Petroleum Geochemistry & Basin Evaluation
Available to EGI Corporate Associate Members

OVERVIEW
This course is an introduction to petroleum geochemistry concepts and applications for basin-scale evaluations. It begins with a review of source rock formation and covers source rock description using qualitative and quantitative methods. The main focus of the course is basin-scale evaluation using basin modeling integrated with diverse geochemical datasets. Students will learn to calibrate basin models using source rock datasets, increase model precision with source rock kinetics data, integrate oil data (i.e., biomarkers) as well as gas data (i.e., isotopes) into the regional model and interpretation. The basin modeling discussion will include issues of migration and charge history. The course covers standard interpretations of rock, oil, and gas data in conventional and unconventional systems. Ancillary geochemical techniques (e.g., surface geochemistry, thermochronology) are described for the participants. The class concludes with an interactive working session where the students and the instructor evaluate host company data collaboratively.

OBJECTIVES
At the end of this course participants should have a knowledge base and workflow to approach simple, basin-scale geochemical problems. The student will leave the short course with an overview of the techniques available, their applications and caveats to their use. The course includes a reference list of essential papers for each of the techniques covered.

TARGET AUDIENCE
This course is designed for petroleum geologists with little exposure to geochemistry, geochemists with experience in conventional but not unconventional petroleum systems, and geochemists and geologists new to basin modeling and regional exploration. The instruction is systematic and recursive to provide repeated exposure to fundamental concepts during the course work and collaborative interpretation sessions.

Instructor:
David Thul, M.Sc.
Manager of Petroleum Geochemistry

Course Structure
Lectures, presentation materials, workbook

Participants
10 – 25 persons

Duration
3 days

Location
EGI’s Salt Lake offices or CA location

Nancy Taylor, Contracts & Assistant Business Manager
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THREE DAY COURSE SCHEDULE

MORNING 1

Origin of Source Rocks
1. Carbon Cycle
2. Diagenesis
3. Thermal Stress

Describing Source Rocks

Qualitative
1. Kerogen Type – Visual Kerogen Analysis
2. Maturity – Coloration Indices

Quantitative
1. Kerogen Type – Elemental Analysis (van Krevelen)
2. Kerogen Type – Pyrolysis (Pseudo van Krevelen)
3. Maturity – Vitrinite Reflectance (Ro)
4. Maturity – Pyrolysis (Tmax)
5. Quality – Pyrolysis (Hydrogen Index)
6. Quality – Combustion (Total Organic Carbon)
7. Issues of Nomenclature – Chemical vs. Depositional Setting vs. Organic Material

AFTERNOON 1

Basin Modeling
1. Approaches – 1-D and 3-D which to use and why
2. Approaches – Geologically Accurate Models vs. Output Accurate Models
3. Basin Modeling Workflow – How to build a model
Example of a 1-D Basin model near the axis of a foreland basin. The increasing maturity during tertiary exhumation is due to increased heating associated with basement activity.

MORNING 2
Basin Modeling Continued
1. Basin Modeling Workflow - How to calibrate a model
2. Basin Modeling Workflow – Using porosity data in basin modeling
3. Basin Modeling Workflow – Oil and gas data integration
4. Basin Modeling for Charge and Migration Assessment
5. Cautions about Regional Modeling

AFTERNOON 2
Biomarker Interpretation in Conventional & Unconventional Systems
1. Depositional Environment
2. Migration Analysis
3. Maturity Indicators
5. Conventional System Examples
6. Unconventional System Examples
MORNING 3

Other Geochemical Techniques

1. Surface Geochemistry
2. Gas Isotopes
3. Thermochronology
4. Clay Chemistry

COLLABORATIVE INTERPRETATION SESSION

(Continue to end of day.)
David Thul
Manager of Petroleum Geochemistry

David is a petroleum geochemist and geologist with experience in unconventional petroleum exploration across North America. He has worked with a range of clients from two-man exploration and production companies to some of the largest unconventional petroleum producers in the United States. His work experience covers 19 sedimentary basins in North America with particular expertise in Cretaceous source rocks of the Rocky Mountain Region and Gulf Coast as well as Paleozoic source rocks of the Rocky Mountain Region and Canada. As Manager of Petroleum Geochemistry David’s experience will be applied globally across a wide range of EGI projects.

As a petroleum geoscientist, David’s focus is to evaluate and understand source rock maturity in the context of a basin’s stratigraphic and tectonic evolution. David’s geochemical specialty is Rock-Eval™ and SRA™ pyrolysis and he also has experience interpreting biomarker, vitrinite reflectance, and gas isotope data. David has worked extensively in 1-D and 3-D basin modeling to predict hydrocarbon charge and phase.

David earned a B.A. in Geology from the University of Colorado at Boulder and a M.Sc. in Geology from the Colorado School of Mines. At CU, his focus was on numerical modeling of earth systems. David’s M.Sc. thesis research at CSM was on the maturity of the Niobrara Formation in the Denver Basin. While at Mines, he managed the Source Rock Analyzer Lab and collaborated on multiple projects across the Rocky Mountains.

David is currently working towards a Ph.D. in Geology at the Colorado School of Mines. His dissertation project, a characterization of the geochemistry of the Uinta Basin petroleum systems with emphasis on the Green River unconventional play, is funded by the Green River Research Consortium.

At EGI, David is developing a research program focused on optimizing the search for, and production of petroleum. His research interests pertain to the generation, expulsion, and migration of petroleum. Heading up EGI’s Petroleum Geochemistry group, David will lead fundamental research about the process of petroleum evolution (e.g. quantifying the effect of organic matter on petroleum fluid retention and migration within source rocks) as well as applied research (e.g. defining the geochemical prerequisites for successful unconventional petroleum systems) through the combination of high-resolution geochemical measurements, basin scale datasets, and integrated information about structure, stratigraphy, and basin history.

David is the lead geochemist on major EGI international projects in South America, Central Eurasia and China. In the coming year, he will be developing EGI’s role in the shale systems of Australia. His experience in North American shale systems will guide geochemical assessments in each of these regions, ensuring their resources can be accurately compared to in-production analog systems.

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Research Interests
• Source rock maturity and basin evolution
• Hydrocarbon charge history and phase prediction
• Petroleum migration in unconventional systems