
N285: Clastic Diagenesis and Reservoir Quality Modeling

Format and Duration

Instructor(s): Rick Tobin

Classroom - 3 Days

Summary

This course describes the basics of sandstone diagenesis, facies analysis and the application of this technology to assess the risk of reservoir quality preservation in the subsurface. Much emphasis is placed on the design and techniques of quantitative pre-drill prediction modeling. Participants will develop the knowledge and confidence to effectively integrate reservoir quality models into ongoing exploration projects.

Learning Outcomes

Participants will learn to:

1. Analyse the effects of sandstone rock properties (composition, texture, pore system and facies) on petrophysical attributes.
2. Determine potential formation damage mechanisms from petrographic examination.
3. Analyse all relevant data required for constructing a diagenetic model, including petrographic data, core analysis data, log data and basin modeling data.
4. Employ fit-for-purpose sampling strategies to acquire rock/core-based data.
5. Monitor the quality of acquired rock data.
6. Interpret how sandstone provenance and diagenesis control reservoir quality preservation and destruction during burial.
7. Establish an appropriate modeling strategy for building predictive simulations of reservoir quality.
8. Understand the basics of how reservoir quality models can be combined with basin analysis and static reservoir models to create 2D and 3D visualizations of reservoir quality.
9. Determine the limitations and uncertainties inherent in diagenetic models.

Training Method

A classroom course comprised of lectures, practical exercises and case studies.

Who Should Attend

This course is designed for exploration geologists, geophysicists and petrophysicists with some prior geological background. This course will be especially useful for technical professionals who collaborate with reservoir quality modeling specialists.

Course Content

For the past decade, the oil and gas industry has relied greatly on the use of diagenetic modeling simulators to predict reservoir quality in a variety of sandstone reservoirs worldwide. This class will introduce participants to the study of sandstone diagenesis and predictive modeling techniques, and will provide the fundamental skills needed to (1) successfully collaborate with reservoir quality modelers, (2) integrate modeling results into ongoing exploration projects and/or (3) launch a career as a reservoir

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Topics covered in the class are:

1. Sandstone Facies and Reservoir Rock Properties

- Seismic/log scale - sandstone grouping by depositional element, depositional facies, lithotype and petrofacies
- Pore scale - basics of sandstone composition, texture, pore system and petrographic evaluation
- Effects of composition, texture and pore system on reservoir quality
- Effects of mineralogy and pore system on log interpretation
- Integration of sandstone rock properties and petrophysics
- Identification of potential formation damage mechanisms

2. Related Analytical Techniques and Applications

- Petrographic techniques - ambient vs. stressed sample preparation, basic petrology, point counting methods, grain size analysis, LPSA, XRD/XRF, SEM, CL and SEMCL, stable isotopes
- Rock properties techniques - routine core analysis, SCAL, acoustic and mechanical rock properties
- Burial history techniques - AFTA Apatite fission track analysis, Fluid Inclusion Stratigraphy, Fluid Inclusion Microthermometry

3. Rock Data and Quality Assurance

- Strategies for acquiring rock samples - coring, core sampling, SWC, cuttings and statistical validity check
- Quality control issues during the coring process
- QC issues related to laboratory handling and analysis
- Human (vendor/consultant) interpretation QC issues
- Using multiple techniques to validate data accuracy

4. Sandstone Provenance and Diagenesis

- Sandstone provenance and usefulness in designing models
- Sandstone diagenesis – interpretation, processes, geologic controls and effects on reservoir quality
- Diagenetic compartmentalization

5. Sandstone Reservoir Quality Controls and Diagenetic Modeling

- Diagenetic controls on porosity destruction during diagenesis
- Development of RQ (reservoir quality) prediction methods (a historical perspective)
- Current RQ modeling techniques, including Touchstone and TMAP
- Examples of modeling projects



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6. Integration of Sandstone Reservoir Modeling Techniques

- Burial history simulations of source rocks and reservoir rocks
- Touchstone simulations of compaction, diagenesis and RQ
- RQ mapping using Touchstone/static model-derived CRS maps and TMAP
- Integration of basin models and Touchstone models for building improved static and dynamic models