

N499: Shallow Marine Reservoir Analogues and their Application to the Jurassic of the North Sea (*Isle of Skye and Raasay, UK*)

Instructor(s): Ronald Steel and Uisdean Nicholson

Format and Duration

Field - 5 Days
Moderate Physical
Demand

Summary

The primary objective of this field course is to examine the Jurassic shallow marine reservoirs of the Hebridean Basins. Discussions will highlight the linkage between active tectonics and depositional processes, and will emphasise the importance of a sequence stratigraphic perspective in order to correlate effectively. Outcrop information is integrated with well data across a range of scales to demonstrate the subsurface workflows required to populate interwell areas of reservoir models. Reservoir architecture and heterogeneity will be addressed comprehensively in the context of fluid flow, development planning, and reservoir management and surveillance.

Business Impact: This field trip is highly relevant for shoreface reservoirs such as the Fulmar and the Ula Formations of the Central North Sea, but also the Brent Group (Broom, Rannoch, Etive, and Tarbert Formations) of the Northern North Sea. The scale of the outcrops offers a valuable **regional scale of investigation** that will be particularly useful for **explorationists**, but the outcrops also provide an excellent opportunity to discuss **shallow marine reservoir characterisation, reservoir modelling, and production performance** in detail.

Learning Outcomes

Participants will learn to:

1. Describe shallow marine facies in a consistent manner
2. Assess the genetic processes which produce various sedimentary structures, bioturbation, diagenetic features etc.
3. Explain why the structural framework and degree of tectonic activity at time of deposition underpins the reservoir stacking patterns and heterogeneity in shallow marine systems.
4. Evaluate the extent to which the palaeocoast can be correctly oriented, offshore and onshore (proximal to distal) assessed and net to gross predicted in such systems.
5. Provide a frame for a reservoir description including the key architectural elements that will likely govern reservoir behaviour.
6. Evaluate how reservoir quality impacts recovery in typical shallow marine reservoirs. Comparison of bottom water vs. edge water sweep and linkage between structural framework and depositional processes in order to optimally locate infill wells to optimise sweep for a range of architectural cases.
7. Describe how flow units could be defined and may operate during production. Discuss the way in which heterogeneities may impact production, perforation strategies and or injection / sweep depending on fluid type and drive mechanism.
8. Discuss how tidal channels would be / should be handled in a reservoir modelling and simulation context.



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Training Method

A field course comprising fieldwork and associated exercises, supported by classroom presentations and discussions in a 70:30 ratio. Fieldwork is supplemented by reservoir analogues from key North Sea fields.

Physical Demand

The physical demands for this course are MODERATE according to the Tetra Tech RPS field course grading system; the course requires good general fitness levels. The longest walk on the class is approximately 3 km (2 miles) into the field area (Screapadal). One outcrop (Barreraig Bay) requires participants to walk down a steep path to the beach with a descent (and later ascent) of 180 m (550 feet). There will be walks of around 1 km (0.5 miles) most days. The field area is in NW Scotland and participants should expect a range of temperatures (6 -12 deg C) and prepare for a wet and windy working environment. Transport will be by coach on paved roads.

Who Should Attend

Geoscientists who have worked with clastic depositional systems and want to further improve their understanding, interpretation skills and predictive ability of reservoir properties encountered within shallow marine depositional environments. Petrophysicists, reservoir engineers or production engineers who wish to gain a better understanding of the subsurface and view at first hand the anatomy of a classic reservoir type.

The Hebridean Basins are the perfect location for multi-disciplinary teams to come together to collaborate and interact with highly suitable analogues as a backdrop for targeted discussions that will add value to any asset.

Course Content

Day 1: Arrival and Lecture

- Depart from Aberdeen / Inverness with general geology of Scotland during journey
- Course introduction and safety briefing
- The geology of Skye
- Barreraig Sandstone Formation Overview

Day 2: Field and Lecture

- Travel to Barreraig Bay to see the type site of the Barreraig Sandstone Formation
- Introductory lecture on shallow marine processes



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- Exercise: Produce a sequence stratigraphic summary of the Bearreraig Bay Outcrop and Upper Glen I well
 - Review the specific field aims for Day 2: make a prediction of the proximal to distal variation on the dip slope of an active half graben and discuss reservoir prediction results including Upper Glen I well

Day 3: Field and Lecture

- Ferry to Raasay and describe tilted fault block structures at oil field scale
- Travel to Screapadal: Examination of proximal stacking patterns including tidal channels
- Discussion of the importance of channelised sedimentary architectures in production
- Review of key insights from the field and review half-graben correlations
- Review specific field aims for Day 3: a prediction of shallow marine processes and products in tidal straits

Day 4: Field and Lecture

- Drive to Glasnakille on the Strathaird Peninsula
- Bathymetric confinement effects due to narrow half graben. Rates of subsidence and sedimentation. Depositional styles and signatures in tidal straits.
- Continue on to see the Elgol Sandstone Formation
- Review the reservoir potential of deposits in a tidal strait discussing compartmentalisation (both stratigraphic and igneous dykes) and a tank of sand versus heterogeneous descriptions
- Review of key insights from the field trip as a whole

Day 5: Departure

- Travel back to Aberdeen / Inverness for departure
- Stop to see modern examples of fluvio-deltaic systems on the way