INTRODUCTION TO CARBONATE RESERVOIRS

Instructor: Peter Gutteridge

November 17 – 21, 2013

Sheraton Senggigi Hotel, Lombok

1.1. Day 1

1.1.1. Introduction

• Importance of carbonate reservoirs to oil industry
• Carbonate reservoirs – definition of a reservoir, petroleum systems, finding and developing reservoirs
• Reservoir characterization, reservoir engineering.
• Sources of direct data on reservoirs – cuttings, SWC, core, logs, seismic, pressure, production.
• Reservoir description work flows
• Unique attributes of carbonates and differences with clastic reservoirs

1.1.2. Carbonate reservoir rock properties

• Carbonate rocks, depositional properties, texture, grain types, grain size, fabric
• Classifications of carbonate rocks
• Reefal rocks
• Sedimentary structures
• Controls on carbonate deposition

1.1.3. Petrophysical properties of carbonate reservoirs

• Porosity and Permeability measurements
• Interpreting and QCing core plug data
• Saturation
• Wettability
• Capillarity

1.2. Day 2

1.2.1. Log response of carbonates

• Logging suites and log responses of carbonates responses
• Image logs and dip data
• Exercise
1.2.2. **Seismic response of carbonates**

- Seismic behavior of carbonates
- Seismic geometries of carbonate systems
- Seismic attributes of carbonates
- Exercise

1.1. **Day 3**

1.1.1. **Carbonates: stratigraphic principles**

- Carbonate platforms and facies patterns
- Depositional settings
- Anatomy of depositional units; facies shapes, trends
- Facies successions and sequences
- Exercise in correlation
- Lithostratigraphy and chronostratigraphy
- Log correlation
- Sequence stratigraphy principles, definition and scales of observation
- Sequence stratigraphy in carbonate reservoirs
- Sequence stratigraphy in carbonate exploration

1.1.2. **Carbonate diagenesis**

- Carbonate mineralogy
- Settings of carbonate diagenesis
- Processes and products of carbonate diagenesis
- Exercise in carbonate diagenesis
- Methods of studying carbonate diagenesis
- Dolomitisation
- Burial processes
- Porosity classifications
- Exercise in porosity and permeability

1.1. **Day 4**

1.1.1. **Matrix porosity carbonate reservoirs**

- Definition and recognition of matrix porosity reservoirs
- Beach/Dune environment
- Tidal flat/Lagoon environment
- Shallow subtidal environment
- Slope break environment
- Slope environment
- Basinal environments
- Mapping of matrix porosity carbonate reservoirs

1.1.2. **Dual porosity carbonate reservoirs**

- Macropore systems in carbonates
- Classification of dual porosity reservoirs
1.2. Day 5

1.2.1. Fractured carbonate reservoirs
- Definition of fractures
- Types of fractures
- Fracture permeability
- $S_w$ in fractured reservoirs
- Detecting fractures
- Predicting and modeling fracture systems

1.2.2. Karst carbonate reservoirs
- Definition
- Controls on karst architecture
- Core, log and seismic expressions of karst reservoirs
- Karst vs. fractured reservoirs
- Quantifying karst reservoirs

1.2.3. Brecciated carbonate reservoirs
- Depositional carbonate breccias, reservoir properties
- Salt-associated breccia bodies
- Evaporite collapse breccias
- Reservoir geometry
- Pore types

1.2.4. Burial diagenetic macroporous reservoirs
- Distinction of karst and burial dissolution
- Pore systems in burial diagenetic carbonate reservoirs
- Hydrothermal dolomite reservoirs

1.2.5. Course summary

1.3. References

ABOUT THE INSTRUCTOR
Peter Gutteridge is currently director of Cambridge Carbonates Ltd. with 29 years experience of carbonate research, consulting and teaching. After receiving his Ph.D. in 1983 from the University of Manchester on the sedimentology and diagenesis of Dinantian carbonates in the UK, he taught sedimentology, stratigraphy and petroleum geology as a senior lecturer for 5 years at Thames Polytechnic in London. Before that, he was an exploration and production geologist for Britoil working on various aspects of North Sea geology 1983-1985).
Since 1990, he has been a consultant specializing in all aspects of carbonate systems and reservoirs and now leads a group of seven carbonate experts who work worldwide. He is responsible for carbonate studies involving sequence stratigraphy, core logging, microfacies and diagenetic studies and internal and external training. He is working on integrating these types of conventional geological studies with Petrel-based reservoir models. Peter’ particular areas of expertise are: Tertiary carbonate systems of SE Asia and North Africa; Mesozoic carbonates of the Middle East and Mexico, Palaeozoic carbonate and evaporite systems of western Europe, the Russian Federation and the Arctic; pre-salt carbonates of the south Atlantic margins and the interaction of salt movement with carbonate depositional systems and reservoir development in the Mesozoic of SE Mexico. He is also a skilled interpreter of karsted and brecciated carbonate reservoirs.

Industry courses he has presented include, carbonate reservoir characterization, carbonate sequence stratigraphy and diagenesis and field courses in the UK on Dinantian and Zechstein carbonate and evaporite systems.

ENROLLMENT
In order to allow sufficient time for arranging travel plans, early enrollment is recommended. Registration will be closed on October 1, 2014. Late enrollment may result in course cancellation.

CERTIFICATE
A certificate of participation will be awarded to each person completing the course.

CANCELLATION, SUBSTITUTION & REFUND
The tuition fee will be refunded (less US$ 100 registration fee) only if notification of cancellation is received at least 10 days prior to the commencement. Non-payment of tuition fee does not constitute automatic cancellation of participation. Substitution may be made at any time for those enrolled.

TUITION FEE
Tuition fee at USD 4350 + 10% VAT per delegate is due and payable upon confirmation of enrollment. The fee is excluded accommodation. Payment should be settled at the latest on October 1, 2014. Any bank charges connected with payment in US Dollars must be added to payment. Tuition fee includes admittance to the course, course materials, daily refreshments and full lunch.

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