N264: Prediction of Changes in Reservoir Architecture in Tidal-, Wave- and Fluvial-influenced Marginal Marine Systems: An Outcrop and Core Perspective *(Alberta, Canada)*

Instructor(s): James MacEachern and Bruce Ainsworth

Format and Duration

Field - 5 Days
Moderate Physical Demand

Summary

The key objectives of this course are to provide participants with the ability to recognise and classify mixed-influence marginal marine systems utilising sedimentological, stratigraphical and ichnological techniques. This will enable them to better manage uncertainties and to improve predictions of lateral facies changes, to correlate more realistically and to recognise potential stratigraphic compartmentalisation issues in these types of systems.

Learning Outcomes

Participants will learn to:

1. Characterise sedimentary and biogenic structures attributable to different depositional processes operating in the marginal marine zone.
2. Integrate sedimentological and ichnological information to apply process- and architectural-based classifications to marginal marine systems.
3. Perform rigorous, auditable analysis and interpretation of mixed-process marginal marine systems.
4. Predict both spatial and temporal changes in depositional process and architecture in marginal marine systems.
5. Predict potential stratigraphic compartmentalisation in marginal marine systems.
6. Manage the uncertainties associated with the prediction of changes in depositional process, three dimensional architecture and potential stratigraphic compartmentalisation in marginal marine systems.

Training Method

A five-day field, core and classroom course based in Drumheller and Calgary, Alberta, Canada. The course is comprised of a mixture of group and individual exercises and discussions at the outcrops, in the core lab and in the classroom. The focus is on observations followed by interpretation and then prediction away from the data. The apportionment of time is 50% field, 25% classroom lectures, 20% core workshop and 5% computer application.

Participants are strongly encouraged to bring a laptop computer or tablet for web-based classroom exercises.

Physical Demand

The physical demands for this class are MODERATE according to the Nautilus Training Alliance field course grading system. Fieldwork is in Alberta, Canada, where conditions can vary from cold and wet to hot and dry. Participants will be taking moderate walks of up to 1.6 km (1 mile) each day. The longest walk

on the course is 3.2 km (2 miles) with an ascent of 90 m (300 ft). Transport is by bus.

Who Should Attend

The course is aimed at exploration, development and production geoscientists whose focus is on clastic marginal marine systems. Asset managers responsible for exploitation of hydrocarbons in these types of systems would also benefit from the course. Reservoir engineers seeking exposure to laterally complex stratigraphic systems with the potential to impact fluid flow in reservoirs are also encouraged to attend

Prerequisites and Linking Courses

Participants must have a basic knowledge of sedimentology and stratigraphy before attending this course. At a Basic Application level this can be acquired on courses N096 (Recent Depositional and Stratigraphic Analogues for Fluvial and Shallow Marine Reservoirs, South Carolina, USA), N155 (Introduction to Clastic Depositional Systems: a Petroleum Perspective) and/or N156 (Clastic Depositional Systems in a Basinal Framework: Exploration and Reservoir Implications, Pyrenees, Spain). The evidence for fluvial, wave and particularly impressive tidal facies in the Drumheller shoreline deposits distinguishes them from the more wave-dominated shoreline systems examined in N011 (High Resolution Sequence Stratigraphy: Reservoir Applications), N035 (Sedimentology, Sequence Stratigraphy and Reservoir Architecture of Paralic Deposits), N042 (Reservoir Sedimentology and Stratigraphy of Coastal and Shelfal Successions) and N117 (Shoreline and Shelf Reservoir Systems: Outcrop Lessons for Exploration and Production).

Course Content

Mixed-process marginal marine systems (those influenced by combinations of waves, tides and fluvial processes) are the norm on the majority of modern-day coastlines (both deltaic and non-deltaic) and are being increasingly recognised in the ancient record. The Horseshoe Canyon Formation in the Drumheller area is characterised by spectacular examples of tidal, wave and fluvial interactions.

Course participants will learn how to consistently classify deposits at a process and architectural level and how to predict potential changes in reservoir architecture and stratigraphic compartmentalisation both spatially and temporally.

A consistent and rigorous framework is developed that can be utilised in exploration-scale predictions or production-scale 3D geocellular modelling. Concepts are discussed and reinforced using (1) outcrop data, (2) subsurface core and wireline datasets from boreholes drilled adjacent to the outcrops in addition to 75 wells with wireline data and 6 hand-held outcrop gamma rays,
(3) 3D reservoir model and synthetic seismic of the area, and (4) worked oil and gas field examples.

Day 1 – Introduction to Field Area and Classification Concepts (Drumheller)

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Half-day classroom session followed by a half-day in the field to reinforce process classification concepts.

Day 2 – Process and Architecture Classification Concepts (Drumheller)
Field exercises - consolidation of process and architectural classification concepts.

Day 3 – Architecture Classification Concepts and Temporal and Spatial Prediction (Drumheller)
Field exercises - consolidation of architectural classifications and prediction away from data (temporal and spatial).

Day 4 – Core Workshop (Calgary)
Drive from Drumheller to Calgary ERCB Core Facility. Introduction to key ichnological concepts and start core exercise.

Day 5 – Core Workshop and Wrap-up (Calgary)
Complete core and core to wireline exercises. Wrap-up in classroom with exercises that utilise both outcrop and subsurface data to (1) predict marginal marine process, architecture and compartmentalisation and (2) manage associated uncertainty.