Advanced Quantitative Seismic Interpretation

Learn the modern techniques in Quantitative Interpretation concepts, workflows, and data requirements

3RD – 7TH NOVEMBER 2014 at Kuala Lumpur, Malaysia

Petrosync Distinguished Lecturer:
Drs GERHARD DIEPHUIS
International Geophysical Consultant
Exploration & Production Technical Services (EPTS, Netherlands)

- Geophysical expert and experienced lecturer, specialized in quantitative seismic interpretation for exploration as well as petroleum development
- Over 40 years of work experience in the O&G industry, primarily with Shell International for 20 years (1977-1997), and has consulted for a number of multinational companies including UNOCAL, CONOCO, TAQA Petroleum, BG Group, Saudi Aramo, etc.
- Course module developer for SHELL internal training (1999-2002)
- Has presented in conferences, delivered courses, and published technical reports for various industrial groups including European Association of Geoscientists and Engineers, European Association of Geoscientists and Engineers (EAGE), American Association of Petroleum Geologists (AAPG), and Society of Exploration Geophysicists (SEG)

Masterclass Objectives
- APPLY specific statistical techniques for quantitative interpretation and JUDGE the feasibility of a quantitative interpretation project for a dataset in question
- AVOID the most common pitfalls in quantitative seismic interpretation
- GAIN a better understanding of the seismic interpretation concepts necessary for industry tools application
- UNDERSTAND the requirements for forward models based on geologic scenario’s
- MODEL seismic response of alternative geological scenario’s, and LEARN the main inversion techniques

Specially Designed for
This course is specially designed for geologists, geophysicists and petroleum engineers involved in the processing and interpretation of 2D and 3D seismic data with more than 5 years working experience and interested to learn of more quantitative methods.

- Exploration Geophysicists, Geoscientists and Geologists
- Petroleum Engineers
- Seismic Interpreters
- Exploration Managers

Supported by
In addition to structural and stratigraphic interpretation, quantitative Interpretation of seismic data can add considerable value in the subsurface evaluation process. For exploration prospects, various seismic attributes can be used to differentiate between alternative porefill scenario's and improve the decision making. In field development settings, where more well calibration is normally available, tools like seismic inversion can extrapolate and predict key reservoir properties outside well control and thus improve the reliability of a reservoir model. The QI workflow necessitates consistent integration of the available geological, geophysical, petrophysical data, yielding also team integration and data QC as an important spin-off.

Knowledge of the possibilities and limitations of the various QI techniques and workflows is essential for successful application. Knowing what data is required and how it must be pre-conditioned is important as well. The course uses a mixture of lectures, practical exercises and case histories. Participants can bring own cases for discussion.

COURSE AGENDA

DAY ONE

The program will begin with recapitulation of seismic fundamentals in order to establish a common understanding of geophysical principle on which the course will be built. This will be delivered complete with a number of short exercises. The second-half of the day will be used to introduce Statistics, necessary for QI. Exercises will be on Excel and/or paper.

• Quantitative Seismic Interpretation Fundamentals
• Recapitulation of Seismic Fundamentals
• Statistics for Quantitative Interpretation

DAY TWO

The morning will be used for the log data preparation and the generation of synthetic seismograms. Well to seismic matching will be discussed afterwards. The afternoon is dedicated to Rock Physics, of which, a continuous “red thread” exercise will be given.

• Log Data Preparation
• Generation of synthetics
  o Log editing
  o Treatment of different wavelets/band pass filtering
• Well to Seismic Matching
  o Derivation of seismic wavelet
  o The White approach to matching
  o The deconvolution model
• Rock Physics
  o Elastic moduli and their inter-relations
  o Hashin-Shtrickman-Berryman model
  o Eberhart-Phillips for shaley sandstones
  o The Xu-White method for estimation of Vs
  o The Gassmann fluid replacement algorithm
DAY THREE
Following on to the last subject of the previous day, Direct Hydrocarbon Indicators will be dealt with, followed by an in-depth treatment of seismic inversion methods. A start will be made with capita selecta on Tine to Depth Conversion Techniques.

- Direct Hydrocarbon Indications
- Seismic inversion
  - Pre-stack versus post-stack
  - Sparse spike method
  - Model based inversion
  - Stochastic inversion
- Time Depth Conversion
  - Types of velocity
  - The anisotropy problem/paradox

DAY FOUR
TZ conversion will be completed, followed by an extensive treatment of seismic attributes. The last topic of the day will be on managing and reducing uncertainties -- their sources, magnitudes and effects on reserve calculations.

- Time Depth Conversion – continued
  - Pseudo velocities
  - Guidelines for TZ model generation
  - Matching of well and seismic velocities
- Forward models
- Seismic attributes
  - The Barnes classification
  - Coherency and related attributes
  - Geometrical attributes
  - Pitfalls
- Uncertainties
  - Mathematical derivation
  - Dependencies
  - Reserve Calculations

DAY FIVE
A selection can be made by the audience of a set out of the following topics: Shear wave techniques, the Natih Multicomponent survey, Introduction to AVO, Introduction to Time Lapse techniques, or overview of Passive seismic.

Selection Of:
- Shear Wave Techniques
- The Natih multicomponent survey
- AVO Application
- Time Lapse (4D) seismic
Drs Gerhard Diephuis (1947) studied Geology and Geophysics at the State University of Leiden, The Netherlands. After his military service he joined Shell International in 1977 and was posted soon thereafter to Sabah Shell Petroleum/Sarawak Shell Berhad in Malaysia, where he worked as seismic interpreter in various provinces. In 1982 he was seconded to Woodside Petroleum, in the Petroleum Engineering Department, where he jointly interpreted the Rankin 3D survey, the first in the country. In 1984 he moved to Shell Expro in London, where he first worked as senior geophysicist in the Central North Sea Team and later led the Business Opportunity Team. In 1987 he was posted to Oman where, after an initial stint in the North Oman Team, he became Discipline Head Production Seismology. In that function he was the main instigator of the Natih 3D3C Experimental Survey, an industry first in the field of shear-wave exploration. In 1991 he left for the Nederlandse Aardolie Maatschappij in The Netherlands, where he headed a section that applied novel techniques in Quantitative Interpretation.

Since 1997 Diephuis is independent consultant engaged in a large number of highly varied assignments in combination with educational activities both for industry and university. He undertook major assignments in UAE, Suriname, Morocco, Saudi Arabia, India, Libya, UK, Norway, Nigeria and the Far East, apart from various unitisation activities in the North Sea.

In 2006 Diephuis became senior advisor for IF Technology, a small engineering firm in The Netherlands engaged in the deep geothermal industry. In addition to his consultancy activities, Diephuis is long involved in education at the Technical University Delft and in professional training mostly for Schlumberger. From 1997 to 2004 Diephuis was first Associate Editor and later Editor in Chief of “Geophysical Prospecting”, an ICI listed journal – for these efforts he was awarded honorary life-membership of EAGE.
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