

N083: Petrophysics and Formation Evaluation: Principles and Practice

Instructor(s): Mike Lovell / David Eickhoff

Format and Duration

Classroom - 3 Days

Virtual - 6 Sessions

Summary

Business Impact: Participants attending this course will acquire **key petrophysical ideas** that underpin petrophysical analysis and how **integrated analysis** of downhole logs, core data and downhole pressure measurements can **enable quantitative estimates of hydrocarbons in place**. It also provides an **essential foundation** as a precursor to the more advanced petrophysics courses.

This course examines the fundamental concepts, vocabulary, and techniques used in petrophysics. The course starts with a review of the controls on hydrocarbon accumulation and distribution in a conventional reservoir, before exploring how petrophysical properties can be determined from core and downhole logs.

Learning Outcomes

Participants will learn to:

1. Understand how the critical properties of wettability and capillary pressure control the process by which hydrocarbons accumulate in a hydrocarbon reservoir.
2. Define porosity; water saturation; gross, net and pay; and permeability.
3. Explore how petrophysical properties can be estimated from core and from downhole logs and appreciate the limitations involved.
4. Establish lithology and calculate porosity from open hole wireline log and core data.
5. Calculate water saturation from open hole wireline logs.
6. Understand the basic principles of (a) fluid sampling and borehole pressure measurements and (b) gross net and pay.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussions, case studies, and practical exercises.

Who Should Attend

Newly graduated scientists and petrophysicists are the main target audience, together with geologists, geophysicists and engineers who communicate with petrophysicists in regional evaluations, prospect generation and development studies. This is an excellent technical entry point for petrophysics evaluation and an ideal prerequisite to N054 (Skilled Petrophysical Methods for Conventional Reservoirs)

Prerequisites and Linking Courses

There are no formal prerequisites for this class. The class makes an excellent entry point for both early career petrophysicists, as well as more experienced geoscientists and engineers.

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For more information on well logs and their application, participants could attend N003 (Geological Interpretation of Well Logs). Follow up classes at Skilled Application Level include N054 (Skilled Petrophysical Methods for Conventional Reservoirs), N187 (Low Resistivity, Low Contrast Pay), and N073 (Integration of Sedimentology, Petrophysics and Seismic Interpretation for Exploration and Production of Carbonate Systems). All of these classes do assume a working knowledge of Petrophysics, which this class can provide.

Course Content

This petrophysics course focuses on the petrophysical analysis of hydrocarbon reservoirs to demonstrate how the main petrophysical attributes of porosity and saturation can be estimated in the laboratory from core, and downhole in the reservoir from openhole logs.

Particular emphasis is given to explaining the important principles underpinning the different measurements and the limitations of petrophysical data. Short webinar lectures are typically associated with short discussions, exercises or demonstrations designed to explore the topic, apply knowledge and develop skills.

Another key emphasis of the course is on evaluating the hydrocarbons in place (porosity and saturation) in conventional clean reservoirs. Crucially, the course considers the important effects of wettability and capillary pressure on the fluid distribution in the reservoir. Permeability and the concepts of gross, net and pay are also introduced and discussed.

Topic 1

- Introduction to Petrophysics
- The hydrocarbons in place equation
- Petrophysical properties: porosity, water saturation and permeability

Topic 2

- Fluid distribution
- Wettability and capillary pressure
- Interpretation exercise/demonstration – capillary pressure curves

Topic 3

- Core analysis: porosity, water saturation and permeability
- Interpretation exercise/demonstration - porosity and permeability; drying effects

Topic 4

- Openhole logs for lithology and porosity
- Gamma ray, SP, Density, Photoelectric, Neutron, Sonic and NMR logs

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- Interpretation exercise/demonstration – lithology and porosity from logs

Topic 5

- Openhole logs for water saturation
- Resistivity logs and Archie's equation
- Special Core Analysis for Archie's parameters
- Interpretation exercise/demonstration – porosity and water saturation from logs

Topic 6

- Pressure gradients for fluid identification
- Defining gross, net and pay
- Integrating petrophysical data
- Integrated interpretation exercise/demonstration