SEISMIC DATA INTERPRETATION

GEP004

COURSE DESCRIPTION

Seismic data, in particular 3D seismic data, is a mainstay of the petroleum industry. Seismic data are used by geophysicists, geologists and engineers alike to image subsurface structure and stratigraphy, identify hydrocarbons, and thereby generate drilling prospects and effectively drain oil and gas reservoirs. Achieving an understanding of all of the methods and concepts used during the interpretation process can be a daunting task. A partial list of disciplines incorporated into a complete interpretation includes rock physics, signal processing, wireline log analysis, computer visualization, structural geology, stratigraphy and petroleum engineering.

COURSE GOAL

To enhance the participants' knowledge, skills and abilities necessary to gain a practical knowledge and understanding of the techniques and concepts used in the seismic interpretation process, this course provides a thorough introduction covering all aspects, from the fundamentals of the seismic method to mapping and the use of seismic attributes.

COURSE OBJECTIVES

By the end of this course, participant will be able to:

- Explain fundamental aspects of seismic wave propagation, diffractions, and reflection criteria.
- Compare 2D and 3D seismic acquisition techniques; evaluate key survey requirements necessary to achieve project objectives.
- Assess the importance of key seismic data processing steps including datum and statics corrections, velocity analyses, migration and depth imaging.
- Contrast 2D and 3D seismic data benefits, recognize common imaging pitfalls.
- Explain how prospect risk factors can influence project objectives and interpretation workflows.
- Demonstrate practical interpretation skills; construct and use synthetic seismograms, perform well-seismic ties, 2D line correlation, horizon and fault identification, seismic picking and basic mapping.
- Compare seismic time-to-depth conversion techniques and recognize the advantages and disadvantages of different methods.
- Determine factors affecting seismic resolution at the reservoir scale.
- Differentiate the various types of seismic attributes available and select appropriate attributes for a given project.
- Demonstrate the relationship between mapping exercises on paper and modern workstation practices.

- Apply basic stratigraphic seismic interpretation skills including identification of major sequence boundaries, and also 3D stratigraphic slicing to map channel reservoirs.

WHO SHOULD ATTEND

Geologists, geoscientists and petroleum engineers.

COURSE DURATION

5 Working Days

COURSE OUTLINES

1. Prospect risk factors influencing interpretation workflows

2. The seismic method
   - Rock properties.
   - Wave propagation, reflectivity, impedance.
   - Data acquisition – Land and Marine.
   - Exercises; reflection coefficients, time/depth domains, mapping.

3. Seismic data processing overview
   - Conventional pre-stack processing and CMP gathers.
   - Post-stack processing.
   - Seismic migrationd. Exercises; datum statics, migration.

4. Calibration methods (well-tie)
   - Velocity surveys.
   - Sonic logs.
   - Synthetic seismograms.
   - Exercise; Seismic well tie.

5. Vertical Seismic Profiles
   - Exercise; VSP correlation to 3D surface seismic.

6. Structural Interpretation
   - Structural styles.
   - Fault interpretation.
   - Exercise: Fault plane interpretation.
   - Horizon interpretation techniques.

- Horizon attributes.
- Exercise: Structure mapping.
- Validation methods.
- Interpretation pitfalls.
- Exercises: Compressional tectonics.

7. **Attributes for lithology, fluids, and rock mechanics**
   - Acoustic impedance and inversion.
   - AVO and Elastic seismic response.
   - Pore pressure effects on velocity.
   - Interpretation tools for Unconventional Reservoirs.
8. **Modeling and Depth conversion tools**
   - Types of velocity information.
   - Depth conversion methods.
   - Exercise: Velocity model building.
   - Workflow: Depth conversion using 2-layer model.
   - Image ray map migration.
   - PreStack depth migration.
9. **Validation using 2D modeling, ray tracing, and full waveform modeling**
10. **Project planning**
    - Interpretation techniques.
    - Issues to consider when building a project on the workstation.
11. **Stratigraphic interpretation of seismic data**
    - Sequence stratigraphy.
    - Seismic facies identification.
    - Exercise: Seismic stratigraphy.
    - Seismic tuning amplitudes and isochron mapping.
    - Exercise: Mapping reservoirs using stratigraphic slices.
    - Spectral decomposition.
    - Visualization tools.