Integrated strategies to maximise recovery from heterogeneous, low-porosity formations

Carbonate rocks produce 40-50% of oil and gas globally. With clastic reservoirs depleting fast, that figure is set to rise.

The pressure is on to produce these hydrocarbons now, or risk losing $millions in untapped resources. You need to ensure accurate prediction, optimise recovery and overcome the huge technical barriers that tight, complex carbonate formations place on your project.

To achieve success, you must:
✔ Develop and apply accurate reservoir characteristics to predict performance and productivity
✔ Effectively manage diagenesis to optimise production
✔ Maximise recovery through reservoir stimulation technology

Attend Carbonate Reservoir Prediction, Modelling & Stimulation to hear field-proven strategies for overcoming these hurdles. With a practical, integrated look at your biggest carbonate challenges, this is the only event where you can:
✔ Gain watertight solutions through a full-spectrum approach to the technical challenges of carbonate reservoirs
✔ Find out what really works, with carbonate experts from 10 leading operators delivering case study presentations
✔ Understand the global carbonate landscape, with experience from Europe, South America and the Middle East

Carbonate reservoirs are the future of oil and gas production. Failure to conquer them will stunt your company’s E&P development and jeopardise profit margins. So keep ahead of the game and maximise revenue from your carbonate operations now by attending this unique event.

PLUS, engage interactively with key industry experts in our 2 post-conference workshops:
A) Application of (micro-) computed and synchrotron tomography techniques for carbonate reservoir characterisation
B) Accurate reservoir characterisation for reservoir modelling

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Hear carbonate case study experience from 10 leading operators:

Saudi Aramco  Shell  Statoil  BP  Total E&P Norge  ConocoPhillips  BG Group  Petrobras  ENI  Norsk Hydro

With expert insights from:

UAE University  Cambridge Carbonates Ltd  Cardiff University  NTNU  Oman Geo-Consultants Ltd  Katholieke Universiteit Leuven  Schlumberger
How Saudi Aramco have met the challenges of carbonate reservoirs

Working in one of the most carbonate-rich regions in the world, Saudi Aramco have developed extensive experience of meeting the challenges associated with carbonate reservoirs. This presentation will outline their Middle Eastern experience, looking at how this can be applied to other projects and regions.

Sa‘id Al-Hajri, Exploration Technical Services Department Manager, Saudi Aramco

Effective planning for successful carbonate operations

- General introduction on fractured reservoirs
- Different workflow used to model and petrophysically evaluate the fracture network in different cases (e.g. case with a complete dataset, case with few data, core scale methodology)
- Methodology to include into the discrete fracture network modelling fractures across the scale
- Importance of analogues data during modelling
- Fast means of facing the uncertainties related to data and geological modelling

Claudio Toscano, Reservoir Geologist – Reservoir Characterisation & Modelling Department, ENI

Improving reservoir performance by using an integrated approach

For optimum results, your field development plan must assimilate all the knowledge of all your asset team members. This presentation will show you how Schlumberger’s expertise, and the Petrel technology, can help you achieve game changing results.

Colin Daly, Principal Workflow Consultant, Schlumberger, Petrel

Overcoming the challenges of a giant fractured reservoir: The Fahud Field

The Fahud Field is a giant fractured carbonate reservoir in the Sultanate of Oman. It is contained in the Natih Formation, a 450m thick section of Albian to Turonian, high porosity, low permeability, shallow water carbonates. This presentation will look at Shell’s experience with this field, including:

- Petrophysical characterisation of the reservoir
- Reservoir rock typing

Cathy Hollis, Group Supervisor, Carbonate R&D Team, Shell

Effectively implementing reservoir modelling in North Sea chalk environments

- North Sea chalk: recent developments
- What are the unique challenges of North Sea chalk?
- How can new depositional models help us to work in these conditions?
- Seismic amplitudes and chalk
- Comparison of Norwegian and UK chalk reservoirs

Juergen Schlaf, Geologist, ConocoPhillips

How to model chalk reservoirs accurately: Total's Norwegian experience

The workflow and methodologies used by Total in recent studies have made it possible to establish and further use mapped geological models to populate key parameters. In chalk fields, this has ensured that that geology has been recognised from the static to dynamic modeling of the chalk field. This presentation will outline the findings from Total’s work and how these can be applied to future projects.

Michel-Claude Thomas, Geologist, Total E&P Norge

Squeezing the last drop from carbonates by integrating outcrop studies, seismic modelling and subsurface data

The integration of outcrop data and the understanding gained from continuous exposure of full reservoir intervals, with forward seismic modelling of regional to reservoir scale features, and the iteration of these with subsurface data from mature producing fields, provides high resolution geological models that considerably improve the understanding of reservoirs. In turn, the constraints emplaced when establishing geological models at this scale of detail require a combination of high resolution sequence stratigraphy and sedimentology that puts best practices in reservoir characterisation a step further. This presentation will draw on numerous sites and case studies in the US (Carboniferous, Paradox Basin), Canada (Devonian, Rocky Mountains), Turkey (Miocene) and then at the Shell-SQU Centre for Carbonate Studies in Oman (Carboniferous, Natih).

