



N519: Introduction to Seismic Interpretation and Reservoir Characterization

Instructor(s): John Randolph

3 Days

Competence Level:
Foundation



Classroom Course

Summary

After reviewing the fundamentals of seismic wave propagation, data acquisition, and image processing, participants will learn seismic interpretation workflows that will enable them to quickly and efficiently evaluate the resource potential of large 2D and 3D data sets. Specialized workflows covering AVO analysis, time/depth conversion, and estimation of reserve potential are also included. Participants will acquire the skills necessary to perform property evaluations in data rooms as well as the advanced skills necessary for reservoir characterization. Course materials include case studies of both conventional and unconventional reservoirs.

Learning Outcomes

Participants will learn how to:

1. Explain the fundamentals of seismic wave propagation and factors affecting resolution at the reservoir level.
2. Calibrate seismic data using well data.
3. Communicate effectively with data acquisition and processing specialists.
4. Execute an effective interpretation workflow for a 2D seismic project.
5. Apply interpretation fundamentals to design a 3D workflow on a workstation.
6. Utilize multiple offset volumes to perform reconnaissance AVO analysis.
7. Apply basic seismic sequence stratigraphic interpretation principles.
8. Perform time-to-depth conversions using simplified velocity models.
9. Utilize common seismic attributes to characterize reservoirs.
10. Generate volumetric estimates of recoverable reserves (EUR).

Duration and Training Method

This is a three-day classroom which will include a mix of lectures (65%) and hands-on exercises (35%). The class is also available via five interactive online sessions (four hours each). Printed exercise materials can be mailed to participants, and several mapping exercises may be completed by participants off-line.

Who Should Attend

The course has been designed for early career geoscientists and technical support staff who work with seismic data. This class would also enable engineers and managers to interact effectively with geoscience teams, and to establish realistic expectations regarding decisions to invest in seismic data.

Prerequisites and Linking Courses

A general geological background and some familiarity with oil and gas industry terms and practices are assumed. N519 also provides the foundation necessary for other geophysics courses such as:

N004 (The Essentials of Rock Physics for Seismic Amplitude Interpretation)

N485 (Advanced Seismic Interpretation)



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N049 (Seismic Attributes for Exploration and Reservoir Characterization)

Course Content

Workflow training begins with the calibration of seismic data, the establishment of correlation loops, and structural contouring. More advanced workflows including depth conversion and the practical application of AVO using multiple offset volumes will be demonstrated. Direct hydrocarbon indicators and basic principles of seismic sequence stratigraphy will also be discussed during the course of the lectures and exercise sessions.

Day 1

- What is seismic data? What can it do? What are its limitations?
- Introduction to seismic wave propagation and elastic behavior of rocks.
- How is seismic data recorded?
- What is required to generate useful subsurface images?
- What can go wrong?
- The interpreter's role in working with acquisition and processing specialists
- **Seismic Well Tie Exercise:** Using synthetic seismograms or VSPs

Day 2

- A practical 2D seismic interpretation workflow
- Understanding the geology of a project
- Identifying critical geologic risk factors
- **Interpretation Exercise:** Constructing an interpretation baseline for a project
- **Interpretation Exercise:** Tying interpretation loops for multiple horizons
- **Interpretation Exercise:** Constructing a lineament map to guide the interpretation
- **Interpretation Exercise:** Generating a structure map
- **Interpretation Exercise:** Construction and use of isochron maps
- **Interpretation Exercise:** Using 3D time slices to validate an interpretation
- A simplified approach to time/depth conversion

Day 3

- A 3D interpretation case history
- **Interpretation Exercise:** Using time slices to validate an interpretation.
- Using stratal slices to characterize a reservoir
- Useful seismic geometric attributes
- Reservoir Characterization: What rock parameters can seismic "see"?
- **Interpretation Exercise:** Use of direct H/C indicators to estimate reservoir size
- Seismic inversion tools
 - Seismic inputs to geocellular modeling
- AVO Interpretation workflows using multiple offset volumes
- Unconventional Reservoirs



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- Tomographic velocity models and reservoir stress
 - Fracture characterization tools
 - Benefits and limitations of using fiber optics sensors
 - Can seismic data image stimulate rock volume?
 - Wrap-up discussion