

PETROLEUM SYSTEMS & EXPLORATION & DEVELOPMENT GEOCHEMISTRY

EXP012

COURSE DESCRIPTION

This course focuses on the dynamic petroleum system concept, exploration geochemistry of conventional and unconventional petroleum, and reservoir geochemistry. It provides interpretive guidelines for sample collection and project initiation, how to evaluate prospective source rocks, and how to define petroleum systems through oil-oil and oil-source rock correlation. Case studies and exercises illustrate how geochemistry can be used to solve exploration, production, and development problems while minimizing cost. The course contents improve basic understanding of the processes that control petroleum quality in reservoir rocks and the bulk, molecular, and isotopic tools that facilitate that understanding. The contents cover TOC, Rock-Eval pyrolysis, vitrinite reflectance, thermal alteration index, kerogen elemental analysis, geochemical logs and maps, reconstructed generative potential calculations, water analysis, gas chromatography and gas chromatography-mass spectrometry of oil and gas, compound-specific isotope analyses (CSIA) of light hydrocarbons, biomarkers, and diamondoids, and chemometrics to classify oil families, identify compartments, and de-convolute mixed oils.

COURSE GOAL

To enhance the participants' knowledge, skills, and abilities necessary to understand the dynamic petroleum system concept, exploration geochemistry of conventional and unconventional petroleum, and reservoir geochemistry.

COURSE OBJECTIVES

By the end of this training course, participants will learn to:

- Use geochemistry to reduce the risk associated with petroleum exploration
- Predict oil quality from inexpensive wellbore measurements
- Identify reservoir compartments and de-convolute commingled petroleum,
- Assess completion problems.

WHO SHOULD ATTEND

Exploration, Production, and Development Geologists

COURSE DURATION

5 Working Days

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COURSE OUTLINES

1. The Dynamic Petroleum System Concept

- Objectives, Terms, Nomenclature
- Petroleum System Folio Sheet:
 - Map and Cross Section at Critical Moment
 - Table of Accumulations
 - Event Chart
 - Burial History Chart
- Timing of Petroleum System Events and Processes
- Introduction to Basin and Petroleum System Models
- Origin and Preservation of Sedimentary Organic Matter
- Project Initiation and Sample Collection, Exercises

2. Evaluating Source Rocks

- Vitrinite Reflectance:
 - Thermal Maturity
 - Calibration
 - Kinetics
- TOC, Rock-Eval Pyrolysis, Geochemical Logs
- Fractional Conversion, Original TOC, Expelled Petroleum, Expulsion Efficiency
- Interpretive Pitfalls; Exercises

3. Exploration Geochemistry

- Gas Chromatography, Stable Isotopes, Surface Geochemical Exploration
- Semi-variograms and Spatial Significance of Data
- Biomarker Separation and Analysis
- Source- and Age-Related Parameters, Introduction to Oil-Oil and Oil-Source Rock Correlation
- Interpretive Pitfalls; Exercises

4. Preservation and Destruction of Accumulations

- Thermal Maturity Parameters; Cracking, Thermochemical Sulfate Reduction
- Biodegradation Parameters
- Ancillary Geochemical Tools; Semi-Volatile Aromatics, Light Hydrocarbons, Mud Gas Isotope Logging, Fluid Inclusion Volatiles, Diamondoids
- Chemometrics for Correlation, Mixture Analysis

- Interpretive Pitfalls; Exercises
- Exploration Geochemistry Case Studies

5. Reservoir Geochemistry

- Objectives, Terms, Nomenclature
- Migration and Compartments
- Migration Mechanisms: Diffusion, Solution, Gas-Phase, Oil-Phase
- Sample Collection/Water Chemistry
- Gravity Segregation, Biodegradation/Water Washing
- Phase Changes:
 - Deasphalting
 - Wax Crystallization
 - Retrograde Condensation
 - Evaporative Fractionation
- Thermal Maturation, TSR, Reactive Polar Precipitation
- Interpretive Pitfalls; Exercises

6. Gas and Oil Fingerprinting, Production Allocation

- Gas Chromatography, Stable Isotopes
- Oil Fingerprinting: Reservoir Compartments
- Leaky Casing, Production Allocation
- Interpretive Pitfalls; Exercises
- Hydrocarbon and Non-Hydrocarbon Gases
- Gas Shale and Other Unconventionals
- Reservoir Geochemistry Case Studies

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