Professor Peter Homewood, Consultant for Geosciences and Reservoir Characterisation, Oman Geo-Consultants

Carbonate reservoir modelling and its challenges: An example from mid-Cretaceous carbonate reservoir in South West Iran

- Using sequence stratigraphy in geological modelling
- How to capture vertical and horizontal heterogeneity
- How to distribute petrophysical parameters in a geological model

Ali Asghar Taghavi, Research Associate, NTNU
Day Two: 28th September 2006

08:30  Coffee & registration
09:00  Chairman’s recap
09:15  Achieving accurate reserves estimation through pore-type classification

In carbonate reservoirs the most widely used pore-type classification systems are limited by the fact that the relation between porosity and permeability is poorly defined. In many carbonate reservoirs, it is therefore difficult to generate predictive models for reservoir quality distribution, which results in significant uncertainty to hydrocarbon reserve calculations. Based on empirical data a new pore-type classification system has been developed. The new system uses elements from the Choquette and Pray (1970) and Lucia (1983, 1995, 1999) pore-type classification systems, but also introduces many new elements. It includes 20 pore-type classes that show a predictable relation between porosity and permeability. It combines sedimentologic/ diagenetic features and flow-related properties, and reservoir-critical parameters can thus be predicted using sedimentological and diagenetic models. Simple models run on oil reservoirs indicate that pore-type variations may account for several hundred percent differences in calculated hydrocarbon reserves, and pore-types may thus be one of the most critical parameters in the evaluation of a prospect or field.

Marcos Francisco Bueno de Moraes, Senior Geophysical Consultant, Petrobras

10:00  BP’s success with carbonate reservoirs

This presentation will look at BP’s global experience with carbonate reservoirs, including a discussion of the different conditions throughout the world, and the different challenges presented by these conditions.

Trevor Burchette, Carbonate Advisor, BP

10:45  Coffee & networking

11:15  Analysing the effects of diagenesis in carbonate reservoirs through seismic

It is known that diagenesis (early and late/burial) can lead to changes in the porosity and cementation of carbonate sediments and, consequently, changes in the acoustic impedance characteristics. The new challenge of seismic is how to “see” these diagenetic modifications in seismic data. This session will also discuss the influence of the thermoboric processes on carbonates, producing a suite of different lithofacies (saddlerized tite and porous, collapsed breccias, leached limestones and unaffected limestones).

Marcos Francisco Bueno de Moraes, Senior Geophysical Consultant, Petrobras

12:00  Interactive panel session

This session will give delegates the opportunity to discuss the biggest challenges their carbonate operations present. The panel will then examine ways in which technology can be applied to overcome those challenges.

Panelists include: Colin Daly, Principal Workflow Consultant, Schlumberger, Petrel

12:45  Lunch & networking

13:45  Understand and Manage the effects of complex carbonate diagenesis on carbonate reservoirs in Foreland Fold and Thrust Belts

Reconstruction of the different diagenetic processes that affect carbonate reservoirs is a very challenging task, especially in complex areas such as Foreland Fold and Thrust Belts. In contrast to classical subsiding basins, in these tectonically overprinted areas, a number of particular diagenetic processes occur, which may destroy or enhance reservoirs. A number of examples from Albania, Canada, Mexico, Pakistan, Sicily and the Emirates will be presented.

Rudy Swennen, Professor, Katholieke Universiteit Leuven

14:30  Multiple karst systems in Cretaceous Apulian shelf carbonates of Gargano, southern Italy: Insights into the structure of karst reservoirs

Karsted Lower Cretaceous shelf carbonates exposed in Apricena Quarry overlain by Miocene and Pliocene sediments provide direct analogues to the Rospo Mare Field, offshore southern Italy. The Lower Cretaceous carbonates contain pre-Miocene and sub-Miocene karst systems that have contrasting flow-unit geometries. Pre-Miocene karst consists mainly of layer-parallel non-collapse caves and some sub-vertical fissures that would produce a sub-horizontal reservoir layering. This karst system is infilled by a complex sequence of internal sediments, probably derived from intra-Cretaceous terrestrial deposits now removed by erosion. Sub-Miocene karst consists of sub-vertical fractures enlarged by dissolution and infilled by the terra rossa developed on the sub-Miocene unconformity. This karst system would produce vertical connectivity and compartmentalisation in the reservoir. An outcrop gamma study shows that intra-Cretaceous palaeosols can be distinguished from karst-fills by their spectral gamma signature. This demonstrates the utility of the spectral gamma tool in karst reservoir description and reservoir management.

Peter Gutteridge, Director, Cambridge Carbonates Ltd

15:15  Coffee & networking

15:45  Porosity can form at depth: deep burial corrosion and palaeokarstic reservoirs

There is a growing awareness that extensive porosity can form at depth by burial fluids. This can produce large, seismically-resolvable features. These effects are often mis-labelled as HTD (hydrothermal dolomite) reservoirs. This is a new play type often associated with strike-slip systems.

