EGI Energy & Geoscience Institute
AT THE UNIVERSITY OF UTAH

Since 1972

TRAINING COURSES

Petroleum Systems Analysis: An Introduction

Available to EGI Corporate Associate Members

Instructor:

Ger van Graas, Ph.D.
Senior Affiliate Scientist

ContactEGI@egi.utah.edu

Course Structure

Classroom lecture plus exercises & presentation materials

Duration

2 to 4 days
(Based on Member)

Location

EGI's Salt Lake facilities or Member's location

OVERVIEW

The course offers an introduction to Petroleum Systems Analysis (PSA). After discussing source rock deposition in different sediment environments, much attention is given to the process of thermal maturation resulting in the generation and migration of oil and gas. After a review of basic source rock analytical methods, the use of these is exemplified in a few exercises.

Analytical techniques for oil, gas and source rock extracts are discussed with a focus on how these can be applied to solve geological issues, e.g. oil quality changes due to in-reservoir processes.

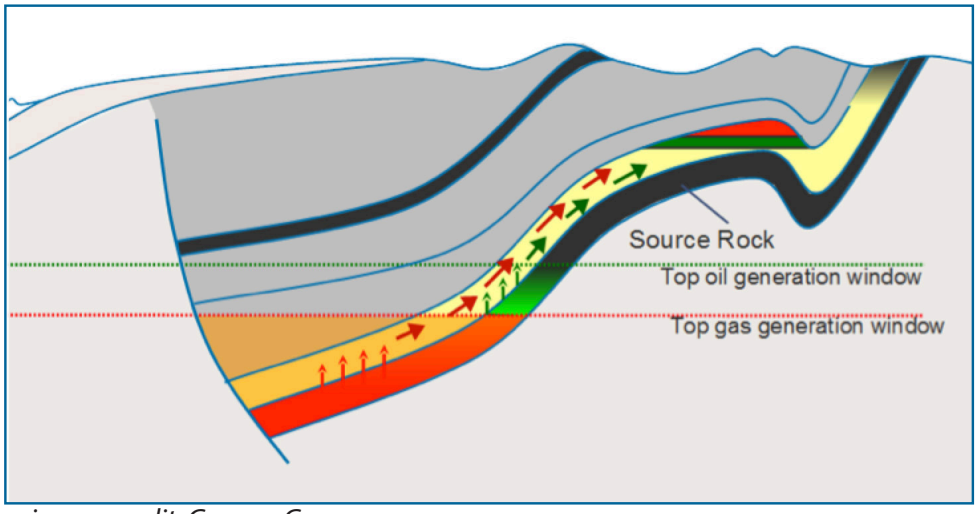

image credit: Ger van Graas

Basin modelling techniques are presented at a general level with much attention to the input required and the results that can be expected. Uncertainty in basin modelling is visualized in an exercise.

A separate module puts together the different ways in which Petroleum Systems Analysis can be applied in frontier basins.

Several optional modules are available covering topics such as Surface Geochemistry, Sample Contamination by Drilling Mud, Oil-Source Rock Correlation on a Basin Scale and Geochemistry in Unconventional Resource Plays.

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The course is to a large extent aimed at exploration settings but also covers applications at a smaller scale. Although a range of basic concepts and processes are presented, the overall approach of the course aims to highlight when and how Petroleum Systems Analysis can contribute to the resolution of geological issues.

Objectives

At the end of the course participants should have a basic understanding of concepts and techniques used in Petroleum Systems Analysis. They will be able to perform basic evaluations on their own but – more importantly – they will be informed customers able to participate in the planning and interpretation of specialist projects.

Target Audience

The course is designed for professionals working with subsurface issues in the petroleum industry with a focus on exploration. It is suited for early career professionals or those who have recently completed education but have a few years' experience to provide a foundation for increased understanding.

