

# Structural Geology in Seismic Interpretation

## by Shankar Mitra, University of Oklahoma

The course is designed for geophysicists working on seismic interpretation of complex structures, who need to understand the seismic expression of structures in petroleum basins, and correctly apply structural models and techniques to seismic interpretation.

### Date

20-23 July 2020

### Duration

3 days (4 hours per day)

### Timing

1100 - 1500 hours - Eastern Australia

1000 - 1400 hours - Japan/ South Korea

0900 -1300 hours - Malaysia/Beijing/Hong Kong/Singapore/Western Australia

0800 - 1200 hours - Indonesia/ Thailand

0630 - 1130 hours - India

19-22 July: 2000 - 0000 hours (US CDT)

### Intended Audience

Intermediate level

**Prerequisites (Knowledge/Experience/Education required)**

This course is designed for geoscientists working on interpretation and processing of seismic data. A general background in structural geology and geophysics is the only pre-requisite.

## Course Summary

The course discusses the geologic and seismic expression of common structural styles in extensional, salt, compressional, strike-slip and inversion settings. Characteristic features associated with each of these styles, which can be used to interpret structures, will be presented. Seismic examples of producing structures from numerous basins worldwide are used to illustrate the common styles and their seismic expression. Key pitfalls in seismic and structural interpretation are discussed. Balancing and restoration techniques that are used to validate structural interpretations will be discussed. Problem sets provide hands on experience in interpreting complex structures using seismic and geologic data.

## Course Outline

1. INTRODUCTION
  - Role of Structural Geology in Seismic Interpretation
  - Concept of Comparative Structural Styles
  - Structural Models and Their Use in Seismic Interpretation
  - Role of Balancing and Restoration in Constraining Interpretations
2. COMMON PITFALLS IN SEISMIC STRUCTURAL INTERPRETATION
  - Velocity Effects
  - Seismic Pull ups and Pushdowns
  - Subsalt and Subthrust Interpretation
  - Fault Shadows
  - Steep Dip Imaging
  - Migration Effects
3. FOLDS AND FAULTS
  - Fold and Fault Geometries and their Seismic Expression
  - Fault Map Patterns and Use of Seismic Attributes
4. SEISMIC INTERPRETATION OF EXTENSIONAL STRUCTURES
  - i. Basement-Involved Structures
    - Symmetric Graben-Horst Structures
    - Rotated Fault Blocks and Half-Grabens
    - Drape Folds
    - Map Patterns and Transfer Zones
  - ii. Detached Structures
    - Listric Faults and Rollover Folds

- Synthetic and Antithetic Faults
  - Map Patterns and Transfer Zones
5. SEISMIC INTERPRETATION OF SALT AND SHALE STRUCTURES
- Salt Properties and Related Seismic Expression
  - Salt Pillows, Diapirs, and Bulbs and Canopies
  - Salt-related Faults
  - Salt Sheets and Canopies
  - Minibasins
  - Subsalt Structures
  - Salt and Shale Structures - Similarities and Differences
6. SEISMIC INTERPRETATION OF COMPRESSIONAL STRUCTURES
- . Fold and Thrust Belts
    - Fault-Bend Folds
    - Fault-Propagation Folds
    - Detachment and Faulted Detachment Folds
    - Duplexes and Triangle Zones
  - i. Basement-Involved Compressional Structures
    - First- and Second- Order Structures
    - Types of Basement Structures
7. INVERSION AND STRIKE-SLIP STRUCTURES
- Mechanisms of Inversion and Reactivation
  - Anomalous Separation and Growth Patterns
  - Inversion Geometries and Mechanisms
  - Transpressional Structures
  - Transtensional Structures
  - Releasing and Restraining Bends

Discussion of all structural styles will be followed by case studies of producing structures and interpretation exercises using seismic and other subsurface and surface data.

## Learner Outcomes

1. Correctly interpret structures in compressional, extensional, strike-slip and diapiric environments.
2. Use characteristic features of structures to interpret structures using seismic data.
3. Avoid key pitfalls in the seismic interpretation of seismic data.
4. Use balancing and reconstruction techniques to improve structural and seismic interpretation.

## Instructor Biography

[Dr. Shankar Mitra, University of Oklahoma](#)