

Differential Alteration of Oil Families in Southwestern Saskatchewan by Biodegradation

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Three stratigraphically restricted oil families dominate SW Saskatchewan. Oils of the Battle Creek, Rapdan-Battrum area have molecular compositions similar to oils that dominate the Madison Subcrop in SE Saskatchewan and SW Manitoba. Thermal maturity indicators suggest that these oils are of uniformly low thermal maturity in SW Saskatchewan. Low thermal maturity results in high density, such that biodegradation has a serious affect on oil quality. A pervasively biodegraded oil family occurring in the Bakken Fm, has molecular compositions that resemble, but are not identical to, oils in the Bakken Fm in SE Saskatchewan and SW Manitoba. A noticeable difference between Bakken oils in SE and SW Saskatchewan is the consistently low thermal maturity of oils in SW Saskatchewan. The third oil family is restricted to Viking reservoirs and it is easily distinguished from oils in Paleozoic rocks. The source of these oils are overlying Upper Cretaceous shales. In Viking oils, high thermal maturities result in low density and high quality, such that subsequent biodegradation, although as pervasive as that affecting Paleozoic oil families, is not similarly detrimental to oil quality. All three families exhibit variable degrees of biodegradation or water washing. Water washing is inferred by the selective removal of more soluble hydrocarbons, particularly benzene and toluene. Biodegradation is recognized by the selective removal of n-alkanes in both the >210°C boiling point saturate fraction and the gasoline range. Oil density and API gravity generally follow heptane value indicating that biodegradation is a dominant control on oil quality in the region. The degradation of Viking oils provides one of the strongest correlations between progressive changes in Heptane Value and API gravity. Biodegraded oils are generally water washed, but water washing is not always accompanied by biodegradation.