

## **Reservoir and Bitumen Heterogeneity in Athabasca Oil Sands**

**Milovan Fustic\***

University of Calgary, Calgary, Alberta, Canada

[mfustic@ucalgary.ca](mailto:mfustic@ucalgary.ca)

and

**Khalis Ahmed, Sammi Brough, Barry Bennett, Lorraine Bloom,  
Michèle Asgar-Deen, Olufemi Jokanola, Ron Spencer, and Steve Larter**

University of Calgary, Calgary, Alberta, Canada

### **Abstract**

The Athabasca Oil Sands (AOS) deposit, the largest petroleum accumulation in the world, is extremely heterogeneous with respect to physical reservoir characteristics such as geometry, component distribution, porosity, permeability; mineralogy and mineral chemistry; aqueous fluid distribution and chemistry; and the distribution and chemistry of bitumen. Variations in these properties appear to be interrelated, and reflect the dynamic and complex depositional history as well as post-depositional oil alteration processes.

Detailed characterization of all of the above aspects is required to better understand the interrelationship of components within the reservoir and the overall reservoir behaviour and reactivity at production conditions, for optimization of exploitation methods and the development of new technologies.

Our geochemical studies focus on the heterogeneous distribution and composition of minerals and hydrocarbons. These are placed in a stratigraphic and sedimentologic context, and integrated to address the problem of reservoir heterogeneity. Variability of the bitumen may be a function of several parameters, including presence or absence of a water leg, the continuity of the reservoir column, sedimentary facies, water chemistry (salinity), and mineralogy. Bitumen composition is correlated with viscosity measurements and the geology of the host rocks. The results obtained indicate that the bitumen is heterogeneous on a reservoir thickness scale and that a close relationship exists between bitumen composition and viscosity, implying bitumen properties are predictable. Generally the quality of bitumen decreases down the hole, but also along certain depositional breaks.

The above provides a multi-faceted approach to obtain information suitable for optimising either in situ or surface mining operational recovery of bitumen and advancing development of new technologies.