TRAINING TITLE

ROCK PHYSICS - INTEGRATING PETROPHYSICAL, GEOMECHANICS, AND SEISMIC MEASUREMENTS

Training Duration

5 days

Training Venue and Dates

DE052	ROCK PHYSICS - INTEGRATING PETROPHYSICAL, GEOMECHANICS, AND SEISMIC MEASUREMENTS	5	13-17 Jan. 2025	$5,500	Dubai, UAE

In any of the 4 or 5-star hotels. The exact venue will be informed later.

Training Fees

- **$5,500 per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Lunch**

Training Certificate

Define Management Consultants Certificate of course completion will be issued to all attendees.

TRAINING DESCRIPTION

This course is the deep level of the introduction of Rock Physics for support quantitative Seismic interpretation (Intermediate level) focuses on the construction and application of models in seismic amplitude interpretation and through this promotes the understanding of the essential aspects of rock physics that are relevant in interpreting all types of seismic displays (including reflectivity, impedance and AVO data, inversion).

TRAINING OBJECTIVES

By end of course participants will be able to understand

- **Employ simplifications to the Zoeppritz equations and understand why they are useful in describing variation of amplitude with offset and how they are used in seismic modelling and interpretation.**
- **Categorise AVO responses.**
- **Appreciate how various rock property factors (such as lithology and fluid fill) affect the contrasts in acoustic properties that give rise to seismic signatures.**
- **Construct simple single-interface amplitude-versus-angle models and determine first order effects to look for on various seismic displays.**

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- **Employ basic AVO interpretation: 1) knowing that an understanding of phase and polarity is critical to successful interpretation and 2) recognising that changes in fluid may give rise to dim spots, bright spots or phase reversals.**
- **Calculate the vertical resolution of seismic data.**
- **Recognise the importance of calibration of seismic to well data, including the issues involved in upscaling log data to the seismic scale, and appreciate the importance of understanding accuracy in well ties.**
- **Recognise the data sources used for building seismic models and understand the basics behind the application of rock physics models in fluid and lithology substitution.**
- **Apply Gassmann's equation to evaluate the effect of changing fluids on acoustic properties.**
- **Comprehend the basics of seismic inversion and the potential pitfalls.**
- **Understand the basics behind the various approaches to AVO analysis:**

  1)conventional 2 term reflectivity interpretation
  2)elastic inversion
  3)physics-driven trace matching.
  •Construct an AVO projection designed to optimise changes in fluid fill.
  •Appreciate the issues involved in Prospect Risking and understand the need for systematic analysis of both geological and geophysical factors.
  •Appreciate the principles of seismic acquisition and processing needed to achieve 'AVO friendly' seismic data.. The course comprises a mixture of lectures and practical exercises.

Create an order of reflectivity models and understand the basics and advanced behind the buzzwords (AVO, EI etc) but also to ask pertinent questions that relate to the use of seismic data in prospect risking and inversion. Lecture review topics include: advanced rock properties and reflectivity The mechanics of seismic data processing (Geometry, Stacking and Migration) An advanced to key processing issues Seismic bandwidth and the convolutional model Wavelets – phase and polarity Resolution – sections and maps Trying wells to seismic The concept of trace inversion to acoustic impedance Seismic data and the AVO plot The rock physics advanced of AVO. The elements of seismic modelling Rock physics - where to get the numbers for modelling Understanding real rocks – the key to rock physics modelling Applying Rock Physics in Exploration (models and risk) Useful checklists for amplitude interpretation Practical exercises include: Creating models of various AVO scenarios Predicting the expected responses for various types of seismic display Modelling fluid parameters and the effects of fluids and lithology on rock properties Investigating the issues behind the use of log data for seismic models

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WHO SHOULD ATTEND

- **Geophysicists**
- **Reservoir Engineers**
- **Petrophysicists**
- **Geomechanics Engineers**
- **Seismic Engineers**
- **Drilling Engineers**
- **Geologists**
- **Civil and Geotechnical Engineers**
- **Hydrocarbon Exploration Professionals**
- **Geothermal Energy Specialists**
- **Carbon Capture and Storage Experts**

TRAINING METHODOLOGY

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions and motivating everybody to find the right answers. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course.

