



N366: Shale Reservoir Workshop: Analyzing Organic-Rich Mudrocks from Basin to Nano- Scale

Instructor(s): Ursula Hammes

5 Days

Competence Level:
Skilled



Classroom Course

Summary

This workshop focuses on rock-based interpretation of mudrocks from basin to nano-scale. Participants will learn how to use core, cuttings, geochemical, and petrophysical data to characterize mudrocks and apply mudrock depositional, sedimentological, sequence stratigraphic, geochemical and petrophysical principles to exploration areas and production assets in shale basins. Subsurface data from a variety of oil and gas shale plays will be examined.

Learning Outcomes

Participants will learn to:

1. Appraise the variety of shale systems from basin to nano scale.
2. Characterize mudrock facies and identify facies and sequences in cores and be able to tie those to well-log character.
3. Assess and interpret geochemical data critical to understanding mudrock systems.
4. Judge controls on source rock deposition, reservoir heterogeneities, and determine frackable intervals.
5. Recognize and quantify the rock properties that will have an impact on completion success.

Duration and Training Method

A five-day core workshop in Austin, Texas, comprising classroom sessions, core viewing and core descriptions exercises.

Who Should Attend

Geoscientists, reservoir engineers, and managers who desire to develop a better understanding of the geological, mechanical, and chemical character of mudrock systems and how mudrock attributes vary in the context of shale gas/oil reservoir exploitation.

Prerequisites and Linking Courses

Participants are expected to have a basic awareness of shale reservoirs, as presented in Basic Application level course N313 (Evaluating Resource Plays).

Course Content

The class will utilize lectures, core examination and exercises, to address the reservoir characterization, sedimentology, facies, sequence stratigraphy, petrophysics, fractures, and geochemistry of shale-gas/oil bearing mudrocks.

Day 1: Course Overview, AM

- Approaches to understanding the geology of shale-gas/oil plays



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- Overview of organic-rich mudrock systems
 - Carbonate-dominated systems
 - Clastic-dominated systems
 - Mud-dominated systems
- Factors determining organic-rich deposits
 - Paleogeography
 - Ocean chemistry
 - Climate
- Modern examples (Cariaco Basin)

Day 1- Course Overview, PM

- Techniques for characterization of mudrocks (overview)
 - Sedimentology
 - Sequence Stratigraphy
 - Geochemistry
 - Petrophysics
 - Seismic and Geomechanics
 - Fractures
- Examples from different North American resource plays
 - Inter- and intrabasinal variations – examples from different shale basins (Haynesville, Barnett, Eagle Ford, Bakken, Wolfcamp)

Day 2: Course Overview, AM

- Interpretation of depositional environments in shale basins
 - Facies interpretations
 - Calcareous shales (Haynesville, Eagle Ford examples)
 - Siliceous shales (Barnett, Wolfcamp examples)
 - Clay-rich shales (Tuscaloosa Marine Shale; Tertiary Shale)
- Mudrock sedimentology
 - Sedimentary structures and depositional processes
 - Exercise
- Introduction to cores (at BEG core Facility, Austin)
 - Core interpretation guidelines
 - Core viewing: Introduction to cores at the BEG-CRC
 - Eagle Ford, Haynesville, Bossier, Bakken, Barnett, and Wolfcamp

Day 2- Course Overview, PM

- Stratigraphic framework
 - Regional correlations and variations
 - Sequence stratigraphy (shelf to basin correlations)
 - Hands-on exercise for shelf to basin correlations
- Core descriptions and examination



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Day 3: Course Overview, AM

- Geochemical Tools and Geochemistry Review
 - Overview of definitions in source rock evaluation
 - Lithology
 - XRD
 - XRF
 - Organic-matter type and richness
 - Kerogen / TOC
 - Maturity
 - Rock-eval
 - Interpretation of Geochemical results – incorporating data
 - Exercise (Van Krevelen plot, chemostratigraphy)

Day 3- Course Overview, PM

- Mudrock Diagenesis
 - Type of cements
 - Timing of paragenesis
 - Influence of diagenesis on production
- Core exercise: Relating geochemistry to facies and mineralogy

Day 4: Course Overview, AM

- Reservoir characterization and reservoir quality of mudrocks
 - Porosity
 - Porosity from wire line logs
 - Porosity from core measurements
 - Porosity from SEM pictures
 - Permeability
 - Permeability measurements and pitfalls
 - Wireline log interpretation and petrophysics
- Methods for calculating TOC from wireline logs
 - δLogR and Multimin methods
 - Lithology, porosity and permeability modeling from wireline logs
 - Exercise identifying TOC-rich zones on logs

Day 4- Course Overview, PM

- Seismic tools and Fractures
 - Faults, fractures, TOC, acoustic impedance, Q-factor, attribute maps, pore pressure, effective stress
 - Geocellular modeling
 - Fractures in mudrocks
 - Types of fractures



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- Control of fractures on fracs
 - Microseismic monitoring
- Core viewing and descriptions

Day 5: Course Overview, AM

- Course Summary
 - Integration: evaluating and finding best shale reservoirs using learned skills
 - Course summary and take-home lessons

Day 5: Course Overview, PM

- Optional Field trip to Eagle Ford and Austin Chalk Outcrops
 - Walnut Creek, North Austin