Implications Of Dipmeter Data For The Definition Of The Internal Architecture In Point Bar Deposits From The Athabasca Oilsands

Howard Brekke* and Richard W. Evoy
Petro-Canada Oil and Gas, P.O. Box 2844, Calgary, AB T2P 3E3
hbrekke@petro-canada.ca

ABSTRACT

Deposition of multi-story point bars by an aggrading and meandering estuarine system is the generally accepted geological model for the middle unit of the McMurray Formation. However, interpretation of dipmeter data from the Hangingstone area suggest a different interpretation; a single, 35 metre thick point bar deposited by a westerly flowing fluvially-dominated estuary that avulsed from the main northward-flowing McMurray Valley System. This model contrasts with the regional lower and middle McMurray continental to tidal flat facies that prograded from the south.

Surfaces interpreted from Formation Micro-Imager (FMI) and dipmeter logs were identified, and facies from core were assigned to the surfaces. The dominant facies, inclined heterolithic stratification, consists of interbedded sands and muds characterized by a common azimuth, and a dip profile which gradually steepens, then gently flattens (epsilon cross-stratification). Mud beds within the IHS are lightly to moderately bioturbated, trace fossils are diminutive and have a low diversity. A facies consisting of clean sands with steeply dipping beds occurs less commonly. These sands are characteristically bitumen-stained and have no observable bedding in core, but are recognizable on FMI logs. Mudclast breccias are another secondary facies and typically have no detectable bedding. The mud clasts are various sizes and degrees of roundness and sorting. An additional feature present in the Hangingstone area consists of IHS beds that gradually steepen, typically to greater than thirty degrees, then abruptly flatten out to the underlying, undisturbed dip angle. Stretched and curve trace fossils are characteristic of this unit, and fluidized mudstones may be present.

The IHS beds are here interpreted as lateral accretion surfaces that consistently dip southward; dip azimuths radiate outward in a fan shape over an area roughly four by six kilometers. In many of the wells, the middle McMurray consists of a continuous epsilon cross-stratified dip pattern, implying a single point bar. The steeply dipping clean sands represent current beds indicative of flow from the northeast. Locally, minor features such as current beds or breccias disrupt the continuous epsilon cross-stratified dip pattern.

The discrepancies between the interpretations based on dipmeter data, and those based on conventional wireline log suites alone are both pronounced and significant. Facies correlations from the typical wireline suites are interpreted solely on “fining-upward” cycles controlled by sand and shale/mud percent (Vsh).

This can be misleading since lithology fluctuations are not uncommon due to seasonal cycles of deposition and erosion. Additionally, erosional surfaces (scours) are not necessarily disconformities that mark the base of a new channel. While additional work is required, dipmeter data represent a valuable tool in the determination of vertical channel continuity.