

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Training Method

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

Who Should Attend

The course is structured to appeal to all geoscientists who wish to broaden and deepen their knowledge of carbonate reservoirs.

Course Content

The course will commence with an examination of the principles of carbonate deposition and the factors that control the formation of carbonate systems. The main structure of the course falls into three parts with all aspects being firmly set in a sequence stratigraphic framework:

Part 1 outlines the seismic scale of carbonate systems. This will include a discussion of the types of carbonate platforms, modern and ancient analogues, platform architecture, seismic recognition, play types and exercises.

Part 2 will summarise the reservoir scale of carbonates. The subjects covered will include all the key depositional systems including platform interiors, shoal belts, reefs, slopes and chalks. Criteria for recognition, key reservoir properties and common play associations will be distilled for each facies type. There will also be discussions of key reservoir types for “reefs” such as rudists, Miocene buildups, buildups of late Paleozoic age. Reservoir case studies and exercises will be integrated into the webinar sessions. This section ends by studying sequence stratigraphic aspects and also drowned platforms.

Part 3 focuses on the origins of porosity, diagenetic environments, reservoir aspects, layering issues and techniques used to examine carbonate reservoirs. Two reservoir types are studied in detail – dolomite reservoirs, and palaeokarsts.

The key topics are:

1. An Introduction to Carbonate Systems
2. Carbonate Sediment and Limestone Components
3. Limestone Classification
4. Carbonate Platforms
5. Carbonate Shelves - Sequence Stratigraphy of Flat-topped Platforms
6. Carbonate Ramps
7. Carbonate, Evaporite and Siliciclastic Sediment Partitioning
8. Platform Interior Carbonates
9. Sandbodies on Platform Margins and Ramps
10. Reefs

11. Carbonate Slope Systems
12. Pelagic Systems and Chalk Reservoirs
13. Platform Drowning and Tethyan Carbonate-dominated Passive Margin of the Alps
14. Facies Belts
15. Introduction to Porosity in Carbonates
16. Carbonate Porosity and Rock Fabrics
17. Introduction to Diagenesis and Sequence Stratigraphy
18. Upper Jurassic, Corallian Reefs of the Weald
19. Porosity Development, Diagenesis and Diagenetic Environments
20. Marine Diagenetic Environments - Western Canada Basin
21. Meteoric Diagenesis
22. Porosity Development During Burial Diagenesis
23. Dolomites - Dolostones
24. Palaeokarst and Karstic Porosity Systems
25. Rudist-rich Formations
26. Techniques
27. Carbonates and Tectonics