Advanced Petrophysics

Practical application of various techniques to maximize economic recovery of hydrocarbons

21st April 2014 - 25th April 2014, Kuala Lumpur, Malaysia

Petrosync Distinguished Instructor

Mr. Peter Betts
International Petrophysical Consultant

- Over 35 years of experience in Oil & Gas industry
- Specializes in petrophysics, petroleum engineering, business process analysis, software specification, technical writing and training
- Worked for a number of multinational E&P companies: Shell International E&P, Maersk Oil & Gas, Petroleum Development Oman, Shell International Petroleum Maatschapij & Sarawak Shell

Course Objectives

- To provide participants with a sound understanding of the various evaluation techniques to enable them to select the appropriate methods for their environment
- Understand principles, quality, editing and response characteristics of the major open hole logging devices
- Understand the differences and application of the effective and total porosity systems using the Archie, Simandoux, Indonesian, Waxman Smits, Dual Water and Juhasz saturation equations
- Practice the various crossplot methods that can be applied to determine clay volume, lithology and assist in hydrocarbon differentiation
- Understand capillary pressure curves and saturation height functions
- Learn how probabilistic interpretation methods can be applied in complex formations
- Use various statistical techniques and logging tool responses to estimate permeability
- Apply uncertainty analysis and appropriate cut-off methods for volumetric calculations
- Be aware of the logging methods that can be applied in the cased hole environment
- Understand the response relationships between petrophysical measurements and seismic interpretation
- Be introduced to the techniques that can be applied in unconventional resources

Specially Designed for

The course is primarily intended for junior petrophysical staff to augment the skills that they should have already acquired during basic training. The course is also suitable for participants from other disciplines, who wish to have more insight into petrophysical analysis methods. Such participants should be familiar with basic petrophysical principles and will typically have 2 to 5 years or more working experience in a geoscience or reservoir engineering function.
In the E&P business, integrated petroleum engineering studies and field development plans are management tools which are used to maximise economic recovery of hydrocarbons. Petrophysical engineers fulfil a key role in analysing and interpreting subsurface reservoir data, which form the basis for reservoir models. E&P technical staff and team leaders involved in integrated studies require more than general skills in petrophysical interpretation techniques to produce quality input to development plans.

The subjects that are covered are petrophysical relations, tool principles, modern interpretation methods and core measurements. Throughout the course, work sessions will be held on Personal Computers. The importance of interaction between seismology, geology, well log analysis, reservoir engineering and other disciplines is emphasized and illustrated. At the end of the five (5) days several wells displaying different petrophysical characteristics will have been evaluated in detail using different techniques.

The trainer will provide participants with sound understanding of the various evaluation techniques to enable them to select the appropriate methods for their environment. The main emphasis during the course is on practical application rather than extensive discussion around the theoretical background with exercises using Interactive Petrophysics (IP) software and Excel.

**Petrophysics Training Courses (JANUARY - DECEMBER 2014)**

<table>
<thead>
<tr>
<th>DATE</th>
<th>COURSE TITLE</th>
<th>INSTRUCTOR</th>
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<tbody>
<tr>
<td>17th – 21st Mar</td>
<td>Special Core Analysis</td>
<td>Jos Maas</td>
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<tr>
<td>24th – 27th Mar</td>
<td>Integration of Petrophysics &amp; Core Analysis</td>
<td>Ahmed Taha</td>
</tr>
<tr>
<td>5th – 9th May</td>
<td>Advanced Cased Hole Logging Interpretation &amp; Application</td>
<td>Mourad Wassef</td>
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<tr>
<td>9th – 13th June</td>
<td>Advanced Logging Tool Physics</td>
<td>Richard Bateman</td>
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<tr>
<td>23rd – 27th June</td>
<td>Advanced Well Log Interpretation &amp; Formation Evaluation</td>
<td>Ahmed Taha</td>
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<tr>
<td>11th – 15th Aug</td>
<td>Geomechanics</td>
<td>Richard Bateman</td>
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<tr>
<td>22nd – 25th Sep</td>
<td>NMR Petrophysics Application</td>
<td>Ayham Ash</td>
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<td>6th – 9th Oct</td>
<td>Petrophysics Operations Quality Control</td>
<td>Ahmed Taha</td>
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<tr>
<td>27th – 31st Oct</td>
<td>Petrophysics in Unconventional Reservoirs</td>
<td>Mourad Wassef</td>
</tr>
<tr>
<td>24th – 28th Nov</td>
<td>Advanced Production Logging</td>
<td>Mourad Wassef</td>
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**Petrosync Quality**

Limited Attendees
The course has limited seats to ensure maximum learning and experience for all delegates.