Very useful Course Materials will be given.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Group Work& Practical Exercises
- 20% Videos& General Discussions

COURSE PROGRAM

DAY ONE

- **Introduction**
- **Fundamentals**
- **Wave propagation**
- **Seismic basics**
- **Rocks are isotropic and elastic**
- **The convolution models**
- **Modelling seismic reflectivity**
- **What is the wavelet?**
- **What do the trough and peak present?**
- **Reflection, refraction and mode conversion**

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- Single interface model - the simplest and most important seismic model:
- Amplitude varing with angle (AVA)
- Other seismic models
- Amplitude varing with offset AVO response description
- Exercises

Day Two

- How can we Qc the tool measurements of Key logs Vp, Vs (Sonic) & Density?
- Why the Sonic log need processing? How the measurement made by the tool? And converted to slowness?
- SLB example of STC semblance processing
- Why the Sonic Scanner SLB is an advantage in the current industry?
- Sonic Scanner & DSI transducers frequencies
- Depth of investigation of different sonic measurements with frequency dependence
- QC Sonic data
- How the measurement made by the Density tool?
- QC density data
- Qc and Preparation of the data for Rock Physics.
- Guidelines for well editing and QC
- The effect of pore geometry and rock fabric
- Elastic Bounds:
- Distinction between cementing and sorting trends
- Missing log predication
- Log prediction and Correction
- Effect of Geology on Rock physics
- Examples of Xplot Editing, QC analysis and RP trends
- Exercise

Day Three

- Fluid Substitution Analysis
- The importance of P & S Sonic for Fluid sub. & AVO Modelling.
- Gassmann Fluid Substitution
- Understanding the theory.
- Theory and Synopsis.
- Basic Fluid Substitution- Gassmann's equation & Work Flow
- Gassmann assumption and pitfalls with Shaly Sand rocks. (LPS London Petrophysical Society paper – Ahmed Abdelkarim)
- 4 well Examples in Details from Varies Basins
- Density correction for mud filtrate invasion
- Why we are doing this density Correction to mud filtrate invasion?
- Theory

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- **Workflow**
- **Practical examples test in WBM consolidated/ unconsolidated**
- **Conclusion Pros and cons**
- **Conclusion of Day 3**
- **Exercise**

Day Four

- **Conceptual workflow for forward modelling and inversion**
- **QI calibration processes for rock physics and seismic modelling**
- **Petrophysical input To QI modelling processes**
- **Well Tie Process**
- **Synthetic generation**
- **What do the trough and peak present?**
- **How to obtain the wavelet**
- **Well Tie approaches using synthetics**
- **How long is the wavelet optimum length?**
- **5 examples of synthetic to well Tie**
- **Key Conclusion and Observation**
- **Exercise of QAQC the time/depth data with velocity interval**
- **Case History: what-if scenarios answered using wedge models and fluid substitution.**

Day Five

- **Conceptual Workflow for forward Modelling and inversion**
- **Comparison between Forward Modelling and Inversion**
- **Seismic Inversion Benefits**
- **Seismic Inversion Examples around the world**
- **Seismic Inversion in the Frequency Domain**
- **Low frequency model to get absolute impedances**
- **Increase resolution by adding using Stochastic Inversion**
- **Types of Seismic Inversion**
- **Relative Impedance**
- **Coloured Inversion**
- **Deterministic Inversion**
- **Stochastic Inversion**
- **Pre-Inversion Checklist**
- **Typical Inversion Provider**
- **Typical Stage in Funnel**
- **Pre-Stack/Post-Stack Inversion Decision Tree**
- **Relative/Deterministic/Stochastic Inversion Decision Tree**
- **Seismic Inversion: Summary**

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NOTE:

Pre-& Post Tests will be conducted.

Case Studies, Group Exercises, Group Discussions, Last Day reviews, and assessments will be carried out.

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