

The Application of Oil-Source Correlation Tools towards Understanding Oil Charge Systematics in the Carbonate Reservoirs of Northern Alberta

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The oil source(s) that have potentially contributed to the heavy oil and oil sands deposits of Northern Alberta have long been debated using mass balance considerations (Creaney and Allan, 1990) or molecular evidence (Riediger et al., 2000). For example, the presence of C28 bisnorhopane (amongst others) in the oils is often used to indicate a contribution from the Exshaw Formation, while its absence may be attributed to oils from the Duvernay Formation. However, in the realm of the Devonian carbonates, the severe biodegradation often seen in the bitumen extracts e.g. Grosmont Formation renders key biomarker evidence based on steranes and hopanes unreliable.

We have geological information within the context of the regional source contributions to the Devonian carbonate reservoirs from the Gordondale, Exshaw and Duvernay formations, although there are several other source candidates in the basin. The geochemical fingerprints from the highly biodegradation resistant aromatic hydrocarbon compounds such as the tri-aromatic steroids possess unique distributions that may be used to recognize source contributions in these severely biodegraded oils. For example, the tri-aromatic steroid hydrocarbons extracted from Grosmont Formation bitumen resemble those distributions found in the Gordondale / Exshaw type oils, whereas the distributions from a Duvernay type oil is clearly different. Sulfur and Nitrogen whole oil stable isotope data of Grosmont bitumens clearly resolve Gordondale from Exshaw charge components. The degradation resistant biomarkers and isotope proxies provide new insights into oil-source correlations for the carbonate bitumens as well as into the sources of the Athabasca and Peace River oil sands (Marcano et al., 2010; Adams et al, 2010; *ibid*). The geochemical data are interpreted within a geological framework to assess migration / charging and mixing associated with the filling of the carbonate accumulations.