



## Practical well log analysis

### WORKSHOP OVERVIEW

To obtain reservoir parameters for a hydrocarbon field, sufficient data is required to reach reliable figures for reservoir modelling, reserve estimation and reservoir simulation. Petrophysics which is the process of interpreting a combination of log data and integrate them with laboratory measurements is able to provide data needed for both economic analysis and production planning.

This course covers the log analysis for interpreting open-hole and LWD logs and it presents:

- log analysis principles, petrophysical calculations, and interpretation techniques which can be applied to routine wireline and LWD logs.
- practical methods in estimating porosity, permeability, lithology/rock type, shale volume, rock strength, Poisson's Ratio, and water saturation.
- how to integrate core data, and mud log data into log analysis.
- standard log quality control and normalization.
- several practical exercises from real life field data.

### Why You Should Attend

After drilling a borehole there are several critical questions that have to be answered:

- How is the quality of the reservoir rock?
- How much is the effective porosity?
- How is the permeability of the potential reservoir?
- How much is the hydrocarbon saturation?
- Is hydrocarbon producible?
- How much, if any, water will be produced with hydrocarbon?
- How thick is the pay zone?
- How data/experience from a drilled borehole could be used in another borehole?
- How are the rock mechanical properties of the reservoir rock?
- How to predict rock permeability for un-cored intervals?

This course answers most of the above questions by integrating well log data and core data for different conditions.

At the end of the course, each participant should be able to:

- Confidently assemble and assess the quality of a log suite for interpretation
- Identify the effects of gas, oil, salinity on the log suite measurements
- To calculate reservoir rock properties using petrophysical equations
- To use log data to calculate rock mechanical properties
- Confidently use core analysis data and integrate them with log data
- Use log data to accurately and efficiently estimate rock permeability
- Become familiar with artificial neural network and multi-regression analysis methods



## Course Agenda

### Day 1

#### Introduction to well logging and log interpretation

- Subsurface environment and reservoir rock and fluid properties
- Borehole environment, and logging procedure
- Log data QC, editing and caliper logs
- Spontaneous potential (SP) logs, principles and applications
- Gamma ray and spectral gamma ray,
- Principles of sonic logging and applications
- Work on a case study

### Day 2

#### Well log interpretation methods

- Density logging and litho-density, principles and applications
- Neutron logging, principles and quantitative interpretation
- Applications of combined density and neutron logging data
- Resistivity logging and measurement principles
- Electrical properties of reservoir rocks and Archie's relationships
- Practical work on a set of real data

### Day 3

#### Log interpretation procedure in clean formations and Advanced Log Interpretation

- Log interpretation in shaly formations
- Nuclear magnetic resonance (NMR) logging
- Dipmeter and Image logs and their interpretation
- Rock mechanical properties from log data
- Application of intelligent systems in well log analysis
- Work on a case study

### Day 4

#### Conventional and Special Core Analysis

- Coring techniques
- Basic rock properties measured from cores and measurement principles
- Porosity and Permeability measurements
- Fluid Saturations
- Special core analysis
- Permeability, Capillary pressure, wettability: concepts and measurements

### Day 5

#### Methods for permeability prediction

- Porosity and facies/electrofacies approach applying cluster analysis for permeability estimation
- Permeability from Nuclear magnetic resonance (NMR)
- Application of Mercury Injection Capillary pressure data for permeability estimation
- Application of log data and Artificial Neural Network (ANN) to predict permeability
- Multi-regression analysis to estimate permeability from log data
- Practical work on a set of real data using an ANN software



## **Workflow**

Using a set of real world data (wireline, RCA and SCAL) the following parameters will be estimated in the class using spread sheet software:

- Quick look Log Interpretation
- Quality Control
- Identifying the Reservoir
- Identifying the fluid type and contacts
- Calculating Porosity / effective porosity
- Calculating Hydrocarbon Saturation
- Pressure / Fluid Sampling
- Net Sand Definition
- Presenting the Results plus some volumetric estimation
- Routine and special core analysis are methods and how the results of core analysis data can be fully interpreted
- Permeability Determination

## **Who Should Attend**

This workshop is specially designed for professionals involved in exploration and development. These include:

- Geoscientist
- Geophysicist
- Petrophysicist
- Petroleum engineers
- Exploration engineers/ managers