
N550: North Sea Multiphase Rift Evolution: Outcrop to Subsurface Perspectives on Stratigraphy, Sedimentology & Petroleum Systems (*East Coast, UK*)

Format and Duration

Field - 5 Days

Low Physical Demand

Instructor(s): David Macdonald and John Howell

Summary

The North Sea still presents many opportunities for legacy major companies, smaller operators and new entrants alike. In this field course we bring North Sea Plays to life through the integration of outcrop with seismic, well, and core data. Outcrops span the Devonian to the Late Cretaceous to provide a holistic overview of how the basin has evolved. The trip is organised and ordered through the lens of reservoir geology, with other petroleum systems elements also discussed and evaluated.

Business Impact: This course offers a highly **applied field-based experience** for energy professionals involved in **any part of the E&P life-cycle**. Through exposure to all of the North Sea's key plays, participants will be able to add value immediately upon return to the office. Although this course focuses on the North Sea, many of the **tectono-stratigraphic concepts** discussed are relevant to other **rift basins around the globe**. Factors important for **carbon storage**, including **top seal effectiveness**, will also be discussed.

Learning Outcomes

Participants will learn to:

1. Identify the key characteristics of North Sea plays.
2. Consider the play-based risking of exploration projects using a systematic petroleum systems approach.
3. Appreciate the rich variety of North Sea reservoir types, including carbonates and clastics, and discuss development and production issues in a broad context that includes structural and stratigraphic heterogeneities.
4. Recognise North Sea plays on seismic data and use well logs to characterise reservoir, source, and seals.
5. Construct strong narratives and deploy these analogues to illustrate technical presentations and build the case for investment.
6. Work efficiently in teams on exercises that are designed as “learning by doing” industry scenarios.

Training Method

This is a field course, supported by classroom sessions in a 80:20 ratio. Field localities are supplemented with a number of informative, short exercises designed to emphasise key learning outcomes.

Physical Demand

The physical demands for this course are **LOW** according to the Tetra Tech RPS field course grading



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system; the course requires basic fitness levels. Access to the outcrops involves short walks of up to several kilometres along clifftop paths and beach sections.

Who Should Attend

This trip includes important ‘must see’ localities for anyone working the North Sea from a subsurface standpoint. Although the course is aimed at geoscientists with at least 5 years of experience, petrophysicists, reservoir engineers, petroleum engineers, and drilling engineers will also find attending this course highly valuable. Additionally, team leaders or managers in need of a field experience to refresh their play-based knowledge of the North Sea would benefit.

Course Content

Day 0: Arrival

- Travel to Edinburgh and stay overnight

Day 1: Devonian to Carboniferous

- Siccar Point: The birthplace of modern geological science. Examination of the Caledonian unconformity and the subcrop and supracrop. The Devonian conglomerates and sandstones are the first deposits of economic significance for the North Sea (fluvial wadi deposits).
- Pease Bay: Devonian reservoir potential, correlation in barren redbed reservoirs (palaeosols), the Devonian-Carboniferous Boundary.
- Review of relevant oil fields: Clair, Buchan, Embla, Flora, Fife.
- Stay in Berwick overnight.

Day 2: Carboniferous to Permian

- Scremerston: Coal sourced petroleum systems. Lower Carboniferous versus Upper Carboniferous coals. Carboniferous lacustrine oil shales. Fluvial, deltaic to shallow marine reservoirs.
- Bowden Doors (back-up locality): High net to gross fluvial reservoir characterisation (Carboniferous Fell Sandstone).
- Seaton Sluice: Carboniferous fluvial reservoirs and incised valley fills.
- Tynemouth - Priory Point: Base Permian (Variscan/Saalian) Unconformity; Carboniferous and Permian reservoir comparison (fluvial vs. aeolian).
- Tynemouth - Cullercoats: Rotliegendes aeolian reservoir observed in a trapping configuration.
- Review of relevant oil fields: Flora, Fyfe, Murdoch, Caister, Auk, Leman, Viking, Cygnus.
- Stay in Tynemouth overnight.



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Day 3: Permian to Triassic

- Old Quarrington and Crime Rigg Quarries: Rotliegendes aeolian reservoirs.
- Hartlepool - Blackhall Rocks: Zechstein carbonates, primary versus secondary porosity. Dual permeability reservoir models.
- Redcar Rocks: Triassic redbed sedimentology and reservoir potential.
- Review of relevant oil fields: Auk, Argyll, Southern Permian Basin, Snorre, Alwyn North, Jade, Judy, Marnock, Skua, Hewitt, Morcambe Bay.
- Stay in Ravenscar overnight.

Day 4: Jurassic

- Scalby: Low net to gross meandering fluvial reservoirs.
- Whitby: Syn-depositional faulting and the control on net to gross in fluvial reservoirs.
- Staithes: Reservoir potential of upward coarsening shallow marine parasequences.
- Review of relevant oil fields: Culzean, Harald East, Ness Fm of Brent Gp. Fulmar, Ula, Brent (Etive).
- Stay in Ravenscar overnight.

Day 5: Jurassic to Cretaceous

- Cloughton: Reservoir potential of upward coarsening shallow marine parasequences.
- Cayton Bay: Deepwater Upper Jurassic seals and source rocks.
- Flamborough Head: Low permeability chalk reservoirs and development challenges.
- Review of relevant oil fields: Heather, Kimmeridgian source rocks, Kraka, Dan, Ekofisk
- Stay in Ravenscar overnight

Day 6: Departure

- Transfer to Newcastle for departure