Basic Basin Analysis and Geochemistry

Course general description:

The quality of a numeric computer model is highly dependent on the quality of the input data. This 5-days course covers the key aspects of basin analysis and subsequent basin and petroleum systems modeling from input to output. Basin analysis, whether for conventional or unconventional resource play analysis, demands an integrated approach from explorationists. It is both inappropriate and misleading to suggest that the tectonic-thermal-sedimentologic evolution of any one basin is an established fact, or even that all basins submit to the same simple and equivocal models. Therefore, this twenty-day course does not passively present an inventory of basins of the world. Instead, it provides the theory, methods, and active practice for participants to develop and optimize their own individual basin evaluation and modeling modus operandi. Basin evolution beginning with plate tectonics, all the way to petroleum generation and migration will be discussed also. We will look at how risks and uncertainties influence our understanding of the petroleum systems within a basin and how we can quantify those uncertainties. This course also aims to provide the basic geoscience background needed by anyone engaged in petroleum systems modeling. Therefore, it reviews the important control that basin formation and mechanisms have on the petroleum system, examining subsidence, heat flow, structural style, evolution and sedimentation. Global examples of typical basin types are examined with emphasis on the impact that basin style and sedimentation have on the hydrocarbon habitat and prospectivity. Within each basin, depositional systems are reviewed, and the control on reservoir, source, seal and trap are discussed. Attendees will learn what kinds of questions to be asked, what kind of data is needed to build models and solve particular problems and to apply geological reasoning to quantifying uncertainties. It is incorporated as practical problems for workshop analysis and substantial team discussion are case histories and new findings from throughout the world utilizing geologic, and geochemical data sets.

Audience:

This course is designed for:

1. Geologists
2. Petroleum Geologists
3. Geophysicists
4. Wellsite geologists
5. Drilling engineers
6. Stratigraphers
7. Geochemists,
8. Petroleum engineers
9. Production Engineers
10. Petrophysicists.

Course objectives:

By end of the course participants will learn :

- Fundamentals of basin analysis, petroleum systems and play concepts
- Key controls including tectonics, climate and eustacy
- Petroleum systems active on a number of global basins
- Case studies of basin plays how new play types have been developed that have rejuvenated basins, and the flaws of chasing the wrong play, or a step too far
- Key techniques to analyse sedimentary basins including:
  - Source rocks formation, organic matter types, global distribution
  - How to analyse different data types to generate key input data for maturity and migration

modelling
- Hydrocarbon types and distribution
- Controls on migration
- Becoming familiar with basin models and the input data required
- How to calibrate basin models
- Understanding uncertainty and sensitivity of the models
- Introduction to techniques to analyse the petroleum system
- Seals, reservoirs, trap styles
- How to produce Gross Depositional Element Maps
- Common Risk Segment Mapping
  - Basics of how play fairway mapping of the petroleum system elements is used to create play chance maps

- Focusing on the influence of basin formation mechanism on subsequent petroleum systems
- How the mechanism of formation controls the structural style and sedimentary fill.
- Deconstruct a basin through space and time and build predictive basin models useful in exploration
- Evaluate seal/trap quality
- Construct and analyze petroleum events chart
- Classify basins for exploration and development
- Determine within a basin the optimal stratigraphic and spatial location for exploring conventional and unconventional resources

Course duration:

5 days

Course location:

Dubai

Course contents:

Module 1: Introduction to Sedimentary Basins

- Definitions
- Plate tectonics and mechanisms of subsidence
- Basin Forming Mechanisms
  - How are basins formed?
  - Where are basins formed?
- Basin Classification and Structural Analysis
  - Nomenclatures
  - Structural styles within sedimentary basins
- Case studies

Module 2: Basin Types

- Basin analysis techniques (interpretation of seismic and well data)
- Review of basin type by:
  - Extensional / rift basins
  - Compressional / foreland basins
  - Passive margin basins
  - Arc type basins
  - Strike slip basins
- For each basin type the following is reviewed:
  - Structure / tectonic evolution and controls on depositional style
  - Role of tectonics, climate and eustacy
  - Typical facies suites and sedimentary environments

- Typical seismic expression
- Analogue petroleum systems and plays

- Case studies.

Module 3: Sequence Stratigraphy

- Basin fill and accommodation space
- Concepts of Sequence Stratigraphy
- Benefits of Sequence Stratigraphy
- Cycles of relative sea level change
- Hierarchy of sedimentary sequences.
- Depositional system tracts.
- Case studies.

Module 4: Clastic and Carbonate Depositional Environments

- Aeolian environment
- Fluvial – meandering environment
- Fluvial - braided environment
- Shallow marine environment
- Delta - river dominate environment
- Case studies.
- Delta - wave dominated environment
- Delta - tide dominated environment
- Reefs and tidal flat environment
- Carbonate ramp environment
- Deep marine environment.
- Case studies.

Module 5: Thermal Maturation and Modeling

- Thermal Maturation and Generation Potential
- Bio-Markers as maturity indicators and Basin modeling
    - Integration of the previous oil results of the basin and construction of a schematic section illustrating the different "plays" existing in the basin.
- Status of the different “play” in the basin: proven plays, tested dry or conceptual
- Focus on a "play" defined on the seismic line on map at the basin scale ("play" extension map provided).

Methodology:

- 50% lectures & concepts
- 10% Videos
- 20% Case studies
- 10% Exercises
- 10% Discussions

Course code: (TEXP004)