

Petroleum Systems Analysis and Modelling

Consultant / Trainer

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The **Petrogenium** (in collaboration with EPTS) **Petroleum Systems Analysis and Modelling** course participants attending this Petroleum System Analysis course will gain a comprehensive understanding of the fundamental elements and processes required to form hydrocarbon-bearing basins, including source rock, reservoir, seal, trap, migration, and timing of hydrocarbon generation. The course provides both theoretical knowledge and practical experience, with half of the program dedicated to hands-on exercises using 1D Petroleum Systems Modelling software to simulate and analyze basin formation, burial, thermal maturity, and migration pathways.



Participants

This **Petrogenium**. course is designed for Geologists and Geophysicists involved in Exploration and Appraisal



Learning Objectives

At the end of the 5-day course participants will have gained basic insight into essential geochemical concepts, and have gained basic skills in applying geochemical tools. Exercises are aimed at reinforcing the acquired knowledge in a practical context. The major interpretation exercises are aimed at providing real hands-on experience. Geologists and geochemists will have learned each other's language.

Course content

- Basins and Petroleum Systems
- Source rock formation processes
- Recognition & evaluation of source rocks
- Maturity
- Basic organic chemistry of oil and gas.
- Geological information from oil & gas analysis.
- Gas geochemistry
- Oil-oil and oil-source rock correlation
- "Oil families": recognizing different charge systems within a single basin.
- Burial history reconstruction
- Heat flow and temperature
- Generation & Migration of hydrocarbons.
- Simple charge prediction
- Surface geochemistry as exploration tool

Programme

DAY 1

General introductions

1. **Introduction and the basics:** a brief introduction of the topics and concepts that will be covered during the course
2. **Risks, Volumes & Uncertainty:** Explanation of how the terms Risk and Uncertainty are used in exploration. Presentation of a practical workflow to assess prospect risks. Introduction to the calculation of prospect volumes, and a discussion of pitfalls and biases in estimation.
3. **Prospects and Plays:** Module to stress the importance of understanding prospect details in the context of basin type and basin development, and of the "play" to which the prospect belongs.
4. **Prospects and portfolios:** Different prospect categories (near-field, proven play, greenfield, etc) followed by a discussion of ranking criteria for prospects.

DAY 2

Recap Day 1

1. **Traps:** the main uncertainty in assessment of prospect volumes is the uncertainty of the gross rock volume. The importance of recognizing potential spill- and leak-points that may control the HC-water contact is stressed. A "read thread" prospect is introduced followed by an exercise to identify potential spill- and leak-points
2. **Traps in important HC provinces:** examples of working traps in rift basins, sag basins, passive margins, deltas, deep water settings and carbonate settings
3. **Reservoirs:** explanation of the main reservoir parameters (thickness, N/G, porosity, permeability and reservoir geometries. Modern probabilistic volume assessment tools make it possible to input detailed reservoir data. We will discuss cases where detail is essential, and cases where it is not. Correlation (dependency) between reservoir input parameters, and its effect on calculated volumes, will be discussed
4. **Reservoirs in important HC provinces:** examples of reservoirs in different basin types and depositional settings of around the globe: rift basins, deltas, deep water settings, carbonate provinces

Programme

DAY 3

Recap Day 2

- 1. Seals:** In exploration, seals are often not given the attention they deserve. Mechanisms of leakage will be discussed: permeability seals, hydraulic fracturing of seals. The role of seals in the differential entrapment of oil and gas will be discussed. Fault seal mechanisms are presented with an exercise to calculate Clay Smear Potential (CSP) at several points along a fault plane.
- 2. Pressures and overpressures:** Pressure gradients and how they can be used as an indication to determine fluid contacts in traps. Mechanisms of overpressure development, and the provinces where they typically occur are presented. A discussion of the meaning of the fracture gradient and Leak-off Pressures follows.
- 3. Seals & Pressures in important HC provinces;** Examples of working seals in a range of different basin types and settings from around the globe, with examples of cases where seals are breached and of cases where differential leakage of gas has allowed oil to be trapped, despite abundant gas charge.
- 4. Charge:** The conditions under which source rocks can be deposited and preserved in the subsurface as well as the different source rock types (I, II and III) and their typical expulsion products are discussed. There is an exercise on constructing a burial diagramme, and the effect of inversion (uplift and erosion) on hydrocarbon charge is explained.

DAY 4

Recap Day 3

- 1. Charge in important HC provinces:** Examples of charge in different basin types and depositional settings from around the globe. Includes an exercise on predicting source rocks from a regional seismic section.
- 2. Risk assessment - practical group exercise:** The read thread prospect that has been introduced earlier will be used for assessment of the chance factors for trap, reservoir, seal and charge. The exercise is designed such that several practical every-day issues will come up in discussion. **Volume assessment - back-of-the envelope calculation:** this is a short session where the participants are asked to calculate "on the back of an envelope" low, most likely and high volumes of a prospect. The objective of this module is to take away the "black box" feeling that our probabilistic volume assessment tools may bring.
- 3. Volumes and Portfolios:** An explanation in a practical manner how prospect volumes can be added. Some mistaken, but common, practices will be highlighted. Prospect dependencies and their effect on prospect additions will be discussed.

Programme

5 DAY Course

Recap Day 4

1. Exploration economics: An introductory module on exploration economics with an explanation of the main factors that control the economic viability of prospects, and of the terms Net Present Value (NPV) and Expected Monetary Value (EMV). The module includes an exercise on calculating the EMV of a prospect.
2. Geophysical evidence: The presence of "Direct Hydrocarbon Indicators" (DHIs) may provide good evidence that trapped hydrocarbons are present. In this module pitfalls are explained (with real examples) and an approach for determining an increase of the Probability of Success (POS) is presented. The module also touches upon the impact of Controlled Source Electromagnetics (CSEM) on prospect POS.
3. Local prospect examples: In this module participants have an opportunity to bring in examples of prospects that they may be working on, to discuss specific risk and volume assessment issues in the light of what has been learned. In particular for in-house courses this may be a good opportunity to bring the main learnings into practice.
4. Look backs: A short module on how pre-drill predictions can and should be compared with post-drill well findings. It is stressed that we can only improve our pre-drill predictions if we know if there is any bias in our predictions.

Why select Petrogenium.?

The above support will be provided by principal consultants with 30+ years world-class experience in the technology and hands-on know-how from operation of refinery units.

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