

Organic Geochemistry of Heavy Crude Oils of West-central Saskatchewan, Canada

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A number of organic geochemical parameters have been evaluated in crude oils occurring in the Mississippian Bakken and Lower Cretaceous Mannville reservoirs in west-central Saskatchewan. Although these oils share many biomarker similarities, their light and medium molecular weight fractions often display variable geochemical characteristics. Compared to oils from the Bakken strata, Mannville oils contain higher proportions of saturated hydrocarbons (relative to aromatics), are enriched in cycloalkanes, and show much higher K1 ratios and lower paraffin indices. Furthermore, although all oils are generally depleted in normal alkanes, and to a lesser extent acyclic isoprenoids, the loss of these compounds displays a progressive, southward trend. As a result, gas chromatograms of most of the Bakken oils show only large, often bimodal baseline hump.

Destructive microbial interaction (biodegradation) appears to be the primary control on the composition of the saturated and aromatic hydrocarbon fractions. However, despite the apparent loss of n-alkanes, acyclic isoprenoids, alkylbiphenyls and methylated naphthalenes the terpane and sterane biomarkers are not affected, indicating that most of the oils suffered only light to moderate biodegradation. Moreover, some oil samples show a persistent presence of lower homologs of n-paraffins (C5-C8) when higher (>C15) homologs are not present. This compositional characteristic is consistent with relatively higher amounts of light aromatics such as benzene and toluene in these oils, and may indicate that some of the reservoirs containing biodegraded oil were subjected to a subsequent secondary charge of lighter crude or a selective mechanism of biodegradation.