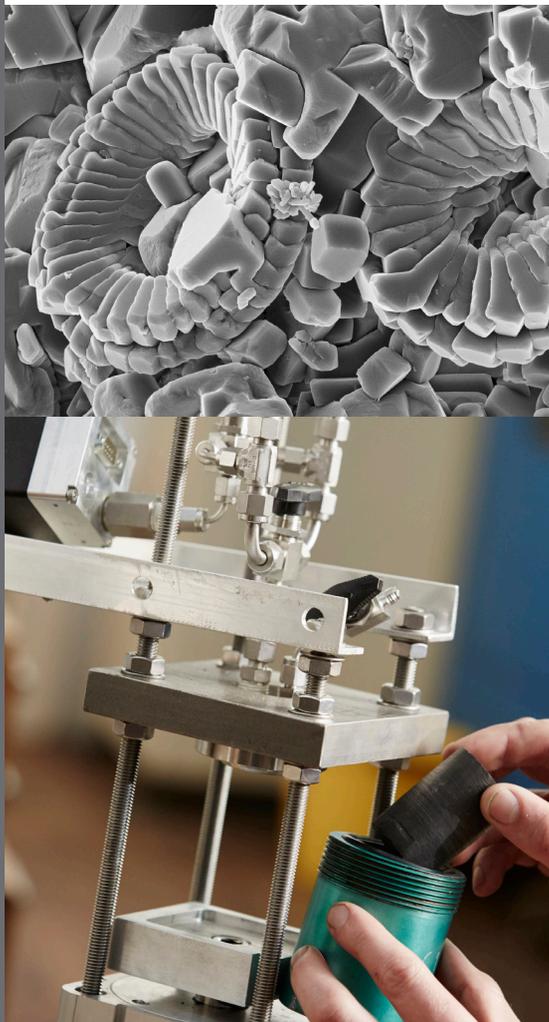# CARBONATE FAULT ROCKS

petroleum.leeds.ac.uk

Predicting the sealing capacity in carbonate fault zones is rarely straight forward due to (a) the inherent heterogeneity of the carbonates, and (b) the propensity of carbonates to diagenetically alter. The lack of documented carbonate fault rock permeability values causes simulations of faulted carbonate reservoirs to be inaccurate, compounded by the fact that the along-strike variation of fault rock permeability can be substantial.

More detailed studies of the petrophysical properties of many carbonate fault rock types, in a range of tectonic settings, with varying carbonate lithofacies and deformation and diagenetic history, will improve our capabilities to predict there hydraulic properties. This will allow better simulation of the effect of faulting on fluid flow.

OVERVIEW

More detailed studies of the petrophysical properties of many carbonate fault rock types, in a range of tectonic settings, with varying carbonate lithofacies and deformation and diagenetic history, will improve our capabilities to predict there hydraulic properties. This will allow better simulation of the effect of faulting on fluid flow.

A key output of this project will be the quantitative understanding of how lithological variations of differing facies combine with extrinsic fault-related deformation and their expression in the petrophysical properties. This will be used to implement a predictive tool in the software T7 (the successor to TrapTester).

This project will:

I. Build a database of the petrophysical properties of fault rocks in petroleum reservoirs;

II. Document examples of how faults affect fluid flow in carbonate reservoirs;

III. Develop a software tool that will link to T7 by Badleys to improve the ability of industry to model fault-related fluid flow in carbonate reservoirs.

The project is a collaboration between the University of Leeds and Badleys and brings together leading experts in structural geology and petrophysical property analysis of faults with the software development team that has created the most sophisticated package currently available for fault modelling.

SPONSORS

ADMA (the Petroleum Institute of the United Arab Emirates), ENI, OMV, Petrobras and Wintershall.

DELIVERABLES

WORK PACKAGE 1: Literature Review

The project will conduct a comprehensive literature review to:

- Collect all data previously published on the flow properties of faults in carbonate reservoirs and their controls.
- Collect data from rock deformation experiments on carbonate rocks to identify key controls on deformation mechanisms and geomechanical properties.
- Identify key field locations from which samples will be collected.

The literature review will be written up as a product within the first six months of the study. The references cited will also be incorporated into a database and will be provided to sponsors via our knowledge transfer website.

WORK PACKAGE 2: Sample collection and analysis

We will collect representative fault rock samples from both outcrop and core. Locations include UK, Germany, Italy, Malta, France, Oman, Greece and Turkey. We will make a particular effort to study outcrops and cores that are relevant to sponsors.

In addition to sample collection we intend to record the structure of the fault zones, the mechanical stratigraphy and place the outcrops in their geological/structural geological context.

We will also analyse core samples provided by sponsors. They will be anonymised but include key data, such as burial history, timing of faulting, carbonate lithofacies, fault displacement and fault type.

Sample analysis will be conducted in the state-of-the-art core analysis facilities and electron microscopy suite of the Wolfson Multiphase Flow Laboratory, University of Leeds.

WORK PACKAGE 3: Atlas of known fault behaviour

We will create an atlas of known fault behaviour in carbonate reservoirs that is built up from both published examples and datasets provided by sponsors. A key task will be to critically appraise the data to assess whether the interpretations are likely due to the presence of faults or whether faults are simply being blamed for unexpected reservoir behaviour.

WORK PACKAGE 4: Software Development

A software module will be designed that draws on the atlas of known fault behaviour. The primary system for prototyping and development will be TrapTester. The software will include guidelines on when faults are likely to act as conduits, barriers or mixed conduit-barrier systems. Therefore the results of the study will be available and applicable at all stages of the E&P process.

KNOWLEDGE TRANSFER

All knowledge-based products from the project will be provided via a project website. Yearly meetings will be held to discuss results from the project and agree on future directions. If possible, we intend to hold these meetings in a location that will allow a visit to a faulted outcrop.

COSTS

Membership of the consortium costs £150K.

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