Certificate of Attendance
You will receive a Certificate of Attendance bearing the signatures of the Trainer upon successful completion of the course. This certificate is proof of your continuing professional development.

Interactive Training
You will be attending training designed to share both the latest knowledge and practical experience through interactive sessions. This will provide you with a deeper and more long-term understanding of your current issues.

High Quality Course Materials
Printed course manual will provide you with working materials throughout the course and will be an invaluable source of reference for you and your colleagues afterward.
Advanced Petrophysics
21st - 25th April 2014, Kuala Lumpur, Malaysia

Course Agenda

Day One - 21st April 2014

The morning session is intended as a refresher of the basic analysis principles and tool responses. Two simple exercises (multiple choice) and visual interpretation of a synthetic well log, are used to establish the level of petrophysical knowledge of the participants.

- The role of petrophysics in exploration & production
- Review of petrophysical principles
- Review of physics of main logging tools

In the afternoon participants will practice quick look methods to make an initial visual interpretation of a Central North Sea well followed by the preliminary interpretation of the well using the IP software.

- Quick look evaluation methods and saturation determination
- Introduction to the IP software

Day Two - 22nd April 2014

The IP evaluation of the North Sea well will continue. Thereafter, the core analysis lecture will deal with various analysis methods employed by core laboratories. The core data from the Central North Sea well will be interpreted to determine the compaction correction factor and electrical parameters (m & n). The last lecture will cover wireline formation testing tools and pressure interpretation plus sampling methods. The pressure data from the North Sea well will be interpreted to finalise the fluid distribution in the well.

The morning session will then go on to deal with clay mineralogy, distribution, properties and influence on logging tools.

- Introduction to the IP software (continued)
- Basic and special core analysis methods
- Wireline formation testing
- Clastic reservoir geology and clay types

Day Three - 23rd April 2014

The basis of the effective porosity interpretation methods will be discussed and the Indonesian equation will be applied to the Central North Sea well.

- Shaly sand analysis for total porosity systems using Waxman Smits equation

In the afternoon the experimental background of the Waxman Smits equation will be discussed along with the derivation of the clay corrected electrical parameters (m* & n*). The core data from the Central North Sea well will be re-evaluated to derive the Waxman Smits parameters and the well will be re-evaluated. The derivation of appropriate cut-off criteria will be discussed and the appropriate cut-offs for the Central North Sea well will be determined. This will show that there is very little difference between the total hydrocarbon content derived using the effective or total porosity systems.

- Shaly sand analysis for total porosity systems using Waxman Smits equation
- Cut-off criteria

In the afternoon the application of the Waxman Smits equation in the absence of core data will be discussed along with the Juhasz normalised Qv method and the Dual Water model. The problems and methods that may be applied to help with hydrocarbon differentiation in shaly sands will be described. For an exercise, the participants will be provided with log data from a West African well and use the techniques discussed to determine the hydrocarbon distribution. Thereafter the well will be evaluated using the three total porosity methods. The challenges of laminated sands will be discussed and a Southern North Sea well will be used as an example.

- Dual Water model and Juhasz normalised Qv method
- Hydrocarbon differentiation in shaly sands
- Evaluation of laminated shaly sands

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Day Four - 24th April 2014

The application of capillary pressure in the reservoir during the reservoir charge process will be described and the difference in capillary pressure characteristics and rock types discussed. The conversion of laboratory data to reservoir conditions will be described along with measurement methods including wettability and contact angles. The generation of saturation height functions from capillary pressure curves as well as log data will be described and the data from the Central North Sea well evaluated.

- Capillary pressure
- Saturation height functions
- Capillary pressure and reservoir simulation

The various methods that may be applied to derive permeability from log and core data for use in reservoir models will be discussed. Techniques to convert atmospheric air permeability to in-situ brine permeability will be described and the Central North Sea data set will be utilised for this purpose. The statistical implications of simple crossplot methods will be discussed and the appropriate regression methods applied.

