

ZymaX Forensics Geochemistry Group

ZymaX Forensics presents a highly experienced environmental forensics consulting group:

- extensive background in organic and petroleum geochemistry
- years of experience in litigation support and expert witness testimony
- national and international consulting on a variety of complex environmental chemistry issues
- contaminant source identification
- environmental liability allocation

The **Forensic Geochemistry Group** provides support to attorneys, insurance companies and environmental consultants in assessment, remediation and litigation of spills in the environment.

ZymaX Forensics laboratories perform specialized analytical testing of petroleum related and other spills with the aim of determining the responsible parties:

- **what** was spilled
- **how much** is there
- **when** it was spilled
- **who** is responsible

Interpretation of the analytical data requires specialized geochemical expertise that many environmental consulting companies do not possess in-house. Our consultants provide interpretation of the data and can perform expert testimony on the findings.

Consultants

Dr. Shantan Lu is Director of Petroleum Geochemistry and consults on analytical methodology and data utilization in forensic geochemistry. Dr. Lu has 26 years experience as a petroleum geologist and geochemist with extensive background in research and development of analytical methodologies. He is an expert in the interpretation of geochemical data and has collaborated on multiple publications in the field.

Dr. Robert Morrison has been working for over 30 years on issues related to soil and groundwater contamination, specializing in the forensic review and interpretation of scientific data in order to identify contaminant releases sources and age. He has published numerous articles and book on soil and groundwater contamination topics, and has shared this information via lectures throughout the world. His books include *Environmental Forensics: Principles and Applications* and *Environmental Forensics: A Glossary of Terms*. Dr. Morrison is active in reviewing technical papers on forensics techniques, has served on the editorial boards of *GroundWater*, *Groundwater Monitoring Review and Remediation*, and is currently the Editor-in-Chief of the *Journal of Environmental Forensics*.

Dr. Alan Jeffrey brings over 20 years U.S. and international experience in environmental science, geochemistry and related consulting. His background includes extensive involvement in stable isotope research, the management of geochemical and environmental analytical labs, initiation and management of a national water monitoring program for Malaysia, and start up of an environmental consulting company in Singapore. At Global Geochemistry and ZymaX, Dr. Jeffrey has collaborated with Dr. Ian Kaplan on adapting geochemical techniques to solve various environmental problems, including sources of spilled hydrocarbon fuels and fugitive methane seeps.

Dr. Wang Yi has been studying stable isotope geochemistry for more than 8 years; he examines stable isotopes and their variations in natural materials to study the function and dynamics of natural systems, to trace the history of climatic and environmental changes, and to understand the causes and mechanisms for such changes.

For complete curriculum vitae,
visit our website:

www.ZymaXusa.com

Facilities and Equipment

ZymaX Forensics occupies a modern laboratory facility in San Diego, California.

Major equipment:

- 3 GC/MS
- 1 stable isotope mass spec
- 2 stable isotope vacuum lines
- 8 gas chromatographs

ZymaX has extensive electronic data delivery capability and can deliver most formats required by our clients.

Analytical Testing

For a full list and description of tests, visit our website:

www.ZymaXusa.com

For information on additional analyses not listed here, call

Customer Service

760.781.3338

We also develop custom solutions for your needs.

Chemical and Analytical Hydrology

- $\delta D/H$ and $\delta^{18}O$ of H_2O
- $\delta^{34}S$ of dissolved SO_4 or H_2S
- $\delta^{15}N$ of dissolved NO_3 or NH_3
- dissolved NO_3 and NH_3
- $\delta^{13}C$ of dissolved carbonate and CO_2
- $\delta^{13}C$ of solid carbonate/bicarbonate

Stable Isotopes Laboratory

- D/H, ^{13}C , ^{15}N , ^{34}S of petroleum: crude, fuels, gasoline
- D/H, ^{18}O of groundwater
- ^{15}N of nitrate, ammonia

Environmental Forensics and Geochemistry

hydrocarbon fuel identification

- C_1-C_5 gaseous, 9 compounds
- C_3-C_{10} gasoline, 90 compounds
- C_3-C_{44} whole oil, 149 compounds
- $C_{10}+$ Alkane Analysis, fuel type and age
- BTEX, oxygenated blending agents
- dye analysis
- edb, MMT, and organic lead, 5 alkyl leads
- fuel-type apportionment
- GC/MS full scan, alkanes, alkylbenzenes, PNAs, polycyclic biomarkers
- PNA SIM- 15 PNAs by EPA 8270 SIM
- PNA expanded list, alkylated benzenes and chrysenes, benzo- and naphthothiophenes, aromatic steranes (53 PNAs by SIM)
- simulated distillation
- stable isotopes of D/H, C, N, S
- extractions
- column cleanup and separation
- TPH column separation in aliphatic, aromatic and
- polar fractions

gas geochemistry

- C_1-C_5 hydrocarbons
- C_3-C_{10} hydrocarbons
- fixed gases
- $\delta^{13}C$ & $\delta D/H$ of C_1 , C_2 , C_3 , i- C_4 , n- C_4 , total C_4
- $\delta^{34}S$ of H_2S

Petroleum Exploration and Production (E&P)

sample screening

- headspace gas (C_1-C_2)
- total organic carbon (TOC)
- total inorganic carbon and total carbon
- Rock-Eval
- C_3-C_{10} hydrocarbons by capillary GC (*cuttings*)
- API gravity (*oil*)
- Ni and V (*oil or fraction*)
- elemental analysis (C, H, N, S) (*kerogen/oil*)

geochemistry of oil and source rock

- C_8+ saturated hydrocarbons
- high res GC/MS
- $\delta^{13}C$, $\delta D/H$, $\delta^{34}S$, $\delta^{15}N$ (*kerogen, whole oil, extract, fractions*)
- $\delta^{13}C$ or $\delta D/H$ of C_1 , C_2 , C_3 , n- C_4 , i- C_4 , total C_4



forensics

Environmental Forensics
hydrocarbon fuel identification
gas geochemistry
stable isotope analysis

Chemical and Analytical Hydrology
subsurface source identification

Petroleum Exploration and Production
sample screening
geochemistry of oil & source rock

Stable Isotopes Lab
source identification

Consulting
expert witness testimony
interpretative reports
depositions

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