N923: Modelling of Reservoir Structure and Fractures *(Somerset, UK)*

Format and Duration
Field - 5 Days

Instructor(s): Tim Wynn and Ed Stephens

Summary

This course provides a practical, integrated approach to characterising, classifying, analysing and modelling natural fractures. It uses lectures, modelling software and field examples to deliver an understanding of: geomechanics; the building and use of simple conceptual and more complex finite difference models; and the impact of fractures on well and reservoir productivity and recovery. The course combines field sessions in Somerset looking at world-class fault and joint systems along with classroom sessions assessing the Quantock Field case study that contains different host lithologies and structures that require participants to perform data analysis, fracture model design and creation of a modelling plan.

Learning Outcomes

Participants will learn to:

1. Characterise the presence or influence of fractures from a multitude of data sources (open-hole logs, core, image logs, mud losses, PLT's, well tests, and production performance).
2. Construct simple conceptual models of fracture origins, types, and distributions for use as input to reservoir modeling.
3. Plan preliminary proposals for selecting the optimal modeling process for specific modeling objectives.
4. Develop simplified implicit fracture property models (i.e. fracture porosity, fracture permeability, and sigma) in geocellular modeling packages.
5. Integrate simplified fracture properties into a finite difference simulator.
6. Evaluate fracture/matrix fluid exchange mechanisms of imbibition and gravity drainage.
7. Instigate and run a finite difference simulator in dual porosity/dual permeability mode.

Training Method

This course is a combination of

- classroom sessions comprising lectures, worked examples, hands-on exercises, and discussion
- visits to coastal field locations that provide illustration of fractures and opportunities for further exercises

Physical Demand

This course has a LOW physical demand. The majority of sections consist of walks no more than 4 km along beach sections, which can be a little uneven in places.

Who Should Attend

This course is aimed at subsurface professionals working in Oil & Gas, CCS, Gas Storage and Geothermal to provide a basis for understanding and modelling fault and fracture systems and their influence on fluid

flow in reservoirs and caprock systems.

Course Content

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Fault systems exposed on the North Somerset foreshores deform Triassic to Lower Jurassic stratigraphy and are located on the southern margin of the Mesozoic to Tertiary, E-W and NW-SE trending East Bristol Channel and Central Somerset Basins. Excellent 3D examples of extensional fault systems are exposed in the cliffs and on the foreshore at Kilve in North Somerset. Extensional faults range from a few metres to several hundred metres in strike-lengths and occur in dark coloured shales and interbedded limestones. Extensional and inverted fault systems are also exposed in the cliffs and on the foreshore at Watchet in North Somerset. Inverted Upper Jurassic extensional faults juxtapose grey Lower Jurassic (Lower Lias) shales and interbedded limestones against red Upper Triassic Mercia mudstones.

Itinerary

Day 1

- Introduction, terminology and definitions. Flow in faults – Darcy & Cubic Law. Introduction to Quantock Field
- Quantock Field 1. Field – Fault networks at Watchet

Day 2

- Faults as volumes, faultrock properties, Shale Gouge Ratio, geomechanics
- Quantock Field 1. Field – Fault networks at Kilve Cliff

Day 3

- Open joint systems, origins, fluid flow in fractures Cubic Law, geomechanics
- Quantock Field 2. Field - Joint systems at Kilve Foreshore

Day 4

- Modelling workflows, single porosity, dual porosity, DFNs
- Quantock Field 1 & 2 Workflows

Day 5

- Basement Fracture Systems,
- Quantock Field 3.