TETRA TECH RPS ENERGY | TRAINING

EC022: Basin Analysis

Format and Duration
Self-Paced - 8 Hours

Summary

This comprehensive course delves into the principles and applications of basin analysis, examining tectonic processes and sediment dynamics across diverse geological settings. The eight modules cover foundational topics such as tectono-stratigraphy, sequence stratigraphy, and hydrocarbon migration, alongside tools like seismic interpretation, potential field data, and topographic information. Key tectonic environments—rift basins, passive margins, fold and thrust belts, inversion tectonics, and strike-slip systems—are explored through case studies, including the Gulf of Suez, Orange Basin, and Los Angeles Basin.

Learners will gain insights into fault propagation, sediment dispersal, structural evolution, and petroleum systems analysis. Special emphasis is placed on gravitational processes, salt tectonics, and foreland basin dynamics, with real-world applications in resource exploration. This course equips participants with an understanding of basin formation and tectonic influences on sedimentation patterns, providing critical knowledge for geoscience and petroleum engineering professionals.

Learning Outcomes

Participants will learn to:

1. Analyse tectonic controls on basin formation, including subsidence mechanisms, heat flow variations, and the influence of mantle dynamics.
2. Apply seismic sequence stratigraphy and alternative data sources (e.g., topographic and potential field data) to characterise basin structure and stratigraphy.
3. Evaluate sediment dynamics and fault propagation, including the impact of relay ramps, rift fault polarity, and extensional migration on sediment dispersal.
4. Explain the structural evolution and hydrocarbon potential of passive margins, focusing on gravity-driven processes, salt tectonics, and case studies such as the Orange Basin and the Nile Delta.
5. Assess the formation and petroleum systems of compressional basins and foreland fold-and-thrust belts, using global case studies for practical insights.
6. Understand the principles of inversion tectonics, including structural reactivation, fault geometries, and their implications for petroleum exploration.
7. Interpret the mechanics of strike-slip tectonics and their influence on basin subsidence, sedimentation, and seismic activity, using examples like the San Andreas Fault and Los Angeles Basin.
8. Integrate basin analysis concepts to predict resource potential and enhance exploration strategies across diverse geological settings.

Training Method

This is a self-paced e-learning course, approximately 8 hours learning time, consisting of 8 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.

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Who Should Attend

This course is aimed at geoscience and petroleum engineering professionals.

Course Content

Introduction to Basin Analysis

This module introduces basin analysis, focusing on tectonic controls on basin formation and evolution. It covers key topics like heat flow, tectono-stratigraphy, source rock properties, and hydrocarbon migration, offering foundational knowledge on mechanisms of extension, compression, and variations in passive margins for exploration and petroleum systems.

Basin Definition

Explore the use of well, seismic, topographic, and potential field data to understand basin structure and stratigraphy. This module emphasises sedimentary analysis and integrates alternative data sources, including insights from drilling projects like DSDP, ODP, and IODP, for enhanced accuracy in modelling basin evolution and hydrocarbon systems.

Seismic & Sequence Stratigraphic Analysis

Delve into seismic and sequence stratigraphy to predict reservoir characteristics. This module covers sequence boundaries, tectonic influences, and sea-level changes, highlighting their impact on sedimentary sequences. Applications in tectonics and petroleum systems analysis are emphasised.

Lithospheric Extension - Rift Basins

This module explores fault growth, relay ramps, and the effects of seismic events on sediment dispersal. Using case studies like Borah Peak, USA and the Gulf of Suez, it examines rift fault polarity, sediment entry points, and the impact of fault migration on sedimentation in rift basins.

Passive Margins Gravitational Collapse

Examine passive margin processes, including gravitational sliding and spreading, with case studies such as the Orange Basin, SW Africa, and the Nile Delta. The role of salt tectonics in trap formation is highlighted, alongside insights into structural configurations and hydrocarbon reservoir development in key global regions.

Compressional Basins

Focus on the structure and dynamics of compressional basins and foreland fold-and-thrust belts. This module explores foreland basin formation, fault development, and sediment dispersal, using case studies from Europe, the Middle East, and South America to analyse hydrocarbon reserves in compressional settings.

Inversion Tectonics

Discover the reactivation of extensional basins under compression in this module. Structural inversion, fault geometries, and intraplate deformation are explored through real-world examples and sandbox modelling, providing insights into petroleum prospectivity and structural evolution.

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Strike Slip Tectonics

Learn about strike-slip fault mechanics, associated features, and their influence on basin subsidence and sedimentation. This module uses examples like the San Andreas Fault and Los Angeles Basin to examine geological formations, seismic activity, and the role of strike-slip tectonics in petroleum systems.