Paul Wright, Professor, Cardiff University and Advisor for Carbonates to BG Group

16:15  Improve oil recovery by using CO2 in miscible flooding of tight carbonate reservoirs

- Displacement efficiency of CO2 flooding
- Interactions between supercritical CO2 and crude oil
- Interactions between supercritical CO2 and formation water
- Effect of CO2 flooding on carbonate reservoir relative permeability

Abdulrazag Y. Zekri, Professor of Petroleum Engineering, UAE University

17:15  Chairman’s summary & close of conference

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Workshop A: Application of (micro-) computed and synchrotron tomography techniques for carbonate reservoir characterisation

Based on computed and synchrotron tomography techniques it is possible to infer data on porosity network and mineralogy in core plugs in three dimensions. The major advantage is that this can be done at different resolution scales, from submicron to mm-scale. It allows operators to assess microporosity, dual porosity, and since data can be acquired about mineralogy (dolomite, calcite, anhydrite), the effects of diagenesis can also be studied.

This workshop will cover:

- Introduction to the techniques
- Overview of the physical principles
- Case studies and applications

Facilitated by:

Rudy Swennen, Professor, Katholieke Universiteit Leuven

Rudy Swennen heads up the Laboratory for Sedimentpetrology and Environmental Geology at KU Leuven. He has extensive experience of working with carbonate reservoirs. His recent work includes research in Sicily and the Lebanon. He sits on the organising committee of the AAPG's carbonate reservoirs conference.

Workshop B: Accurate reservoir characterisation for reservoir modelling

This workshop will discuss how we can improve reservoir characterisation in order to generate more accurate reservoir models. Topics of examination will include:

- “Reference” conceptual depositional models
  - Given the limited picture that subsurface data provides, should a generic series of conceptual depositional models be developed in order to help characterise subsurface reservoirs?
  - How should this series of conceptual models be categorised? By age? By tectonic setting?
  - What data is needed to devise this series of models?
- Translating static data to dynamic models
  - Selecting the key data from outcrop analogues to help define shapes of flow units and geobodies
  - Scales of data: from plug data to well flow rates
- Interactive computer modelling (i.e. stratigraphic modelling)
- Prediction of properties outside of the wellbore
  - Defining flow units
  - Use of sequence stratigraphy
  - Using the correct analogues
  - Using seismic attributes
  - Use of geostatistics
- Diagenesis in reservoir modelling
  - How do we predict and model diagenetic processes?

Reference will be made to carbonate case histories and examples.

Facilitated by:

Peter Gutteridge, Director, Cambridge Carbonates Ltd

After completing a PhD in UK Dinantian carbonates, Peter worked in the North Sea for Britoil and researched on Dinantian carbonates in the UK. Peter has particular expertise in Tethyan carbonate reservoirs in the Mediterranean and the Middle East, Mesozoic reservoirs in Mexico, late Palaeozoic carbonates and evaporites in NW Europe and the description of karst, breccia and fracture systems. In total, he has 22 years’ post-PhD experience.

Joanna Garland, Consultant Geologist, Cambridge Carbonates Ltd

Joanna has a PhD in sedimentology and sequence stratigraphy of cyclic Devonian carbonates of NW Europe. She worked at Enterprise Oil for 5 years, primarily as an explorationist in the UK North Sea in both siliciclastic and chalk reservoirs, and at Statoil for 2 years as an exploration activity leader in their Carbonates Research Group. Joanna is experienced at collating and interpreting large datasets for statistical analysis, and the use of GIS.

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Dear Colleague,

Converting carbonate formations into profitable plays is no easy task. The challenges are complex, and you need to make sure your strategy covers all bases to maximise ROI from your carbonate assets.

Welcome to **Carbonate Reservoir Prediction, Modelling & Stimulation**. Following industry demand, this conference has been uniquely designed to offer proven experience from 10 leading operators. You will hear them explore and resolve the full spectrum of your carbonate challenges.

Spend two days with our unrivalled panel of industry experts to discover how you can:

- **Generate accurate predictive models** through incorporating sedimentology and diagenesis in pore-type classification
- **Integrate outcrop studies, seismic modelling and subsurface data to develop fail-safe reservoir models**
- **Improve oil recovery** in tight carbonate reservoirs through miscible CO2 flooding
- **Apply new depositional models to optimise understanding of chalk reservoirs**

Nowhere else will you find such a broad range of carbonate expertise under one roof. So keep ahead of the game, maximise revenue from your carbonate operations, and register your place now!

I look forward to meeting you in September.

_Claire Dickinson_

Conference Director

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- Carbonate Specialists
- Geologists
- Geophysicists
- Petrophysicists
- Seismic Analysts
- Reservoir Engineers

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  **KERR-McGEE**

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  **UNOCAL**

- “Every speaker delivered a valuable presentation, both interesting and relevant”
  **AMERADA HESS**

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