CARBONATE RESERVOIR CHARACTERIZATION

Learn effective methods in predicting reservoir performance through an integrated approach across exploration disciplines.

25th MAY 2015 - 29th MAY 2015 at KUALA LUMPUR, MALAYSIA

PetroSync Distinguished Instructor:
DR. ANTHONY (TONY) KIRKHAM
Director and Consultant Geologist,
Sedimentology and Reservoir Development Ltd

- Over 40 years of international experience in oil and gas exploration and development
- Specialized in carbonate sedimentology, reservoir characterization and 3D modeling
- Previously worked for BP Exploration mainly as Senior Development Geologist for 20 years; Abu Dhabi Company for Onshore Oil Operations (ADCO) as Geological Specialist; Landmark Graphics as Senior Technical Consultant; Reservoir Characterization Research and Consulting Inc. (RC)² as Managing Director; and Schlumberger as a Principal Geologist.
- Taught Field Courses and Training Programs for ADCO, Landmark Graphics, (RC)², PDO, Statoil, BP, Occidental, AAPG, SPE and others
- His affiliations include: memberships of American Association of Petroleum Geologists (AAPG), Society of Economic Palaeontologists and Mineralogists (SEPM), and International Association of Sedimentologists (IAS). He is a Fellow of the Geological Society of London.

Course Objectives
- UNDERSTAND the factors affecting carbonate reservoir characterization
- PROVIDE an insight to the complexity of carbonate depositional systems, including associated evaporites
- EXAMINE the susceptibility of carbonates to post-depositional (diagenetic) changes
- APPLY petrophysical approaches to carbonate reservoir description
- MANAGE the uncertainties in predicting depositional environments
- INTEGRATE different geological, petrophysical and reservoir engineering data sets

Specially Designed for

This course is designed for, but not limited to, those who are directly involved with carbonate reservoir characterization, and who need a deeper understanding of the complexity and problems associated with carbonate reservoirs.

- Exploration & Development Geoscientists (Geologists & Geophysicists)
- Sedimentologists
- Reservoir & Petroleum Engineers
- E&P Managers
- Petrophysicists

Pre-requisite: It is assumed that participants have at least the basic understanding of reservoir characterization and modeling to fully appreciate the course.
The course introduces the participants to modern carbonate environments and explains how the constituents of a carbonate sediment become lithified and changed after deposition to provide potential reservoir rocks. Modern carbonate environments from particularly the Arabian/Persian Gulf and the Caribbean are examined in detail to provide a sense of scale and perspective. Large scale carbonate architectures are discussed and illustrated from a sequence stratigraphic perspective with seismic scale examples illustrated from outcrop.

There are numerous illustrations of outcropping carbonates and evaporites from a wide range of depositional settings throughout the Phanerozoic. Petrophysical approaches to reservoir characterization of fields are illustrated with emphasis on fracture modeling, fluid saturation modeling and hydraulic flow units. A selection of carbonate oil and gas plays and fields from various parts of the world are discussed. Presentations are interspersed with videos and exercises. The participants are given the course notes in electronic form upon completion.

### Course Content

#### DAY ONE - CARBONATE ESSENTIALS AND MODERN DEPOSITIONAL ENVIRONMENTS

- **Carbonate Grains and Classifications**
- **Carbonate Study Techniques**
- **Carbonate Ramps and Platforms**
  - Examples from Middle East, Alps, UK and the Bahamas
- **Modern Carbonate Depositional Environments**
  - Abu Dhabi - a classic location for studying arid coastal carbonates
  - Caribbean - humid climate carbonates of Bahama Bank, Caicos Platform and Florida

#### DAY TWO - CARBONATE FACIES AND SEQUENCE STRATIGRAPHY

- **Aeolian Deposition and Deflation**
  - Examples from Abu Dhabi
- **Evaporites**
  - Modern and ancient sabkhas and salinas
  - Examples from British West Indies, Permian Zechstein of North Sea, Upper Jurassic Arab Fm., Miocene Mediterranean Salinity Crisis
- **Modern and Ancient Microbial Mats (stromatolites and thrombolites)**
  - Examples from UK, Shark Bay Australia, Brazil Santos and Campos Basins, Angola
- **Modern and Ancient Reefs**
  - Examples from Majorca, Great Barrier Reef, Gulf of Suez, Far East, UK, British West Indies
- **Carbonate Sands** with emphasis on grainstone accumulations, including oolites
- **Bioturbation** by fauna and flora
- **Resedimented Carbonates**
  - Examples from Italian Dolomites, Pyrenees, United Arab Emirates, UK
- **Sequence Stratigraphy** with rock outcrop examples

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If you like to know more about this program, please contact Jerry Tay (Conference Director) on +65 6415 4502 or email jerry.t@petrosync.com
DAY THREE - DIAGENETIC ALTERATIONS AND RESERVOIR CHARACTERIZATION

Diagenetic Alterations
- Cementation (vadose and phreatic; early and late burial; palaeosols)
- Replacement (focusing especially on dolomitization mechanisms)
- Neomorphism (factors affecting mineral transformations)
- Dissolution (secondary porosity with focus on karstification processes)
- Compaction (mechanical and chemical - pressure solution)

