Advanced techniques for light and ultra-stable hydrocarbon analysis: discovering, fingerprinting, understanding deep basin sources of condensates and natural gas

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Deep basin thermal natural gas and petroleum condensates represent increasingly important energy prospects. Predicting the occurrence, quality, and quantity of these resources at depth relies on both accurate geochemical measurements of available materials and models of production and transport with time. This presentation will focus on advances in analytical techniques for the measurment (abundance and stable isotope composition) of C4-C10 hydrocarbons, small cyclic hydrocarbons, diamondoids, small aromatics, and thermodynamically stable biomarkers in a variety of natural samples. New separation techniques allow direct comparisons of source rock and petroleum samples and greatly increase the complexity of the geochemical fingerprint available for distinguishing similar high maturity sources and discovering unique features which allow more accurate source apportionment in mixed samples. Important applications include 1) assessing the occurrence, source, and quantification of high maturity hydrocarbon contributions to black oils in petroleum basins with multiple stacked source rocks, 2) assessing the maturity and percent conversion of liquid to gas in condensates, 3) fingerprinting and distinguishing condensate sources, 4) quantifying evaporative and diffusion-related discrimination in condensates and condensate contributions to black oils, and 5) assessing percent conversion during gas formation in tight shales and mapping the predicted occurrence of authigenic natural gas.