Applications of Advanced Geochemical Technologies (AGTs) to Petroleum Systems Analysis

J. M. MOLDOWAN[1] AND JEREMY DAHL[2]

[1]Biomarker Technologies, Inc., 638 Martin Avenue, Rohnert Park, CA 94928, USA. jmmoldowan@biomarker-inc.com

[2]Stanford Laboratory for Materials and Energy Science, Stanford University, CA 94305, USA. dahl@stanford.edu

The generative formations and the migration paths for hydrocarbons are critical root determinates for developing basin models. However, source components are often missed when only the typical biomarker and isotope methods are applied to a regional study.

This presentation will show how AGTs can be applied to expand basin models to consider the deep sources and determine components of oil mixtures that are difficult to correlate by other means.

We start with quantitative diamondoid analysis (QDA) to assess whether there are active deep sources in the basin and whether black oil has been co-sourced by over-mature condensate. QDA can be critical for determining maturity and defining relationships among produced oils, as well. Quantitative extended diamondoid analyses (QEDA) and compound specific isotope analysis of diamondoids (CSIA-D) are applied to determine the deep over-mature sources of some oils by correlation with less mature manifestations that can be correlated using biomarkers. The effectiveness of biomarkers is increased by application of CSIA of hopanes and steranes, which together with the diamondoids can de-covolve the sources of co-sourced oil mixtures.

We will also show how identification of oil co-sources is teased out by analysis of the oil produced by hydrous pyrolysis of asphaltenes, a technique that can be particularly helpful for the full understanding of mixed oil and biodegraded oil provenance.

In our brief overview of AGTs we will touch on examples from applications to basins in Brazil, Colombia, the central United States and elsewhere, in which these methods have contributed information to expand the associated petroleum systems.