

# **Using 3D photogrammetric outcrop model to recognize genetically related depositional packages in the Lower Cretaceous McMurray Formation at Christina River Outcrop, NE Alberta, Canada**

**Presenter: Qi Chen**

## **Abstract**

The McMurray Formation is in large part represented by the point bar deposits of a Cretaceous fluvial-tidal channel system that flowed northwards in NE Alberta, Canada. The fluvio-tidal system has generally been assigned to the informally termed middle McMurray Member, which can be coarsely divided into 2 facies: 1) mega rippled, cross-bedded sandstone; 2) inclined heterolithic stratified sandstone/mudstone (IHS). The two facies have been widely interpreted as genetically associated facies representing lower (trough cross bedded sandstone) and middle (IHS) parts of tidally influenced, fluvially dominated inner estuary point-bar deposit. This study analyzes the two facies exposed at Christina River outcrop using 3D photogrammetric methods, investigates the genetic relationships between different depositional units. Bedding orientations are analyzed in combination with sedimentary and ichnological characteristics of the outcrop to form a synthesized architectural interpretation of the point bars in the Christina River area. The results of this study challenge the conventional interpretation of a thick, continuous point bar deposit.

The 3D outcrop model reveals 2 cross bedded sandstone units (CB units) and 3 sand-dominated IHS units (IHS units) separated by erosional contacts. Brackish trace fossil assemblage and tidal cyclicities of the CB units suggest a tidally influenced inner estuary origin. Consistently dipping cross beds in the CB units suggest a uniform paleocurrent flowed in the WSW direction. IHS units characterized by alternation of sandstone and mudstone suggest deposition of seasonal or episodic events, therefore interpreted as lateral accretion deposits of estuary point bars. Consistently NNW dipping master bedding planes in IHS units infer a SW oriented paleocurrent flow direction, which coincide with measurements from CB units. The integrated sedimentological, ichnological, and architectural analysis of the depositional units suggest two depositional interpretations: 1) the entire succession comprises a thick, continuous point bar, and sharp contacts mark abrupt shifts in migration orientation or changes in the position of the point bar; 2) the outcrop is dominated by stacked small-scale point bars which share similar lateral accretion directions with respect to one another. The latter interpretation is a favored architectural interpretation because: 1) extensive sharp

contacts between depositional units can be interpreted as scouring at base of point bars, 2) thinning upward bedsets thicknesses and increase in bioturbation intensity within each depositional unit conform to a point bar deposit.