TETRA TECH RPS ENERGY | TRAINING

N064: Uncertainty in Petrophysics: Shaly-Sands, Carbonates, and other Problem Areas

Format and Duration
Classroom - 5 Days

Instructor(s): Martin Kennedy

Summary

This course looks at the fundamental reasons for errors and uncertainty and the tools and techniques used to handle them. The concepts are illustrated with examples from a range of different reservoirs that are known to cause problems. These include tight gas sands, carbonates,shaly sands, thin bed pay, and fractured reservoirs.

Business Impact: For some plays, petrophysics can contribute a lot of uncertainty and even lead to gross errors. Attendance on this course will allow participants to better understand and quantify this uncertainty and more acurately calculate the range of petrophysical properties and hydrocarbons in place.

Learning Outcomes

Participants will learn to:

1. Estimate the various sources of error and uncertainty in petrophysical data.
2. Understand the reasons why conventional log analysis can fail to produce satisfactory answers in carbonates. Appreciate that petrophysical properties may be subject to much higher uncertainty in carbonates.
3. Quantify and account for the effects of clay and/or shale in log analysis, particularly when computing saturation. Use special core analysis data to quantify excess conductivity.
4. Appreciate tools and techniques that can be used to evaluate thin bedded reservoirs.

Training Method

This is a classroom course comprising lectures, discussions case studies, and practical exercises. Problems are designed to be tackled with calculators, charts, and graph paper and/or Excel.

Who Should Attend

Geoscientists and engineers working with such problem reservoirs and petrophysicists seeking to extend their log analysis skills beyond well-behaved pore systems. Participants are expected to have experience or petrophysics and formatio evaluation.

Course Content

1. Introduction and administration

- Revision of the petrophysical workflow and inherent assumptions
- Sources and handling of errors and uncertainty in petrophysics

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- Tools and techniques (Image logs, NMR, geochemical logs, petrography)
- Case Study: tight gas sands.

2. Case study on carbonates

- Pore systems in carbonates
- Heterogeneity
- Porosity estimation
- Saturation estimation
- Permeability prediction

3. Classical shaly sand reservoirs

- Total and effective porosity (Vshale estimation)
- Excess conductivity
- Waxman-Smits/cation exchange capacity
- Permeability prediction

4. Thin bed pay

- Recognition and characterisation
- Total and effective porosity
- Sand-shale ratio estimation (Vshale)
- Thomas-Steiber methodology
- Resistivity and saturation estimation
- Resistivity modelling

5. Fractured reservoirs

- Diagnostics
- Characterisation
- Tool response to fractures

6. Course wrap-up

- Designing logging suites
- Electrical vs. hydraulic conductivity
- Real vs. artifact fractures in the borehole wall
- Integrating petrophysical, drilling, and dynamic data
- Closing comments