The use of Monte Carlo methods to quantify uncertainty ranges will be described and applied in the Central North Sea well.

- Permeability prediction (including NMR logging) and statistical considerations
- Uncertainty ranges

Day Five - 25th April 2014

The application of probabilistic methods for the evaluation of complex formations will be discussed and two exercises will be made using these methods on wells from the Southern North Sea and Dutch mainland.

- Probabilistic methods for the analysis of complex formations (main emphasis on carbonates)

The logging tools and techniques available for use in cased hole wells will be described along with the principles of production logging. A more extensive discussion will be provided for wellbore seismic applications dealing with the principles of VSP surveys, generation of synthetics, log editing methods and Gassmann substitution. A single well synthetic will be generated using the IP software.

The course closes with a discussion on the methods that may be applied to use petrophysical data in geothermal projects and to recognise potential tight gas reservoirs and shale oil/gas prospects. The derivation of mechanical properties from log data to be used in planning frac jobs will be described.

- Cased hole saturation determination and production logging
- Wellbore seismic applications
- Petrophysical support for geothermal projects, tight gas reservoirs and shale oil/gas projects

Program Schedule

08:00 – 09:00 Registration (Day 1)
09:00 – 11:00 Session I
11:00 – 11:15 Refreshment & Networking Session I
11:15 – 13:00 Session II
13:00 – 14:00 Lunch
14:00 – 15:30 Session III
15:30 – 15:45 Refreshment & Networking Session II
15:45 – 17:00 Session IV
17:00 End of Day

WHY YOU SHOULD ATTEND PETROSYNC’S EVENTS

To ensure that all objectives of the course matches yours, all PetroSync programs are developed after intensive and extensive research within the industry.

- PetroSync programs focus on your immediate working issues to ensure that you are able to apply and deliver immediate results in real work situations.
- Application and implementation of industry knowledge and experience are the drivers for our course design, not theoretical academic lectures.
- PetroSync training focuses on practical interactive learning tools and techniques including case studies, group discussions, scenarios, simulations, practical exercises and knowledge assessments during the course. Invest a small amount of your time to prepare before attending the course to ensure maximum learning.
- PetroSync follows a rigorous selection process to ensure that all expert trainers have first-hand, up-to-date and practical knowledge and are leaders of their respective industrial discipline.
Peter Betts (1952) graduated in Petroleum Engineering from The Royal School of Mines, Imperial College, London in 1975 and joined Shell as a Petroleum Engineer in the same year. Peter had a variety of assignments in Malaysia, Oman, the United Kingdom, Denmark and the Netherlands, working as well-site engineer, petrophysicist and area team leader. In the Netherlands, he headed the petrophysics technology development group, and spent two years as senior petrophysics trainer before moving to the integrated studies group, where he served a joint role as project manager for contract field studies and petrophysics consultant. Peter left Shell in 1999 and joined Logica, a major IT systems integrator, where he worked as an account manager and IT business consultant. In 2003 he returned to his EP roots, working as an independent petrophysical consultant.

He is a highly experienced consultant with an international background and wide knowledge of the oil and gas exploration business. His experience and skills base can be applied to a variety of tasks, ranging from petroleum engineering technical services, with specialist knowledge of petrophysics, to business process analysis and software specification. Petrophysical expertise covers all aspects of shaly sand evaluation, complex carbonates and mixed lithology probabilistic analysis techniques, capillary pressure analysis and cased hole interpretation. He has well-developed technical writing abilities, negotiating, facilitation, training and communication skills. Job experience to date includes business and technical consultancy, account management, operational and studies activities, equity determinations, training, software development and contract field studies project management.

Recent Clients
- Technical University of Delft
- SGS-Horizon
- YPF-Argentina
- Energie Beheer Nederland
- TNO-Nederland

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INVESTMENT PACKAGES

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<tr>
<th>Investment Package</th>
<th>Deadline</th>
<th>Course Fee</th>
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<tbody>
<tr>
<td>Standard Price</td>
<td>18th Apr 2014</td>
<td>SGD $ 5,995</td>
</tr>
<tr>
<td>Early Bird Offer</td>
<td>21st Mar 2014</td>
<td>SGD $ 5,795</td>
</tr>
<tr>
<td>Group Discount (3 or more Delegates)</td>
<td>18th Apr 2014</td>
<td>10% discount for groups of 3 registering from the same organization at the same time</td>
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Group Discount is based on Standard Price

* To enjoy the promotion & discount offer, payment must be made before deadline
* For 7 or more delegates, please inquire for more attractive package.
* Prices include lunches, refreshments and materials. Promotion & discount cannot be combined with other promotional offers.
* Important: Please note that registration without payment will incur a SGD 200 administration fee.

