

## Geoforensic chemical analysis of oil samples from the Madison Group – What can it tell you?

Phil Richards<sup>1</sup> and Court Sandau<sup>1</sup>

### Abstract

*There are thousands of individual chemicals in oil. These constituents of the oil provide a wealth of information about its history that includes the depositional environment it formed in, the subsequent geochemical alteration over geological time, the potential migration and the anthropogenic alteration due to oil recovery methods. This information is presented by the abundances of a wide range of marker chemicals and chemical families (biomarkers).*

*This presentation discusses the advanced comprehensive chemical analysis of oil samples from the Madison Group within the Canadian portion of the Williston Basin. Oil samples were analysed to determine the potential source formation, in particular whether the Bakken, or Madison itself, provided the oil-forming kerogen. The findings of this analysis are presented with discussion of the recent scientific consensus of oil reservoirs in the Williston Basin. Further, the oil samples were analysed to investigate the variability within the sample group, which includes variability in maturity, sulfur content and in-situ biological alteration. The latter is an example of the anthropogenic alteration of oil during secondary and tertiary recovery, resulting in subsequent reduction of oil value.*

*The oil samples were characterized by analyzing for a suite of petroleum biomarkers and polycyclic aromatic hydrocarbons (PAHs) (a chemical family constituent of oil) as well as using an advanced geoforensic analysis technique (called 2DGCMS). This novel technique provides a detailed composition of important marker chemicals and chemical families. The presentation demonstrates that subsequent data interpretation using state-of-the-art diagnostic analysis can be successful at determining differences between very similar oil samples.*

*Those interested in the determination of oil origin or in the alteration of oil reservoirs by secondary and tertiary recovery methods will find this presentation highly informative.*

<sup>1</sup> Chemistry Matters, 2120 First Avenue NW, Calgary, AB T2N 0B5

**Phil Richards** has a Masters and PhD in Chemistry from The University of Liverpool, England, and a Masters in Environmental Forensics from The University of Strathclyde, Scotland. He has worked as a senior research scientist in the UK chemical industry prior to working as an environmental consultant in Calgary, Alberta. He currently works as a chemistry consultant and specializes in the advanced interpretation of chemical data. He has a particular focus on using chemical statistics and targeted diagnostic marker chemicals for the determination of oil alteration mechanisms, both anthropogenic and natural.