

Geochemistry And Quantitative 1-D Burial History Modelling Of The Peace River Tar Sands

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ABSTRACT

Oil sand bitumen has been well-characterized chemically; however, much controversy remains concerning the source rocks, migration pathways and time of migration. Previous studies have focused on economic oil sand resources with only cursory characterization of the deposits of the Peace River area. In Alberta, the Peace River hydrocarbons are the only tar sands trapped west of the Exshaw sub-crop edge. The Exshaw Formation is thought to be the main source rock of the Peace River tar sands, but contribution from other source rocks with mixing of the various oil families cannot be ruled out. Burial of source rocks during subsidence of the Peace River Embayment in the Late Paleozoic to Triassic may have caused maturation of the source rocks prior to maximum burial in the Late Cretaceous to Eocene. Varying degrees of biodegradation (API gravity 8-24) of Peace River oil sands may reflect complex and possibly episodic source rock maturation and/or reservoir charge history. In addition, we test the hypothesis of possible sterilization of the reservoir via burial past 80°C, thereby curtailing biodegradation.

In this study, several Mesozoic bitumen samples were taken across the Peace River oil sands region, for detailed petroleum geochemical analysis. Biomarkers were used to define oil-source rock correlations and to map biodegradation levels across the study area. One-dimensional basin models along an up-dip Peace River Arch section were developed to investigate the burial history of the Peace River tar sands. The source of the Peace River tar sand bitumens combined with burial histories constrains the timing of migration, sources for the Athabasca oil sands and the relative timing of biodegradation.