N522: Integrated Charge Access Evaluation: The Key to Successful Exploration

Instructor(s): Leon Dzou & Mark Thompson

Format and Duration

Classroom - 3 Days
Virtual - 5 Sessions

Summary

Charge access considers the journey of expelled hydrocarbon from the source rock into the reservoir of a prospect. It is often a critical, if not the critical, risk to the success of any exploration well. Often the seismic interpreter hands over their maps to the petroleum systems analyst at the last minute, giving no time for the necessary integration. This integration of the geological framework with petroleum systems modelling is key to avoiding drilling dry holes and is the focus of this course. The course presents a rich series of global examples and case histories, taught by two industry experts with over 80 years of experience between them. Participants in this course will learn to integrate the basin-wide regional understanding with prospect evaluation principles in order to more accurately quantify resource estimates and risk in any prospect, ultimately drilling fewer dry holes or underfilled traps.

Business Impact: Does your company drill numerous failures with no shows? Do you consider faults as the main migration route into your prospect? Do you make complex 3D basin models that don't predict the next well result? If so, we have a useful course for you!

Learning Outcomes

Participants will learn to:

1. Understand the science that underpins petroleum migration and accumulation.
2. Understand the impact of the overall tectonic style in different mega-sequence settings, structural relief, and the role of faults and fractures in migration and trapping.
3. Apply the principles to make better predictions of charge access in prospect evaluation.
4. Appreciate a rich variety of case histories from basins worldwide and how they can be applied to your prospect to help understand the risk.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussion, case studies, and practical exercises.

Who Should Attend

This course is aimed at geoscientists working on basin, play fairway, and prospect evaluation with 5 years or more experience working frontier to mature basins. This is an applied and integrated course involving all geoscience disciplines.

Course Content

The course will consider four key factors in charge access:

1. Source rock potential and distribution;
2. Carrier bed extent and distribution;
3. Structural focusing;
4. Structural relief and seal capacity;

N522: Integrated Charge Access Evaluation: The Key to Successful Exploration

Instructor(s): Leon Dzou & Mark Thompson

Format and Duration

Classroom - 3 Days
Virtual - 5 Sessions

The following shows the anticipated schedule of content, which may vary according to the pace of your course and focus of the participants, as well as if any new case studies arise.

Part 1: Source Rock Potential

An overview of the controls on source presence and quality.

- Case history: Gulf of Mexico - the nature and distribution of the various petroleum systems (organo-facies A and B);
  - Exercise: Mensa gas field - did we miss thermogenic oil charge in the mature GoM basin or is the Tithonian source rock not present?
  - Exercise: Are the Gulf of Mexico Norphlet fields sourced from the Smackover?
- Case history discussion: Cooper Basin, Australia (organo-facies D/E);
- Biogenic gas generation processes: An overview of the biological and chemical processes involved;

Part 2: Geological Models (Source-Carrier-Seal Systems)

An overview of secondary petroleum migration principles.

- GDE mapping (clastics and carbonate systems).
  - Exercise: Zohr gas field, Nile Delta Egypt;
- Case history: Pearl River Mouth Basin, South China Sea;
  - Exercise: Where's the oil charge in the South PRMB?
  - Exercise: Liuhua 11-1 field, what are the main factors favouring long-distance transport of petroleum?

Part 3: Migration and Entrapment

- Focussed vs dispersive migration on a basin scale. Downwards vs upwards migration.
  - Case history: (Lateral drainage coupled systems) foreland basin North Slope Alaska;
  - Exercise: Migration blind spots Bintuni Basin, Papua New Guinea;
  - Case history and discussion: (Vertical drainage) petroleum system Marco Polo Field, Gulf of Mexico (charge focus, structural relief and seal capacity, migration time lag);
  - Exercise: W Shetlands Basin Palaeocene discoveries;
- Roles of faults and fractures.
  - Case history: Thunder Horse;
  - Trap configuration concept: Evaluation of the capillary sealing capacity of all the seal rocks (top, bottom, lateral, and fault seal);
  - Case history: Columbus Basin, offshore Trinidad - use of fault-seal analysis in understanding petroleum migration in a complexly faulted anticlinal trap;

Part 4a: Post-Well Evaluation

- Case history: Mexican Ridge undercharged systems v poor regional top seal;

- Case history: Exploration results on the Equatorial Margin. Good discovery rate, but very limited commercial success;
- Case history: Brigadier Trend NW Shelf Australia, followed by a discussion of Ironbark well failure mode;
- Exercise: Good luck, Bad luck and Mukluk;
- Case Histories: Using shows as a smoking gun (Buzzard and Marconi fields, North Sea);

Part 4b: 3D Petroleum Migration Modelling

- Case History: 3D modelling study of the low-permeability petroleum system of the Bakken Formation, Williston basin;
- Discussion: The use of 3D petroleum migration modelling in exploration; How useful are these models in exploration risking and decision making?
- Alternative workflow for petroleum migration modelling: Thinking processes to draw schematic charge cartoon and then test with appropriate software (percolation modelling).

Part 5: Prospect Charge Analysis

- Impact of DHI's on charge access risking;
- Hydrocarbon charge assessment: Procedures for estimating amounts of oil and gas generated, migrated, and trapped in prospects;
- Case history: Great White Field, Gulf of Mexico.
    - Exercise: Biogenic gas charge assessment
- Case history: Frade and Roncador Fields, Campos Basin.
    - Exercise: Using seismic lines to assess Southern Mexico offshore exploratory wells charge access risk.

Concluding remarks and summary of best practice.