Geological Controls on Production in Unconventional Reservoirs (G052)

Tutor(s)

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Overview

This course classifies unconventional reservoirs from a petroleum systems perspective and leads participants through how depositional controls on reservoir architecture and mechanical stratigraphy affect development strategies.

Duration and Logistics

Classroom version: 3 days; a mix of lectures exercises. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Four 4-hour interactive online sessions presented over 4 days. A digital manual and exercise materials will be distributed to participants before the course.

Level and Audience

Fundamental. Intended for subsurface professionals (geologists, geochemists, geophysicists, reservoir-, completion- and drilling engineers) who have some working knowledge of unconventional reservoirs but are looking to understand how multi-disciplinary integration can improve exploration and development decisions.

Objectives

You will learn to:

1. Describe unconventional reservoirs based on all parts of their petroleum system's character, and use that knowledge in a predictive way at all steps from exploration to development
2. Maximize the benefit of common tools for unconventional reservoir characterization.
3. Define stratigraphic and structural controls on development strategies: landing-zone definition, horizontal vs vertical wells
4. Develop a common language that can be used to facilitate information exchange between various engineering and geoscience subdisciplines.

Course Content

Course Details

This course classifies unconventional reservoirs from a petroleum systems perspective and leads participants through hands-on exercises (data from the Eagle Ford, Bakken, San Juan Basin and elsewhere) that reinforce the concepts of depositional controls on reservoir architecture and fractures.

The term “unconventional reservoirs” encompasses a wide range of reservoir types: tight-gas sandstones, naturally fractured reservoirs, source-rock (“shale”) plays, etc. The common bond is that the reservoirs have permeabilities measured in the nano- to microDarcy range and require hydraulic fracturing and/or horizontal drilling for production to be economic. These reservoirs develop in a variety of different petroleum systems. In some, e.g., tight-oil sandstones, the source rock and reservoir are separate. In other cases, e.g., source-rock reservoirs, the source- and reservoir rocks are the same. Because of these and other genetic differences, exploration and development strategies need to be tailored to optimize economic return.

Goals of the course include:

- Examine how a genetic classification of unconventional reservoirs, using concepts from petroleum systems analyses, can guide decision making from exploration to development stages of a play.
- Illustrate how depositional controls on reservoir architecture and mechanical stratigraphy affect development strategies: the choice of horizontal vs vertical wells, landing zone definition, frack barrier identification, etc.
- Characterize the positive and negative effects of natural fractures and faults and means for their identification.
- Examine how to maximize the benefit of common tools (triple combo logs, core analyses, etc.) for identifying the potential of unconventional reservoirs.

Introduction

- Petroleum systems to completion design: the wholistic view
- What are petroleum systems?
  Conventional vs unconventional plays (petroleum systems perspective)
- Unconventional play types
- Pressure systems
- Horizontal drilling, hydraulic fracturing and factory drilling

Source-Rock Reservoirs (“Shale Plays”)

- Petroleum systems characterization of source-rock reservoirs
- Source-rock characterization
- Mineralogy and mechanical properties of source-rock reservoirs
- Pore systems and reservoir quality
- Eagle Ford case study & exercise

Tight-Oil Reservoirs

- Petroleum systems characterization of tight-oil reservoirs
- Shaley sandstones: petrophysical evaluation, pore-system characterization
- Bakken and Cardium case studies and exercises

Naturally Fractured Reservoirs

- Petroleum systems characterization of naturally fractured reservoirs
- Fracture characterization
- Fractures and fluid flow
- Drilling naturally fractured reservoirs
- Mesaverde Group (San Juan and Piceance Basin) case studies and exercises

Synthesis

- Beginning with the end in mind: Thinking “development” during exploration
- The Unconventional-Conventional Spectrum: hybrids, haloes & headaches
- Stratigraphic controls on unconventional reservoir potential
- Structural controls on unconventional reservoir potential
- Full integration, from start to finish