

# Stratigraphic Architecture of the Jasper Basin, North-Central Alberta Front Ranges

J. Weissenberger<sup>1</sup>, M. Gilhooly<sup>2</sup>, and P. Wong<sup>3</sup>

1(john.weissenberger@aer.ca) Alberta Energy Regulator, Calgary, Alberta

2Consultant, Calgary, Alberta

3Consultant, Victoria, British Columbia

## Abstract

A sequence stratigraphic framework for the Frasnian, north-central Alberta Rocky Mountains, is presented. Six third-order depositional sequences are correlated across the study area. The base of the succession unconformably overlies Middle Cambrian strata, representing transgressive onlap of the West Alberta Ridge, an antecedent landmass. This transgression initiated several large carbonate complexes: Sunwapta-Big Hill, Southesk Cairn and Miette. Three platform/basin transitions on these complexes – Toma Creek, Big Hill, and Nikanassin Range respectively – were examined. In the Jasper basin, the base Woodbend Sequence One (WD1) boundary is characterized by red, iron-oxidized carbonate breccia. At Toma Creek and Big Hill, the WD1 is comprised of aggradational to retrogradational stacking platform interior lagoonal and tidal flat cycles. The basal WD2 developed significant in situ carbonate lowstands in the Jasper basin. The WD2 margin was initiated after pronounced southward platform retrogradation. The WD3 transgression caused substantial shrinking of the carbonate platforms and deposition of nodular basinal wackestones and mudstones at all Jasper basin locations. Limited progradation characterizes the Winterburn Sequence One (WI1, Southesk Cairn, Sunwapta-Big Hill complexes). By contrast, the southeast Miette complex (Nikanassin Range) displays pronounced progradation. This is attributable to high carbonate production there, compared to the Southesk Cairn and Sunwapta-Big Hill complexes. The Miette margins display steeper foreslopes (>10 degrees) compared to the ramp margins to the south. This may be due to Ireton Formation shale basin fill in the Cline Channel region. The steep, progradational Winterburn Sequence Two (WI2) and Three (WI3) margins are best exposed at Miette, with well-defined component systems tracts. Its architecture reflects decreasing late Frasnian accommodation, manifested by decreased aggradation and increased progradation. The WI2 late highstand shows an absence of topset deposition, pronounced foreset truncation and a well-developed, abrupt downlap surface, culminating in the second-order sequence boundary. Margin styles and third-order sequence stacking controls in the Jasper basin are: shale bank paleogeography, carbonate accumulation rates and relative sea level. Sequence and bounding surface correlations are well constrained and supported by biostratigraphy (conodonts).