BIOMARKERS ANALYSIS & APPLICATION TO E&P

7 November—11 November 2016
Kuala Lumpur, Malaysia
**Course Overview**

This course is developed to better equipped attendees to interpret biomarker geochemistry data and reports that use such data. They will also be able to make informed decisions relating to the commissioning of sampling/analysis for biomarker data, and understand the questions that biomarker geochemistry can provide answers to.

**Using p:IGI-3 Software**

This course will provide temporary licenses (on USB sticks) for the p:IGI-3 geochemical interpretation software for use during the course.

**Includes Specific and Practical Case Studies**

Numerous examples and case histories are included in the course, and it is encouraged for client to consider the inclusion of their own data into the course program lecture.

This program will present a detailed understanding of how to apply biomarkers in petroleum geochemistry, including various challenges in their use, drawing on extensive experience and case studies from around the world, including examples from SE Asia.

**How Does This Course Benefits You?**

**Familiarize with the Types of Data Used**

Overcome the barriers of complex biomarker terminology to become familiar with the types of data of use in petroleum geochemistry.

**Understand Biomarker Types and Ratios for Interpretation of Oils**

Understanding of the wide range of biomarker types and ratios, and how they are used, particularly for the interpretation of oils.

**Gain Confidence in Biomarker Data Application**

Becoming confident in the use of biomarker data, including interpretation software and techniques.

**Understand, Analyse and Apply Oil Correlations**

Developing an ability to both understand how oil correlations are done, and to be able to use biomarkers in oil-oil correlation.

**Learn What Types of Samples and Data would be Most Useful for E&P**

Understand what types of samples and data would be most useful for different applications/questions in various aspects of petroleum exploration.
PetroSync Distinguished Instructor

Dr. Paul Farrimond
Director & Geochemical Consultancy Manager

Practical & Consulting
Dr. Farrimond has a particular expertise in the molecular composition of oils and their source rocks, and especially in biomarker geochemistry. Prior to joining IGI, Dr. Farrimond was a lecturer then Senior Lecturer in Geochemistry. In the last 11 years, he has conducted specialist molecular geochemistry consultancy projects for a large number of oil companies focused on petroleum systems all around the world.

Training Experience
Dr. Farrimond was a University Lecturer/Senior Lecturer for 17 years from 1988, giving courses mainly in petroleum geochemistry. At IGI, he has developed and presented petroleum geochemistry training courses both on a multi-client basis and for a large number of individual oil companies, specializing in molecular geochemistry and especially biomarkers.

Who Needs This Program
- This training program is developed and designed for Mid to Senior Level explorationists. Some basic experience of petroleum geochemistry would be beneficial. Petroleum Geochemists with moderate experience would also benefit from the course.

Course Schedule

| 08:00—09:00 | Registration (Day 1) | 13:00—14:00 | Lunch |
| 09:00—11:00 | Session I           | 14:00—15:30 | Session III |
| 11:00—11.15 | Refreshment Session I | 15:30—15:45 | Refreshment Session II |
| 11:15—13:00 | Session II          | 15:45—17:00 | Session IV (Last Session) |

PetroSync Quality Assurance
All PetroSync courses are developed with top quality to address all your training needs and purposes. Our courses are vetted strictly to ensure that we always deliver the best courses with the best industry expert.

PetroSync Inhouse Solutions
PetroSync can tailor our courses to meet your specific needs at your preferred location and schedule. Contact us for more information at +65 6415 4500 or email to general@petrosync.com

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### Course Agenda — 5 Days

**DAY 1—FUNDAMENTALS OF BIOMARKER GEOCHEMISTRY**

**Introduction to Molecular Geochemistry**
- Fundamental Concepts
- Introducing the various compound types used in petroleum geochemistry

**Molecular Analyses in Petroleum Geochemistry**
- Sampling for molecular analyses
- GC & GC-MS analysis for biomarkers & other compounds

**Introduction to Biomarker Geochemistry**
- Definitions, origins & preservation in the geological record
- Introducing the types of biomarker compounds

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**DAY 2—BIOMARKER APPLICATIONS: SOURCE, ENVIRONMENT AND AGE**

**Biomarker Interpretation: Sources of Organic Matter**
- Land plant-derived biomarkers
- Algal-derived biomarkers
- Bacterial biomarkers

**Biomarker Interpretation: Source Rock Depositional Environment**
- Identifying environment types: Biomarkers for marine, deltaic, lacustrine & hypersaline settings
- Biomarkers for environmental conditions: Oxicity & water column stratification
- Biomarkers and source rock lithology

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**DAY 3—EFFECTS OF MATURITY AND PETROLEUM ALTERATION**

**Molecular Maturity Parameters**
- Maturity information from gasolines, aromatic hydrocarbons & diamondoids
- Biomarker maturity parameters
- Relative benefits of different molecular parameters

**Exercise: Application of molecular maturity parameters in a suite of oils**
- Interpret tabulated molecular maturity parameters (including biomarkers) for a suite of oils using p:IGI software
- Learning goal: Understand and gain experience in the application of molecular data for the determination of maturity, and the relative advantages of different compound types

**Hydrocarbon Alteration: Migration & Phase Fractionation**
- Effects of oil migration on molecular composition
- Effects of phase fractionation on molecular composition of oils

**Hydrocarbon Alteration: Biodegradation**
- Molecular effects of biodegradation; biomarkers and degradation scales
- Concept of palaeopasteurisation

**Exercise: Application of molecular data to recognizing biodegradation in oils**
- Review and interpret tabulated geochemical data, including biomarkers, and example chromatograms for a suite of variably biodegraded oils
- Learning goals: Understand how to use geochemical data to identify biodegradation effects in oils, and the effects of this process on biomarker composition

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**Exercise: Examples of Molecular Geochemical Analytical Reports**
- Reviewing example data sheets/reports from a service company, including recognizing the types of biomarkers and derived ratios/parameters
- Learning goal: Becoming familiar with biomarker data and reports

**Exercise: Introduction to p:IGI-3 Software for Interpretation of Petroleum Geochemical Data**
- A demonstration of the functions of p:IGI-3 geochemical interpretation software.
- Learning goal: Becoming familiar with the software so that it can be used in most of the subsequent data interpretation exercises.

