From source to seep: New challenges and emerging technologies in petroleum systems analysis

LORI L. SUMMA*

ExxonMobil Upstream Research Company,Houston TX
(*correspondence: lori.l.summa@exxonmobil.com)

Global energy demand continues to rise, and in the near term, fossil fuels remain a major component of energy supply. To meet demand, hydrocarbon exploration has moved into extraordinarily challenging environments, including ultra-deep water basins with limited calibration data, onshore basins with complex histories, and resources that are difficult to develop, e.g. unconventional gases and liquids, shallow gas in deep water, heavy oil, and accumulations with high concentrations of CO_2, and H_2S. In these environments, petroleum systems analysis plays a major role in exploration success, and novel geochemical tools are a critical element of effective petroleum systems analysis. Key questions asked of the petroleum systems analyst are: is there a robust petroleum system; will the fluids be oil or gas; and why was this well unsuccessful? During the 1980's and 1990's, efforts to answer these questions led to new geochemical tools for quantitative petroleum systems analysis, e.g. molecular and isotopic geochemistry of oils and gases [1] [2], and fluid inclusions in diagenetic minerals [3]. This talk explores current petroleum systems issues in ultra-deep water systems and complex onshore basins, and illustrates the challenges and opportunities they provide for emerging breakthroughs in geochemistry, e.g. new isotopic systems [4] [5], novel hydrocarbon tracers [6], and tools to extract information from traditionally underutilized samples [7].

[1] Chung et al (1988), *Chemical Geology* **71**, 97-103. [2] Whiticar (1994), *AAPG Memoir* **60**, 261-283, [3] Goldstein and Reynolds (1994), *SEPM Short Course* **31**, [4] Selby and Creaser (2005), *Science* **308**, 1293-1295, [5] Stolper et al (2014), *Science* **27**, 1464-1467, [6] Sherwood-Lollar and Ballentine (2009) *Nat Geosc.* **2**, 43-547, [7] Valentine et al (2010) *Nat Geosc.* **3**, 345-348.