Geological Controls on Bitumen Heterogeneity in Athabasca Oil Sands

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Abstract
Athabasca Oil Sands, the world's largest petroleum accumulation, contains an estimated 1.7 trillion barrels of heavily biodegraded oil that occurs in a solid phase (bitumen) that ranges from 6 to 11 API. Current exploitation technologies involve surface mining with warm water extraction and in-situ recovery by Steam Assisted Gravity Drainage (SAGD). Extracted bitumen then undergoes thermal or hydro cracking upgrading to synthetic crude oil. Both processes require a large amount of energy to recover the resource.

While reservoir quality is commonly assessed using classical approaches, very little attention is given to bitumen characterization and mapping distribution of variations in its properties.

In this study, variations in measured bitumen viscosities, estimated biodegradation level (using molecular markers), and bulk molecular composition in Athabasca province tar sand reservoir sections were correlated with the following reservoir conditions:

- presence or absence of an oil-water interface
- continuous or discontinuous reservoir columns
- reservoir facies

The results obtained indicate that bitumens are heterogeneous on a reservoir thickness scale and that a close relationship between exists bitumen composition and viscosities, implying those bitumen properties are both predictable and mappable at high resolution. This provides a new level of information suitable for optimizing either insitu or surface mining operational recovery of bitumen.