**Biomarker Interpretation: Source Rock Age**
- Sterane biomarkers as age-diagnostic indicators
- Oleanne & tricyclic terpanes as age-diagnostic indicators

**Exercise: Interpretation of biomarker data from oils to determine source rock age and depositional environment**
- Paper exercise using chromatograms and laboratory biomarker data sheets to interpret the type and age of the source rocks for various oils
- Learning goal: Learn to recognize biomarkers in chromatograms and use of biomarker ratios to make interpretations regarding oil source rock characteristics.
DAY 4—Biomarkers and Oil-Oil & Oil-Source Correlations

Introduction to Stable Carbon Isotopes in Petroleum Geochemistry
- Fundamentals and analysis of carbon isotopes
- Factors controlling carbon isotopic compositions of oils and source rocks
- Compound-specific isotope analysis in oils: Correlation tools

Oil-Oil and Oil-Source Correlation: Theory & Approaches
- Concepts behind correlations
- Tools and approaches used for correlation
- Multivariate statistical analysis in correlations
- Content

Oil-Oil and Oil-Source Correlation: Examples & Case Histories
- Several examples from published literature showing the application of biomarkers and various techniques (including multivariate statistics) to both oil-oil and oil-source correlations. (A good example from South East Asia will be sought and included)

Exercise: Application of biomarker data in oil-oil correlation
- Using tabulated biomarker (and isotope) data in an oil-oil correlation; identification of groups of oils from the different source rocks; this currently uses an unidentified suite of oils, but an example from SE Asia will be sought for this exercise; the instructor will also demonstrate the use of Principle Components Analysis in oil correlations (comparing the results with those of the attendees from this exercise)
- Learning goal: How to use various biomarker characteristics and approaches in oil-oil correlations.

DAY 5- Reservoir Geochemistry & Oil Mixing

Applications of Molecular Data in Reservoir Geochemistry
- Identifying field fill points, charging history and compartmentalization
- Analytical methods for detailed oil fingerprinting
- Time lapse geochemistry during field production

Molecular Geochemistry and Oil Mixing
- Concepts: The importance of compound concentrations
- Recognizing & quantifying oil mixtures
- Identifying contamination: Effects on biomarker compositions

Exercise: Application of Biomarker Data to Correlation in a Suite of Oils with Extensive Mixing
- Using tabulated biomarker data to perform an oil-oil correlation, recognizing end-member oils and potential mixed oils; if the p:iGi software is used in this course than attendees can also conduct a Principal Component Analysis in this exercise.
- Learning goal: To further develop experience and confidence in using biomarker parameters in oil-oil correlations, including the use of Principal Components Analysis, and the recognition of end-member oils and mixtures.

Discussion: Group discussion and review of any particular topics; examination and group discussion of client’s own data examples.

Register For This Course Now!
Kindly fill up your particulars in the registration form placed at the end of this brochure, and send it to us or email to registration@petrosync.com
COURSE DETAILS

Title: Biomarkers Analysis & Application to E&P
Date: November 7—11, 2016
Location: Kuala Lumpur, Malaysia

INVESTMENT PACKAGES (Please Circle)

<table>
<thead>
<tr>
<th>INVESTMENT PACKAGE</th>
<th>DEADLINE</th>
<th>FULL MASTERCLASS</th>
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<tr>
<td>Standard Price</td>
<td>14 October 2016</td>
<td>USD 3,895</td>
</tr>
<tr>
<td>Early Bird Offer</td>
<td>30 September 2016</td>
<td>USD 3,795</td>
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<tr>
<td>Group Discount (3 or more Delegates)</td>
<td>14 October 2016</td>
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Group Discount is based on Standard Price
*To enjoy the promotion & discount offer, payment must be made before dateline
* For 7 or more delegates, please inquire for more attractive package.
* Prices include lunches, refreshments and materials. Promotion & discount cannot be combined with other promotional offers.
* Important: Please note that registration without payment will incur a SGD 200 administration fee.

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1st Delegate Name: ____________________________
Direct Line Number: __________________________
Email: __________________________
Job Title: __________________________
Department: __________________________
Head of Department: __________________________

2nd Delegate Name: ____________________________
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Email: __________________________
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Department: __________________________
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3rd Delegate Name: ____________________________
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Email: __________________________
Company: __________________________
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- If you have not received an acknowledgement before the training, please call us to confirm your booking.

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  All bank charges to be borne by payer. Please ensure that PetroSync Global Pte Ltd receives the full invoiced amount.

CONFIRMATION

I agree to PetroSync’s terms & conditions, payment terms and cancellation policy.

Authorized Signature: __________________________

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COURSE CONSULTANT

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TERMS AND CONDITIONS

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CERTIFICATE OF ATTENDANCE

70% attendance is required for PetroSync’s Certificate of Attendance

DETAILS

Please accept our apologies for mail or email that is incorrectly addressed. Please email us at registration@petrosync.com and inform us of any incorrect details. We will amend them accordingly.

CHARGES & FEE(S)

- For Payment by Direct Telegraphic Transfer, client has to bear both local and oversea bank charges.
- For credit card payment, there is additional 4% credit card processing fee.

I agree to PetroSync’s terms & conditions, payment terms and cancellation policy.

Authorized Signature: __________________________

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