# Recent Developments in Geochemistry Take Exploration Play Strategy to the Next Level

J. Michael Moldowan[1,2,*], David Zinniker [1], Jeremy Dahl[1], Shaun Moldowan[1,2], Geoffrey Bott[3]

[1]Department of Geological & Environmental Sciences, Stanford University, Stanford, CA 94305-2115 USA, and
[2]Biomarker Technology, 2501 Blucher Valley Road, Sebastopol, CA 95472 USA
(moldowan@yahoo.com)
[3]GB Scientific, Inc., 1090 Industrial Ave., Suite B, South Lake Tahoe CA 96150 USA

Classical biomarker and isotope analysis of oil and source rocks has provided a great boon to the industry to determine the active petroleum systems for making exploration plays, basin modelling and reservoir delineation. However, these classical analyses may provide only part of the whole picture. New high-resolution geochemical technologies can fill in the rest. These novel methods are necessary (1) to properly define deep gas plays, and (2) to delineate multiply-sourced petroleum systems.

(1) Analysis of diamondoids may be used to discover hidden gas sourcing into reservoirs containing black oil. The gas may be there or it may all have leaked away, in either case leaving no traces of biomarkers behind. Quantitative diamondoid analysis (QDA) can determine where such phenomena have occurred. Most prolific basins ultimately show such processes. QDA can also be applied to determine the best tight shale zones and their potential. Application of QDA to piston core analysis is outstanding for locating offshore thermal gas/condensate seeps. Condensate can be correlated using compound specific isotope analysis of the diamondoids (CSIA-D), whether mixed with black oil or as clear condensate. Thus, the source of deep thermal gas can be inferred from such analyses and deeper drilling targets can be more confidently selected.

(2) For a clear understanding of multiply sourced petroleum systems CSIA of the biomarkers (CSIA-B) is essential. Thereby, new sources or facies can be identified and subjected to modelling and kinetic analysis. Correlation between oil and immature source rock is facilitated by using CSIA-B, since maturation of the oil does not affect the isotope ratios of the biomarkers generated from the kerogen. This is unlike biomarker fingerprints, which can be difficult to correlate between immature source rock extracts and oil. By using CSIA-B together with QDA and CSIA-D, multiply sourced petroleum systems with a full range of maturities can be fully defined.