
N748: Geological Well Log Interpretation

Instructor(s): Angel Meso

Format and Duration

Classroom - 5 Days

Virtual - 10 Sessions

Summary

This foundation-level course introduces the principles and applications of conventional well logs for less experienced geoscientists, new-hire petrophysicists, technologists, and engineers. Participants will learn how to use combinations of well logs to interpret mineralogy, lithology, facies, depositional environments, and key sequence stratigraphic markers such as flooding surfaces. The course progresses from understanding individual log measurements to analyzing combinations and trends with depth. A culminating exercise involves creating a robust correlation scheme using data from three wells to guide well placement and support geological modeling.

Business Impact: Participants will gain foundational skills in using well logs for geological interpretation, empowering them to establish robust correlation schemes that enhance reservoir characterization, guide well placement decisions to optimize drilling success, and derive reliable property inputs for geological modeling. These capabilities contribute to reducing uncertainty, improving success rates, and lowering costs throughout the life cycle of subsurface projects.

Learning Outcomes

Participants will learn to:

1. Explain the basic principles of conventional well logging tools.
2. Identify key log measurements and their geological significance.
3. Interpret mineralogy, lithology, facies, and depositional environments using combinations of well logs.
4. Recognize sequence stratigraphic markers, such as flooding surfaces.
5. Develop a correlation scheme using well log data to support geological modeling.
6. Apply log interpretations to guide well placement and reduce subsurface project risks.

Training Method

This course employs a range of proven adult learning techniques to ensure maximum understanding, comprehension, and retention of the material. Sessions include visual, auditory, and kinesthetic elements to address different learning styles. The daily sessions are highly interactive and participatory, featuring regular discussions on applications and practical exercises solved manually and/or using Microsoft Excel.

The course can also be delivered in Spanish upon request as a standalone in-house training to better accommodate Spanish-speaking participants.

Who Should Attend

This course is designed for early-career geoscientists, new-hire petrophysicists, technologists, and engineers seeking a foundational understanding of conventional well log interpretation.



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Course Content

1. Introduction to Well Logging and Basic Concepts

- **Overview of Well Logging:** Purpose and objectives of formation evaluation; acquisition methods (wireline and LWD); anatomy of a well log.
- **Basic Geological Concepts:** Porosity, permeability, and fluid distribution (water, oil, gas) in porous rocks.
- **Log Measurements:** Introduction to gamma ray (GR), spontaneous potential (SP), resistivity, density, neutron, and sonic logs.
- **Exercises:** Reading and identifying basic features of a well log (e.g., depth, scale, and log curves).

2. Key Well Log Types and Their Geological Applications

- **Gamma Ray and Spontaneous Potential Logs:**
 - GR: Principles, shale identification, and environmental corrections.
 - SP: Principles, applications for lithology, and water salinity estimation.
 - Quality control basics for GR and SP logs.
- **Resistivity Logs:**
 - Fundamentals of resistivity measurements; differences between induction and laterolog tools.
 - Using resistivity to identify fluid types (water vs. hydrocarbons).
 - Introduction to invasion effects and basic environmental corrections.
- **Exercises:** Interpreting GR and SP logs to identify shales and estimate lithology.

3. Porosity and Lithology Logs

- **Nuclear Porosity Logs:**
 - Density and neutron logs: Basic principles and calibration.
 - Using density and neutron logs to estimate porosity.
 - Environmental effects and quality control.
- **Sonic Logs:**
 - Basics of sonic measurements and their use in porosity estimation.
 - Introduction to wave propagation and borehole effects.
- **Lithology Identification:**
 - Combining GR, density, neutron, and sonic logs to interpret lithology (sandstone, shale, limestone).
 - Introduction to crossplots (e.g., neutron-density) for lithology determination.
- **Exercises:** Calculating porosity and identifying lithology using density and neutron logs.

4. Geological Interpretation and Facies Analysis

- **Facies and Depositional Environments:**

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- Using log shapes and trends to infer facies (e.g., fining-upward, coarsening-upward sequences).
- Recognizing depositional environments (e.g., fluvial, deltaic, marine).
- **Sequence Stratigraphic Markers:**
 - Identifying flooding surfaces and other key markers using GR and resistivity logs.
 - Understanding log trends with depth to support sequence stratigraphy.
- **Petrophysical Basics:**
 - Introduction to Archie's equation for water saturation.
 - Qualitative interpretation of fluid saturation and hydrocarbons.
- **Exercises:** Interpreting facies and depositional environments from log patterns.

5. Well Correlation and Practical Application

- **Well Correlation Principles:**
 - Techniques for correlating logs across multiple wells.
 - Using log trends and markers to establish robust correlation schemes.
- **Practical Exercise:**
 - Correlation exercise using data from three wells to create a correlation scheme.
 - Interpreting lithology, facies, and sequence stratigraphic markers.
 - Deriving property inputs for geological modeling (e.g., porosity, lithology distribution).
- **Applications to Subsurface Projects:**
 - Guiding well placement using log interpretations.
 - Reducing risk and uncertainty in geological modeling.
- **Wrap-Up:** Review of key concepts, Q&A, and discussion of real-world applications.