Reservoir Characterization
- Petrophysics (pore types; permeability prediction, Archie equation and its constants, rock typing)
- Seismic (attributes including inversion, spectral imaging, shear wave splitting)
- 3D Modelling (deterministic and stochastic)
- Saturation Modeling (pros and cons of a range of techniques)
- Fracture Modeling - Continuous Fracture Modeling (CFM) and Discrete Fracture Network Modeling (DFN)
- Quantifying Volumetric Uncertainty (carbonate field case study example)
- Flow Units (Flow Zone Indicators)

DAY FOUR - ANCIENT CARBONATE SEQUENCES

Carbonate Source Rocks
Ancient Carbonate Sequences
- Triassic Dolomites of the Italian Alps with emphasis on the Sella Platform
- Lower Carboniferous Ramp and Platform Carbonates of the UK
- Miocene carbonates of the Mediterranean:
  - Malta - shallow carbonate build-ups to carbonate oozes and large scale collapse features
  - Southern Spain - Sorbas and Nijar Basins
  - Balearic islands - Majorca and Menorca
  - Sardinia - rift margin carbonates and volcanics

DAY FIVE - CASE STUDIES OF CARBONATE PETROLEUM PLAYS AND FIELDS

SOUTHEAST ASIAN REGION:
- Indonesia: Arun (North Sumatra), Kangean BD (East Java Sea), Madura (East Java Sea), Kampang Buru (Sulawesi), Walio (Salawati Basin, Irian Jaya), Kasim (Salawati Basin, Irian Jaya), Kampang Buru (East Java), Tonasa carbonate platform/ramp (Sulawesi)
- Malaysia: Natuna (Sarawak), Luconia Province (Sarawak)
- China: Liuhua (Pearl River Mouth Basin, offshore China)
- Philippines: Nido reef complex (Palawan Basin), Sarap carbonate platform (offshore Palawan Island),
- Vietnam: Offshore build-ups, Da Nang (offshore central Vietnam)

INTERNATIONAL:
- Middle East: Tunisia, Sidi El Kilani field (Upper Cretaceous reservoir), Libya fields - Hamada field (Palaeocene dolomite reservoir). Gulf of Suez - Zeit Bay and Ras Fanar fields (Miocene carbonates)
- Oman - Qarn Alam field (Upper Cretaceous reservoir), Arabian Gulf, etc.
- North Africa: vuggy and fractured carbonate reservoirs of Tunisia and Libya
- Mexico: The Golden Lane plays
- Offshore Brazil: Pre-salt microbial carbonates of Santos and Campos Basins
- Gulf of Suez: Miocene Carbonate Reservoirs
- North Sea: Permian Zechstein, Cretaceous Chalk
Tony Kirkham has 40 years of experience in the industry as an employee of major oil companies and as a consultant. He mostly worked within reservoir engineering teams in international development projects and had long term assignments in Norway, Egypt, Turkey and Abu Dhabi. He was employed for 20 years by BP Exploration prior to working as Geology Specialist for Abu Dhabi Company for Onshore Operations (ADCO). He then became Senior Consultant for Landmark in Abu Dhabi, followed by Managing Director of Reservoir Characterization, Research and Consulting (RC)2 in London with responsibility for Europe, Middle East and Africa. During 2001, Tony joined Technoguide (Petrel) as Manager of Consulting Services prior to several years as a Principal Geologist with Schlumberger. Recently he has operated as Director and Consultant for his own company.

He received his BSc from Aberystwyth University 1970; his MSc from Imperial College London 1972; and his PhD on carbonates from Bristol University 1977. Carbonate sedimentology, reservoir characterization and 3D modeling are his particular interests. Tony designed and led six-day field-based carbonate training courses on the classical modern arid coastline carbonates and evaporites of Abu Dhabi for worldwide staff of BP and BP Affiliates and has led numerous carbonate field trips repeatedly for other major oil companies including, ADCO, PDO, Occidental and Statoil, as well as for organizations such as the AAPG and SPE. He has also taught numerous class-based courses on 3D modeling and geostatistics, Petroleum Geology and other subjects for ADCO, Landmark, (RC)2 and Schlumberger.

DR KIRKHAM’S Selected Qualifications and Affiliations:
- Former Secretary of the Society for Explorationists in the Emirates (1994-1997)
- Member of the American Association of Petroleum Geologists (AAPG)
- Fellow of the Geological Society of London
- Member of the Society for Economical Palaeontologists and Mineralogists (SEPM)
- Member of the International Association of Sedimentologists (IAS)

DR KIRKHAM’S Selected Publications:


Title: CARBONATE RESERVOIR CHARACTERIZATION
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<table>
<thead>
<tr>
<th>Investment Package</th>
<th>Deadline</th>
<th>Full Masterclass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Price</td>
<td>22 MAY 2015</td>
<td>SGD $5,995</td>
</tr>
<tr>
<td>Early Bird Offer</td>
<td>24 APR 2015</td>
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<tr>
<td>Group Discount (3 or more Delegates)</td>
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<td>10% discount for groups of 3 registering from the same organization at the same time</td>
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</tbody>
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