Seismic Interpretation & Basin Analysis of Rift Basin Systems

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Introduction:

Rifts represent part of an evolutionary sequence of crustal and upper mantle stretching that leads to normal faulting resulting from extension. Rift basins, as a distinct geological category, account for only about 5% of the area of basins of the world, however understanding rift systems helps to unravel a very large portion of the earth's geology. Rift basins also occur throughout the geological record with examples from the Palaeozoic, Mesozoic and the Cenozoic.

In addition to rift basins being the foundation of much of the geological history of the earth they are additionally extremely attractive areas for hydrocarbon accumulations. Despite their relatively small geographical distribution they are known to account for 12% of the known oil reserves.

This Seismic Interpretation & Basin Analysis of Rift Basin Systems training course will establish the tectonic setting, the structural style the stratigraphy and the characteristic hydrocarbon production of a typical rift basin. A number of basins have been chosen to illustrate the rift development and they will provide study examples for workshop sessions these include the classic Gulf of Suez rift representing a Cenozoic rift while the Sirt Basin, Libya represents a Mesozoic rift. Additionally the Gulf of Thailand will be discussed as representing a mainly non marine (lacustrine) rift section.

This training course will feature:

- An introduction to rift basins
- Sedimentary basin types
- Tectonic evolution and the structural setting of rift basins
- Identification of rift phases and the stratigraphy of rift basins
- The development of petroleum systems in rift basins
- Case studies of rift basins including the Gulf of Suez, The Sirt Basin and the Gulf of Thailand

Objectives

By the end of the training course, participants will be able:

- To understand the earth processes that form rift basins
- To be able to identify and interpret on seismic the main structural features characteristic of rift basins
- To be able to interpret the main stratigraphical phases characteristic of a rift basin
- To have an understanding of how petroleum systems develop in rift basins and also the geographical distribution of the main hydrocarbon plays
- Will have developed a good sense of where to go looking for hydrocarbon traps in rift basins

Who should attend?

This BTS training course is suitable for exploration and development geologists, seismic interpreters, sedimentologists, petrographers and other upstream subsurface professionals who are interested in optimally utilizing seismic and geological data in the interpretation of rift basins and for identifying the main hydrocarbon plays.

Course Outline:

Day One: An Introduction to Rift Basins

Competency Description: To be able to fully identify all the features of a modern day rift sequence and to understand how, why and where they form and to be able to recognize the same features in the geological record with the interpretation of both seismic and well data.

Key behaviours

- Understand what the different basin types are
- Identify typical features of a rift system
- Develop 3D visualization skills
- Understand how the present is the key to the past. A study of modern rift systems helps to interpret those represented in the geological record

Topics to be covered

- Outline and overview
- Earth processes that lead to the formation of a rift basin
- A modern day rift development – East Africa
- Typical features of a rift basin
- Multiple rifting phases and superposition
- Outcrop geology and the study of rift basins

Day Two: Tectonic Evolution and the Structural Setting of Rift Basins

Competency Description: To understand the tectonic evolution of rift basins, to be familiar with the typical structural style and the main geometries that are associated with rift basin development.

Key behaviors

- Understand key technical laws and principles
- Identify the main fault styles in rift basins
- Understand the main structural processes that form rift basins
- Identification on seismic of the main hydrocarbon traps that form in rift basins

Topics to be covered

- Crustal stretching models, extension and the development of rift basins
- Identifying the main features of rift basins on seismic
- Fault styles in rift basins and the main hydrocarbon trap types
- Footwall uplift and associated processes
- Hanging wall processes.
- Transtensional overprint and more complex basin development

Day Three: Identification of Rift Phases and the Stratigraphy of Rift Basins

Competency Description: To be able to recognize sequence and seismic sequence boundaries and all clastic systems tracts in a rift basin and to know where these are developed in a typical shelf to basin profile. And also, to be able to integrate all geological data to optimize interpretations

Key behaviours

- Identify key aspects of sedimentary sequences
- Interpret sequences from seismic
- Understand the key controls of basin deposition
- Develop key interpretation skills
- Able to recognize all of the systems tracts and to know where these develop in a typical shelf to basin transect

Topics to be covered

- Pre-rift, syn-rift and post rift development and identification
- Controls on rift basin stratigraphy
- Sequence stratigraphy and seismic sequence stratigraphy in rift basins
- Using integrated well log data to identify different rift phases
- Seismic facies and sedimentary systems in rift basins
- The use of applied biostratigraphy in rift systems for age dating, correlations and palaeoenvironmental interpretation

Day Four: The Development of Petroleum Systems in Rift Basins

Competency Description: To understand the main features of the petroleum systems that are developed in typical rift basins from hydrocarbon source rock presence and distribution to reservoir and seal development. And also, to be able to identify the main hydrocarbon trap styles that are developed in rift basins and where to find them.

Key behaviours

- Develop seismic interpretation skills
- Improve 3D visualization skills
- Understand the process of how to explore in a rift basin
- Identify the key hydrocarbon trap types developed in rift basins and also to know where to find them

- Identify good quality hydrocarbon source rocks from well log, seismic and also geological data
- Determine from geological and well data whether source rocks are mature for hydrocarbon generation

Topics to be covered

- Hydrocarbon source rock development and distribution in rift basins
- Migration of hydrocarbons in rift basins
- Reservoir presence and development in rift basins
- Structural, stratigraphic and combination traps where to go looking for oil in rift basins
- The use of seismic attributes to explore in rift basins and the pitfalls
- Seal presence and hydrocarbon seal integrity
- The use of basin modelling in rift basins

Day Five: Case studies of Rift Basins

Competency Description: To be able to identify worldwide where the different rift basins are located through case studies of typical rift basins to develop interpretation skills and further understanding that can then be applied in exploring for oil and gas in other similar basins.

Key behaviours

- Develop seismic interpretation skills
- Understand how to fully integrate seismic and geological data
- Develop exploration skills in searching for oil and gas in rift basins
- Understand exploration risk in rift basins using real examples
- Understand data challenges for exploration in rift basins using real examples

Topics to be covered

- The distribution of rift basins in the world
- The different types of rift basins marine, lacustrine and aulacogens
- The Gulf of Suez, Egypt
- The sedimentary basins of Libya ages and styles
- The Sirt Basin, Central Libya
- The Gulf of Thailand, a lacustrine rift basin