CONCEPT

Petroleum Geology and Stratigraphy: Depositional Environments and Well Correlation

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Introduction:

Petroleum geology decisions on where to drill and how to develop a field depend on correlations that are often built from log shapes alone, with little reference to how the rocks were deposited, buried and altered. Mis-correlated reservoir zones lead to poorly placed wells and misjudged connectivity. This Core Concept two-week course trains geoscience staff to read the petroleum system, interpret clastic and carbonate depositional environments, assess diagenesis and reservoir quality, and apply lithostratigraphy, biostratigraphy and sequence stratigraphy. Participants finish by producing a Well Correlation Panel and Reservoir Characterisation Summary.

Course Objectives:

- Evaluate the source, migration, reservoir, seal, trap and timing elements of a petroleum system for a given sedimentary basin
- Interpret clastic and carbonate depositional environments from core, cuttings and log evidence and predict reservoir geometry
- Assess how compaction, cementation, dissolution and dolomitisation have altered porosity and permeability in a reservoir interval
- Subdivide a well succession using lithostratigraphic units, biozones and sequence stratigraphic surfaces
- Describe core and cuttings to a consistent standard and use wellsite observations to confirm formation tops and hydrocarbon shows
- Build a well correlation panel and a reservoir characterisation summary that integrate cores, logs and seismic at overview level

Target Audience:

- Junior and mid-level geologists who describe cores and cuttings and pick formation tops in exploration and development wells
- Petroleum engineers moving into subsurface roles who need to read geological models and correlation panels
- Geoscience data and technical staff who load well data, maintain stratigraphic databases and prepare correlation displays
- Wellsite and operations geologists who follow drilling, log cuttings and report shows and coring points
- Reservoir modelling support staff who take zonation and facies input from geologists into field studies

Course Outline:

Day 1: Sedimentary Basins and the Petroleum System

- Basin Types by Plate Setting: Rift, Passive Margin, Foreland and Intracratonic Basins
- Petroleum System Elements: Source, Reservoir, Seal, Trap and Overburden
- Source Rock Screening: Organic Richness, Kerogen Type and Thermal Maturity Windows
- Migration Pathways, Hydrocarbon Kitchens and Critical Moment Timing
- Structural and Stratigraphic Trap Styles with Shale, Evaporite and Chalk Seals

Day 2: Clastic Depositional Environments

- Grain Size, Sorting and Sedimentary Structures as Flow Regime Indicators
- Fluvial Systems: Braided Channels, Meander Belts and Point Bar Geometry
- Deltaic Systems: River, Wave and Tide Dominated Delta Architecture
- Shoreface, Barrier Island and Tidal Flat Facies Successions
- Deep-Water Turbidite Channels, Lobes and Mass-Transport Deposits

Day 3: Carbonate Depositional Environments

- Carbonate Factory Controls: Water Depth, Light, Temperature and Clastic Input
- Carbonate Texture Classification from Mud-Supported to Grain-Supported Fabrics
- Ramp and Rimmed Shelf Profiles with Reef, Shoal and Lagoon Facies Belts
- Peritidal Flats, Sabkha Cycles and Evaporite Successions
- Carbonate Pore Types: Interparticle, Moldic, Vuggy and Fracture Porosity

Day 4: Diagenesis and Reservoir Quality

- Mechanical and Chemical Compaction Trends with Burial Depth
- Quartz Overgrowth, Calcite and Authigenic Clay Cementation in Sandstones
- Grain Dissolution and Secondary Porosity Development
- Dolomitisation Models and Their Effect on Carbonate Pore Networks
- Thin-Section Petrography and Core Plug Porosity-Permeability Crossplots for Quality Ranking

Day 5: Week-One Guided Case: Petroleum System and Facies Interpretation

- Case Basin Data Pack: Burial History Plot, Source Rock Analyses and Well Summaries
- Petroleum System Events Chart Construction for the Case Basin
- Facies Assignment from Core Photographs and Cuttings Descriptions
- Depositional Environment Interpretation and Reservoir Fairway Sketch Map
- Play Element Risk Summary and Peer Challenge

