N040: Interpretation of 3D Seismic Data

Instructor(s): Alistair Brown / Rachel Newrick

4 Days	Competence Level: Skilled
Classroom Course	

Summary

This course is designed to give a broad-based knowledge and understanding of the key seismic interpretation techniques relevant to subsurface analysis. The nature of the seismic response will be considered, with reference to both structural evaluation and to methods for stratigraphic analysis. The analysis of fluid types within the pore spaces will also be considered, along with attribute analysis and display techniques.

Learning Outcomes

Participants will learn to:

1. Evaluate more effectively their seismic datasets and what interpretation is possible.
2. Perform the principal seismic interpretational techniques for structural, stratigraphic and reservoir scale evaluation.
3. Assess the importance of key seismic data characteristics, such as resolution, phase, wavelet shape, dynamic range and processing artefacts.
4. Manage the main facets of structural interpretation, such as correlation, tracking, slicing, composite and volume displays.
5. Appraise the forms of stratigraphic interpretation within a 3D seismic dataset and demonstrate the leading techniques for the extraction of stratigraphic information, such as horizon slices.
6. Judge the main limitations of seismic display, specifically colour, phase, polarity and resolution and how they may be overcome and harnessed to elucidate further detail in a dataset.
7. Assess the multiplicity of hydrocarbon reflection characteristics, enabling more hydrocarbon reserves to be found through seismic interpretation.
8. Perform those techniques and understand the limitations that allow the seismic method to be pushed to the reservoir scale.
9. Evaluate the range of seismic attributes and establish how to select the correct one for the problem at hand.
10. Manage the use of 3D seismic data in the reservoir evaluation process and examine how to determine such reservoir properties as net-to-gross ratio, net pay, porosity and pore volume.

Duration and Training Method

A four-day classroom course in Europe and the USA. Occasionally runs as a five-day classroom course in some locations. The course comprises of a mixture of lectures, case studies and classroom exercises.

Who Should Attend

Graduate-level geophysicists and geologists, as well as more experienced subsurface professionals from other disciplines who require a working knowledge of seismic interpretation techniques.

Prerequisites and Linking Courses

For those with little knowledge of the seismic method, N080 (Geophysics for Subsurface Professionals) is recommended as a precursor. N085 (Introduction to Seismic Interpretation) covers the fundamentals of seismic interpretation including paper based exercises on 2D data and project management issues and is recommended as a precursor for those with little experience of interpretation methods. Other seismic

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interpretation courses of benefit to more skilled geoscientists include N255 (An Integrated Approach to 3D Seismic Interpretation) and N074 (Geological Seismic Interpretation Field Seminar: Compressional Systems - Montana, USA). For other Geophysics and Seismic Interpretation courses offered by the Nautilus Training Alliance, please consult the Geophysics and Seismic Interpretation Subject Matter Competency Map on the website.

Course Content

This course is designed to give a broad-based review of the key seismic interpretational techniques relevant to subsurface analysis. The nature of the seismic response will be considered with reference to both structural evaluation, and methods for stratigraphic analysis. The analysis of fluid types will also be considered, along with attribute analysis and display techniques.

Introduction

Vertical seismic resolution, the two resolution limits, the seismic wavelet, importance of amplitude and phase control, dynamic range, horizontal seismic resolution, Fresnel zone, seismic migration, regularity and acquisition footprint.

Structural interpretation

Slicing the cube, time (or depth) slices and their importance, fault handling, contouring exercise, structural case histories, interpretable structural detail, composite and volumetric displays, phase sections, subtle faults and their detection, coherence, autotracking and its precision, time-derived horizon attributes, tracking validation, generalized procedure, interpretation confidence.

Stratigraphic interpretation

Recognition of characteristic shapes, importance of strike view, channels, bars, levees, dunes and carbonate features, resolution limitations, horizon slices and their methods of construction, reconstitution of depositional surfaces, stratigraphic patterns to verify structure, unconformities, turbidite mapping exercise.

Colour and phase

Limitations of conventional display, colour principles, contrasting and double and single gradational schemes, visibility of amplitude detail, scales, recognition of data phase, data polarity, natural pairing and phase circles.

Reservoir identification

Bright spots, dim spots, phase changes, flat spots and their necessary characteristics, impact of colour, amplitude and display scales, use of top and base reflections and spatial relationships. Tuning phenomena in reservoir reflections, importance of zero-phaseness and knowledge of polarity, approach to validation, reservoir limits, occurrence of fluid effects, reservoir identification exercise.

Attributes

Classification, amplitude-derived and frequency-derived horizon attributes, windowed attributes, hybrid attributes, 3D AVO.

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Reservoir evaluation

Properties affecting amplitude, interpretation regimes, well calibration, composite amplitude, mapping of porosity, net-to-gross and net pay thickness, tuning estimation and removal, pore volume, case histories.