



# Applications of Well Log Analysis in Petrophysical Characterization

## Course Description

This course provides the basic concepts and main applications of conventional open hole logs. The course is designed in such a way that participants can apply the knowledge gained from practical exercises to estimate petrophysical properties and parameters from resistivity, porosity, gamma ray, and SP logs.

Among the most relevant topics to be developed in class are the concepts related to the logging environment, the fluid invasion process, log quality control, evaluation of clean formations (Archie equation, quick look interpretation methods) and evaluation of clay formations. Each concept is illustrated and evaluated by practical exercises. A brief introduction to the interpretation of special and unconventional logs such as cased hole logs (cement, TDT – carbon oxygen, CCL and GR-Neutron) is made, dip and image logs, and nuclear magnetic resonance logs.

The course will be supplemented by practical class project example problems, group exercises and interactive group discussion designed to consolidate and reinforce learning, and identify and offer solutions to specific problems associated with applications of well log analysis in petrophysical characterization.

## Who Should Attend?

This course is designed for professionals of the petroleum industry in the areas of production geology, operations geology, reservoir engineering, petrophysics, log analysis, sedimentology, drilling engineering, and geophysics applied to development of oil and gas fields.



## What You Will Gain:

- Understanding the fundamental concepts and main applications of well log analysis in petrophysical characterization.
- Learning how to calculate petrophysical properties such as porosity, permeability, water saturation, shale content, and others
- Learning the workflow to determine the petrophysical parameters to be use to perform petrophysical calculations
- Recognizing the importance of electrical properties of each type of formations/materials
- Understanding the basic principles and concepts to interpret special and unconventional logs such as cased hole logs, dip and image logs and nuclear magnetic resonance logs
- Applying quick-look methods for formation evaluation
- Understanding the importance of log quality control in log analysis and interpretation

## Training Methodology

The training course will combine lectures (30%) with workshop/work presentations (30%), interactive practical exercises and case studies (20%), supported by video material, software and general discussions (20%)

## Course Content

### Introduction to Petrophysics

- Definition of petrophysics
- Logging objectives
- Basic petrophysical concepts
- Resistivity, Formation resistivity factor, porosity, water saturation, logging environment
- Invasion process and invasion profile
- $R_w$  calculation

### Basic of logging and Log quality control

- Log quality control guidelines
- Environmental corrections and normalization

### Logs

- Gamma Ray log, GR Spectroscopy
- The Spontaneous Potential (SP)
- Caliper
- Acoustic Log
- Resistivity logs: Induction, Laterolog, Focused Microspherical log, Microlog



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- Porosity logs: Density, Neutron, Sonic, NMR

### **Mineralogy identification**

- Porosity log crossplots and mineralogy identification

### **Evaluation of clean formations**

- Thee Archie Equation
- Quick look Interpretation Methods, effect of clays

### **Evaluation of Clay Formations**

- Conductivity of shales
- Practical exercise of Sw evaluation using the Waxman-Smiths equation.

### **Basic principles and concepts for the interpretation of special and unconventional logs**

- Cased hole logs (cement, TDT – carbon oxygen, CCL and GR-Neutron), dip and image logs and nuclear magnetic resonance logs.