DELEGATES DETAILS

1st Delegate Name__________________________ Mr □ Mrs □ Ms □ Dr □ Others□
Direct Line Number: ________________________ Email: ________________________
Job Title: _____________________________ Department: ________________________
Head of Department: _______________________

2nd Delegate Name__________________________ Mr □ Mrs □ Ms □ Dr □ Others□
Direct Line Number: ________________________ Email: ________________________
Job Title: _____________________________ Department: ________________________
Head of Department: _______________________

3rd Delegate Name__________________________ Mr □ Mrs □ Ms □ Dr □ Others□
Direct Line Number: ________________________ Email: ________________________
Job Title: _____________________________ Department: ________________________
Head of Department: _______________________

INVOICE DETAILS

Attention Invoice to: ___________________________
Direct Line Number: ___________________________ Fax: ___________________________
Company: ___________________________ Industry : ___________________________
Address:________________________________________ Postcode:____________________
Country: ___________________________ Email: ___________________________

Please note:
- Indicate if you have already registered by Phone ☑ Fax ☑ Email ☑ Web ☑
- If you have not received an acknowledgement before the training, please call us to confirm your booking.

PAYMENT METHODS

☐ By Credit Card : ☑ Visa □ MasterCard □ AMEX
Security Code: ___________
Card Number: ____________-__________-__________-__________
Expiry Date: ____________

☐ By Direct Transfer : Please quote invoice number(s) on remittance advice
PetroSync LLP Bank details:
Account Name: PetroSync LLP
Bank Number: 7144 - Branch Code: 013 - Account No: 13-1-005531-6
Name of Correspondent Bank : Standard Chartered Bank, 6 Battery Road, Singapore 049909

SWIFT Code of Correspondent Bank: SCBLSGSGXXX

All bank charges to be borne by payer. Please ensure that PetroSync LLP receives the full invoiced amount.

CHARGES & FEE(s)

- For Payment by Direct Telegraphic Transfer, client has to bear both local and overseas bank charges.
- For credit card payment, there is additional 4% credit card processing fee.

Course Confirmation

I agree to PetroSync’s terms & conditions, payment terms and cancellation policy.

Authorized Signature : ___________________________

PAYMENT TERMS : Payment is due in full at the time of registration. Full payment is mandatory for event attendance.

TERMS AND CONDITIONS

DISCLAIMER

Please note that trainers and topics were confirmed at the time of publishing; however, PetroSync may necessitate substitutions, alterations or cancellations of the trainers or topics. As such, PetroSync reserves the right to change or cancel any part of its published programme due to unforeseen circumstances. Any substitutions or alterations will be updated on our web page as soon as possible.

DATA PROTECTION

The information you provide will be safeguarded by PetroSync that may be used to keep you informed of relevant products and services. As an international group we may transfer your data on a global basis for the purpose indicated above. If you do not want us to share your information with other reputable companies, please tick this box.

CANCELLATION POLICY

You may substitute delegates at any time as long as reasonable advance notice is given to PetroSync. For any cancellation received in writing not less than fourteen (14) working days prior to the training course, you will receive a credit voucher less a SGD $200 administration fee and any related bank or credit card charges.

Delegates who cancel less than fourteen (14) working days of the training course, or who do not attend the course, are liable to pay the full course fee and no refunds will be granted.

In the event that PetroSync cancels or postpones an event for any reason and that the delegate is unable or unwilling to attend in on the rescheduled date, you will receive a credit voucher for another SGD $200 administration fee and any related bank or credit card charges.

PetroSync is not responsible for any loss or damage as a result of the cancellation policy. PetroSync will assume no liability whatsoever in the event this event is cancelled, rescheduled or postponed due to any Act of God, fire, act of government or state, war, civil commotion, insurrection, embargo, industrial action, or any other reason beyond management control.

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