Topics Covered (can be tuned to Sponsor request)

1. Introduction to Petroleum Systems Analysis
2. Source Rocks:
    a. Organic matter in sediments: quantity and quality
    b. Organic matter input: importance of productivity
    c. Depositional setting and kerogen type
    d. Organic matter preservation: processes and controls
    e. Source rock distribution in geological time*
    f. Models for source rock deposition
        - Marine source rocks: stagnant basin and oxygen-minimum layer
        - Carbonate source rocks
        - Lacustrine source rocks
        - Terrestrial source rocks (oil from coal)
    g. Kerogen types, link to organic matter input; organofacies classification
    h. Thermal maturity and petroleum generation: introduction
    i. Transformation Ratio (TR)
        - TR vs temperature, depth or age
        - TR curves for different source rock types
        - Changing composition of generated material during maturation
    j. Expulsion and migration
3. Analytical methods for source rock analysis
4. Expulsion and Migration

5. Oil and Gas
    a. Properties, bulk & detailed
    b. Differences based on OM type and maturity
    c. In-reservoir transformations, e.g., biodegradation
    d. Oil(gas)-oil(gas) and oil(gas)-source correlations
    e. Origin of non-hydrocarbons
6. Basin Modelling
    a. Introduction incl. 1-D vs. 2-D vs. 3-D
    b. Required input
    c. Expected output, including uncertainty
7. PSA in Frontier Basins
    - Surface Geochemistry
8. Sample quality issues, including mud contamination

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Research Interests

General Petroleum Geochemistry and Basin Modelling

Surface Geochemistry / Remote Sensing

Petroleum Biomarkers

Gas Generation and Typing

Interaction of Organic Geochemistry with other Disciplines

Effects of Drilling Fluids on Data Quality

Frontier Exploration

Unconventional Hydrocarbon Resources, in particular Shale/ Tight Oil & Gas

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Ger Van Graas, PhD

Affiliate Scientist

Dr. Ger Van Graas has more than 30 years of experience in the petroleum industry. After completing a Ph.D. on 'Organic Geochemistry of Cretaceous Black Shale Deposits' at Delft University of Technology in 1982, Ger worked at the Continental Shelf Institute in Trondheim, Norway, and at Shell's E&P Research Centre near The Hague, The Netherlands, before joining Statoil in Norway in 1991. He has held a variety of positions, most recently as a senior specialist in geology/ petroleum systems analysis and advisor for the VP of new exploration access. Since his retirement from Statoil in March 2016, Ger has been working as an independent consultant.

During the first part of his career, Ger mainly worked with providing organic geochemical support to exploration and production activities, but after 2000 he became more involved in general frontier exploration, particularly in the Caspian region and in North Africa. Since 2008, much of his time has been spent on assessment of new unconventional resources all over the world with a focus on China, Russia and Australia.

In his role as senior specialist/advisor, Ger has been involved in QA/QC activities, establishment of steering documents and best practices, and in providing advice to exploration management on strategy and specific projects.

Ger has been a board member of the European Association of Organic Geochemists (EAOG) between 1999 and 2011, the last four years as chairman. He is a member of the American Association of Petroleum Geologists (AAPG) & Energy and Mineral Division (EMD).

Selected Publications Since 2000:

Tan J., Horsfield B., Fink R., Krooss B., Schultz H.M., Rybacki E., Zhang J. Boreham C.J., **Van Graas G.** and Tocher B.A. (2014) Shale gas potential of the major marine shale formations in the Upper Yangtze Platform, South China, Part III: Mineralogical, lithofacial, petrophysical and rock mechanical properties. Energy Fuels 28, 2322-2342.

Van Graas G., Mørk G., Scotchman I., Murray J., Atterton L. and Forslund T. (2011) Night-time hunting for furtive animals: data availability challenges in international exploration for partially understood shale resource plays. Search and Discovery #90122 (Abstract).

Van Graas G., Abrams M., Bilbo M., Narimanov A., Crisp and Piggott N. (2004) The use of integrated seepage detection tools in the South Caspian. Search and Discovery #90024 (Abstract).

Van Graas G., Scotchmer J., Rornes A.E. and Husmo T. (2003) Multiple petroleum systems in the Caspian region: implications for prospectivity evaluation and oil quality prediction. AAPG Annual Conference, Salt Lake City 2003. Search and Discovery #90013 (Abstract).

Crossley R., Essiane Essone J.Y., Wubben T. and **Van Graas G.** (2001) Filtrate invasion, barite "sag" and grain crushing by cutter impact - experimental wellbore damage. SPE Europe Formation Damage Conference, The Hague 2001. SPE 68966.