

N446: Fault Seal Analysis: Concepts, Methods and Applications

Instructor(s): Dan Hemingway

Format and Duration

Classroom - 3 Days

Virtual - 5 Sessions

Summary

This course builds upon understanding the basic concepts and application of fault seal analysis using worked examples through a series of classroom based lectures and exercises. Participants will be introduced to the fundamental concepts of structural geology and fault seal analysis, before learning in detail how simplistic methods can be employed to gain a comprehensive understanding of fault sealing behaviour and risk.

Business Impact: This course provides participants with the skills and knowledge to **characterise fault-related fluid flow** during all stages of the E&P cycle in structurally-complex fields. Faults have the potential to act as significant seals in hydrocarbon reservoirs, withholding large fluid volumes over geological and production timescales. This course focuses on fundamental structural concepts that can be easily applied to most datasets, to generate an **estimation of the seal capacity**, and **understand the risks** associated with faulted reservoirs both in **exploration and development** settings.

Learning Outcomes

Participants will learn to:

1. Evaluate complex fault geometries using 2D and 3D approaches.
2. Appraise how fault geometries impact hydrocarbon fluid flow.
3. Characterise and identify faults that are likely to affect fluid flow.
4. Evaluate the sealing potential of faults using simplistic models.
5. Validate and quantify fault-seal associated risk.

Training Method

A classroom course comprising lectures, worked examples and training exercises. Lectures will focus on the theoretical concept of structural geology and fault seal analysis, and will include worked examples from exploration and development environments. Exercises will look at how methods can be applied to working datasets to evaluate sealing behaviour and address fault seal risk.

Who Should Attend

This course is relevant to all subsurface geoscientists and engineers who are concerned with the exploration, appraisal and development of hydrocarbons in structurally complicated fields. The course is aimed at further understanding fault-related fluid flow and associated risk.

Course Content

Part one will focus on introducing structural geology theory to focus on how faults grow and develop in to complex structures that allow the trapping of hydrocarbons. Concepts of fault growth, segmentation, and linkage will be introduced and related to how different fault architectures impact flow.

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Part two focuses on the components of faults that allow for the sealing / baffling of hydrocarbon flow. Fault rock processes (shale gouge ratio, shale smear factor) will be introduced to conceptualise how faults can form impermeable seals, and combined with seal capacity calculations to demonstrate how faults can become sealing through the calculation of hydrocarbon column heights.

Part three focuses on combining all theory and exercises in to worked examples of sealing evaluations and quantifying fault seal uncertainty in both exploration and development settings.

1. Fault Zone Architectures

- Definitions
- Fault development and growth
- Fault segmentation and interaction
- Fault zones

2. Fault Seal Analysis

- Juxtaposition
- Fault rock processes
- Fault rock classification
- Fault seal analysis workflows
- Dynamic Fluid Flow

3. Applied Methods

- Addressing uncertainty in fault seal analysis
- Well juxtaposition analysis
- Seal analysis workflows
- Applied methods

4. Final wrap up