TETRA TECH RPS ENERGY | TRAINING

N676: Carbonate Reservoir Quality for Hydrocarbon and CCS applications

Instructor(s): Arve Lonoy and Conxita Taberner

Format and Duration

Classroom - 3 Days
Virtual - 5 Sessions

Summary

Reservoir Quality characterization and property distribution is key for Oil and Gas, and for Carbon Capture and Sequestration (CCS) projects. The intrinsic Multiscale Heterogeneity of carbonates adds complexity for the correct assessment of the most appropriate and fit for purpose reservoir property distribution in reservoir models. Moreover, capturing the right level of heterogeneity and connectivity of reservoir rocks changes through the Oil and Gas project life cycle (e.g. depletion vs. water or gas flooding), which requirements are in turn different to CCS projects.

This course reviews case examples and end-member scenarios of carbonate reservoir heterogeneity, while discussing how to depict the multiscale heterogeneity patterns in cores and logs, to assess/apply process-based rules and to enable flow unit correlations. The role of multiscale heterogeneity and its relevance for injection projects and potential impact on early breakthrough (including CCS projects) is discussed. Carbonate reservoir rock typing supports the distribution of rock properties in static models, and upscaling into dynamic models. In this course, several rock typing methods applied to carbonates are reviewed and assessed on end-member carbonate reservoir scenarios.

Learning Outcomes

Participants will learn to:

1. Analyze the main depositional and diagenetic processes that control multiscale heterogeneity in carbonates.
2. Assess pore structure heterogeneity and its impact on fluid flow, using novel digital tools for characterizing pore systems and rock properties.
3. Evaluate mineralogical heterogeneity and its relevance to CCS projects, particularly in relation to reactions and mineralization processes.
4. Correlate core and log data through specifically selected case examples, identifying key reservoir characteristics.
5. Examine potential reasons for mismatches between core and log porosity, considering factors such as thin layers, patchy cement distributions, and varying rock types.
6. Classify rock types using Lucia's and Lonoy's frameworks, incorporating participants' examples when available for practical analysis.
7. Interpret porosity, permeability, and capillary pressure (Pc) data, focusing on their distribution, correlation, and upscaling implications for flow dynamics.

Training Method

As a classroom/virtual option this course includes a mixture of lectures and discussions, including case studies. Case examples provided by participants will be used if data sets are made available in advance. Individual / group exercises are inculded in the classroom option.

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Who Should Attend

This course is relevant/aimed to subsurface professionals working on carbonate assets and/or on CCS projects. The course is aimed to providing straightforward tools to enable the characterization of multiscale heterogeneity of carbonates, which is of significant relevance for flow (O&G and CCS/injection projects).

Course Content

This course consists of 5 parts:

1. Main processes controlling multiscale heterogeneity of carbonates.
    - Expression of multiscale heterogeneity (from seismic to pore scale).
    - Mineralogical heterogeneity. Relevance for CCS projects and for core to log correlations.
    - Case examples.
2. Rock types, porosity, permeability and capillary pressure. Reservoir/store units and connectivity
    - Rock typing. Classifications.
    - Case examples.
    - Lonoy's rock typing.
3. Rock types, porosity, permeability and capillary pressure. Reservoir/store units and connectivity (continued).
    - Controls on rock type distribution in reservoir/store units.
    - Connectivity and correlation.
    - Reservoir/Store units.
4. Core to log correlation, rock type distribution and flow units.
    - Core to log correlation. Core vs. log sampling.
    - Mismatches between core and log porosity.
    - High permeability streaks
    - Baffles and barriers.
5. Oil and Gas vs. Injection/CCS Projects.
    - Porosity/Permeability distribution and capillary heterogeneity. Relevance on production and impact on injection/CCS projects.
    - Digital tools applied to capture rock property heterogeneity. Capillary heterogeneity: relevance for injection projects and for capillary trapping (CCS).