

# **Anomalous oil compositions in the heavy oil belt of west-central Saskatchewan - possible implications for timing of biodegradation?**

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## **ABSTRACT**

A detailed geochemical analysis of heavy oils from the Lower Cretaceous Mannville Group strata of west-central Saskatchewan reveals that some oils display unusual compositions, inconsistent with the regional biodegradation pattern. It is especially illustrated by the presence of anomalous constituents such as olefins (n-alkenes), compounds rarely found in crude oils, and relatively high amounts of linearly fused aromatic compounds (anthracene and methylanthracene). As the olefins are generally unstable and do not form during biodegradation, these compounds were most likely introduced to the oils subsequent to the main phase of biodegradation. The occurrence of n-alkenes in oil is usually associated with a relatively recent thermal event, most commonly magmatic intrusions. Therefore, it is possible that their presence in the studied oils resulted from the generation of petroleum in response to Eocene igneous activity in the adjacent area, which would be consistent with the relative geological ages of regional burial-induced oil generation (Late Cretaceous - Paleocene). The olefins could have formed either directly in the reservoir or along the migration pathway prior to augmenting already biodegraded oil. In the latter scenario, the source of the newly generated hydrocarbons is enigmatic, but there is geological evidence that indicates good conditions for fluid migration in this area.

Since the augmentation by unbiodegraded hydrocarbons appears to post-date the main stage of biodegradation, the recognition of these anomalous compositions may be fundamentally important to understanding the timing and mechanism of biodegradation of the original petroleum charge, as well as secondary migration history in the west-central Saskatchewan heavy oil belt.