Reservoir Characterisation and Subsurface Uncertainties in Carbon Stores, Cheshire, UK (G578)

Tutor(s)

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Overview

This course will give participants the opportunity to see some of the rocks at outcrop that are planned UK CO2 storage sites and to analyze the associated range of subsurface challenges. Visiting these outcrops will allow subsurface geoscientists, who generally use logs and limited core to build models, the opportunity to see the larger and smaller scale architecture and heterogeneity of the rocks they are working on and to consider the key processes of injectivity, migration and trapping of CO2. The course will also discuss post-depositional changes to sandstones, including petrophysical and geomechanical property evolution (pre- and post-CO2 injection), and some of the risks (migration and leakage) associated with developing saline aquifers and depleted gas fields as CO2 storage sites in these sandstones.

Duration and Logistics

A 5-day field course comprising a mix of field activities with classroom lectures and discussions. Transport will be by bus.

Exertion Level

This class requires an **EASY** exertion level. Field locations are mainly relatively easy walks of less than 1km (0.6 mile) along paths from road access points, although there is some walking down and up gentle slopes. One outcrop involves a 6km (3.7 miles) round trip walk over an intertidal sandflat.

Level and Audience

Intermediate. This course is intended for geoscience and engineering professionals working in CCS projects, especially those with an active interest in the Triassic Bunter/Sherwood Sandstones.

Objectives

You will learn to:

1. Appraise the main depositional and diagenetic features that influence Triassic Sandstone (Bunter/Sherwood) reservoir properties and CCS reservoir development and likely performance.
2. Validate the CO2 storage volumetrics from the micro (pore-scale) to the macro (aquifer volumes).
3. Predict CO2 flow away from injector wells controlled by permeability and aquifer architecture with reference to injection rates and subsurface pressure.
4. Assess the range of effects that CO2 can have on the host aquifer, from geomechanical to geochemical.
5. Create plume migration models with respect to compartmentalization risk, pressure barriers, faults and fractures.

6. Assess the role of top-seal and fault-seal properties and how they will influence CO_2 storage, from risk of fracking, or induced seismicity, to mineral dissolution.

Course Content

Course Details

As well as lecture content, the course will incorporate field visits to selected outcrops in Cheshire with direct application to Triassic (Sherwood and Bunter) carbon storage reservoirs, with additional consideration of the overlying mudstone caprocks.

Day 1: Arrive in the Wirral

Classroom:

- Introductory lecture and safety briefing
- Group dinner

Overnight in the Wirral

Day 2: Reservoir and volumetrics

Classroom:

- Storage site properties, subsurface architecture, CO_2 in the subsurface, storage and volumetrics

Fieldwork:

- Basin setup, aeolian deposits, grain size variations, kv/kh and connectivity (Runcorn Hill Park)
- Fluvial dominated, cyclical stacked sequence and associated reservoir properties (Frodsham)

Overnight in the Wirral

Day 3: Flow of CO_2, geomechanical and chemical interactions

Classroom:

- CO_2 injection and flow, fluid and rock pressure, baffles and barriers

Fieldwork:

- Mixed fluvial sequence, upscaling, averaging and wells (Hilbre Island)
- Mixed fluvial and aeolian sequence, deformation bands, compartmentalization and faulting (Thurstaston Hill)

Overnight in the Wirral

Day 4: Leakage and containment risk

Classroom:

- Geochemical and geomechanical interactions, seals and leakage risk

Fieldwork:

- Subsurface leakage scenarios and risks (Alderley Edge)

Overnight in the Wirral

Day 5: Wrap up and travel home

Classroom:

- Course summary and wrap up

Departure and travel home