TETRA TECH RPS ENERGY | TRAINING

EC040: Clastic Reservoir Sedimentology

Format and Duration
Self-Paced - 12 Hours

Summary

Clastic sedimentary rocks host oil and gas reservoirs, are major aquifers for water supply and host sedimentary metal and mineral ores. They are also potential subsurface storage sites for carbon dioxide and hydrogen and are sites for shallow geothermal energy systems. The recognition of the environment of deposition of sandstones is fundamental to understanding the subsurface characteristics of the sediment body, from its porosity and permeability properties to reservoir body geometries, extent and connectedness. This course systematically covers all continental and marine environments of deposition of sandstone, conglomerates and mudrocks, considering each in terms of the physical, chemical and biological processes that occur and their role in determining the characteristics of the sediment body. Modern and ancient analogues are considered, but the emphasis is on carrying out a facies-based analysis of successions to objectively determine the reservoir properties.

Learning Outcomes

Participants will learn to:

1. Know the components of clastic sediments and how they are transported and deposited in sedimentary basins.
2. Have a knowledge of the processes that occur in different clastic depositional environments and be able to recognise their products in sedimentary rocks.
3. Be able to determine the environment of deposition from successions of clastic strata formed in continental, shallow marine and deep marine settings.
4. Know the characteristics of aeolian, lacustrine, fluvial, coastal, deltaic, estuarine, shelf and deep water facies and how they are expressed in logged successions.
5. Be able to consider the deposits of different settings in terms of reservoir potential and the characteristic features of these reservoirs.
6. Be familiar with case studies of oil and gas fields hosted in the deposits of different clastic depositional settings.

Training Method

This is a self-paced e-learning course, consisting of 12 modules. Within each module the learning materials are structured into short sections, each including interactive text and image content, animations, video, and audio. Each module has a scored quiz at the end to provide the learner with their learning progress. This course has a learning time of approximately 12-18 hours.

Who Should Attend

This course is designed to provide geoscientists and engineers with a foundational knowledge of clastic sedimentology involved in the exploration, evaluation and production of subsurface reservoirs.

Course Content

Clastic Sediments and Sedimentary Rocks

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In this module you'll learn key terminology and composition of clastic sedimentary rocks, how sedimentary structures form and are described, and how these features reveal depositional environments. These fundamentals set up later modules exploring sandstones and mudstones and reconstructing past environments from sedimentary evidence.

Facies, Environments and Analogues

This module covers sedimentological data collection (core description, palaeocurrents, provenance), the concept and analysis of facies and facies associations, methods for constructing paleoenvironments and Gross Depositional Environment maps, and the limitations of using modern or ancient analogues when interpreting facies associations.

Aeolian Environments and Facies

This module explains how to distinguish aeolian sandstones from other sandy deposits, recognises desert environments and their features, reviews aeolian bedform scales and their preservation in the rock record, and examines how global climate controls the distribution of aeolian facies.

Fluvial Sedimentology

This module covers tributary and distributive river patterns, channel planforms and their deposits, characteristics of bedload and mixed-load rivers, sand and fine sediment floodplain deposition, use of palaeosols for paleoenvironmental interpretation, and controls on fluvial deposit architecture and their impact on reservoir properties.

Lacustrine Environments

Lakes are inland, non-marine water bodies formed in surface depressions and retained by natural sills. Under humid conditions they have low salinity, while high evaporation can concentrate dissolved ions, producing saline or ephemeral lakes. This module examines lacustrine formation, controls, water chemistry and sedimentary expression.

Interior Basins

Interior basins differ from marine-connected basins by limited outlet and distinct sediment-water dynamics. This module examines alluvial fan processes, deposition, and stratigraphic recognition, plus ephemeral lakes and their characteristic facies. Together these topics explain sedimentary patterns and controls unique to enclosed continental basins.

Tidal Environments

This module explains tidal processes and sediment-transporting currents in shallow marine and coastal settings, surveys coastal and shelf environments affected by tides, describes sedimentary structures diagnostic of tidal deposition, and characterises tidal sandstone bodies to aid interpretation of tidally-

influenced reservoir and outcrop successions.

Coastal Environments of Deposition

Coastal environments form the land, sea interface and include coastal plains, beaches, barriers, and lagoons. This module explores waves, wind-driven surface oscillations, shape shorelines. Wave-dominated coasts develop constructional beaches and barriers with protected lagoons, while estuaries receiving riverine sediment can preserve combined wave and fluvial signatures in their deposits.

Deltas

This module explains a delta is sediment built outward from a river mouth into a sea or lake. Delta morphology reflects river discharge and sediment supply, receiving water depth, and shoreline processes like waves, longshore drift and tides. These interactions create a mosaic of depositional sub-environments, each with distinct sedimentary characteristics and architectures.

Shelves

This module covers wave, storm and tidal sediment transport on shallow marine shelves; storm deposits producing graded beds with hummocky and swaley cross-stratification; and recognition of shelf depth zones using characteristic trace-fossil (ichnofauna) assemblages to interpret depositional settings and paleoenvironmental conditions.

Deep Water Processes and Products – Part 1

This module explains deep-water clastic transport by turbidity currents and debris flows (sediment gravity flows), how their deposits build submarine fans whose morphology depends on mud, sand and gravel proportions, and how slope gravitational instabilities cause deformation while distal basin areas accumulate fine suspended sediments.

Deep Water Processes and Products – Part 2

This module examines deep marine clastic deposits, slope channels, submarine fan channels, levees, lobes, turbidite sheets and Mass Transport Complexes. It will explore contourites from ocean currents, pelagic and hemipelagic inputs, and how the calcite compensation depth influences biogenic carbonate preservation and pelagic sediment composition.