Day 6: Lithostratigraphy and Biostratigraphy

- Lithostratigraphic Hierarchy: Supergroup, Group, Formation, Member and Bed
- Steno's Principles, Unconformity Types and Stratigraphic Column Construction
- Biozone Types: Taxon Range, Concurrent Range, Interval and Assemblage Zones
- Microfossil Groups for Age Picks: Foraminifera, Ostracods and Palynomorphs
- Index Fossil Criteria and Biostratigraphic Tops in Well Completion Reports

Day 7: Sequence Stratigraphy for Reservoir Prediction

- Accommodation Controls: Eustasy, Subsidence and Sediment Supply
- Sequence Boundaries, Correlative Conformities and Incised Valley Fill Reservoirs
- Lowstand, Transgressive and Highstand Systems Tract Recognition in Wells
- Maximum Flooding Surfaces as Chronostratigraphic Correlation Time Lines
- Parasequence Stacking Patterns: Progradational, Retrogradational and Aggradational Sets

Day 8: Core Description and Wellsite Geology

- Core Handling, Depth Reconciliation and Core Photography Routines
- Graphic Core Log Construction: Lithology, Grain Size, Structures and Bioturbation Index
- Cuttings Sampling, Lag Time Correction and Mud Log Lithology Columns
- Hydrocarbon Show Evaluation: Fluorescence, Solvent Cut and Gas Readings
- Coring Point and Casing Point Selection from Predicted Formation Tops

Day 9: Well Correlation Methods with Logs and Seismic at Overview

- Gamma Ray, Resistivity and Density-Neutron Log Motifs as Facies Indicators
- Correlation Datum Selection and Flattening on Flooding Surfaces
- Correlation Pitfalls: Faults, Erosional Truncation, Facies Change and Diachronous Tops
- Seismic Section Reading at Overview for Checking Correlation Frameworks
- Reservoir Zonation, Net-to-Gross Estimation and Flow Unit Definition

Day 10: Capstone: Well Correlation Panel and Reservoir Characterisation Summary

- Capstone Data Pack Review: Cores, Wireline Logs, Biostratigraphic Tops and a Seismic Line
- Correlation Panel Build with Sequence Surfaces, Formation Tops and Reservoir Zones
- Facies Distribution Maps and Reservoir Quality Trends Across the Field
- Reservoir Characterisation Summary: Depositional Model, Diagenetic Overprint and Key Uncertainties
- Correlation Panel Presentation and Peer Geological Review

Skills You Will Gain:

- Petroleum System Analysis
- Clastic Facies Interpretation
- Carbonate Facies Interpretation
- Reservoir Quality Assessment
- Biozone Identification
- Systems Tract Recognition
- Graphic Core Logging
- Well-to-Well Correlation

Why Attend This Course:

- Leave with a Well Correlation Panel and Reservoir Characterisation Summary built from real-style cores, logs, biostratigraphic tops and a seismic line
- Gain in week one the petroleum system, depositional environment and diagenesis knowledge that week two turns into stratigraphic zonation and correlation
- Stop correlating on log shape alone by anchoring every panel to flooding surfaces, biozones and core-based facies
- Compare subsurface practice with geologists, engineers and data staff working clastic and carbonate fields in different basins

Conclusion:

Sound correlations rest on understanding how reservoir rocks were deposited, buried and altered. Week one covers sedimentary basins and the petroleum system, clastic and carbonate depositional environments and diagenesis, closing with a guided case. Week two adds lithostratigraphy, biostratigraphy, sequence stratigraphy, core description, wellsite geology and correlation methods that use logs and seismic at overview level. The capstone brings both weeks into a Well Correlation Panel and Reservoir Characterisation Summary that participants can reuse as a template for their next field study.