

# Quaternary stratigraphy of the lower Athabasca valley and implications for glacial Lake Agassiz meltwater drainage and Lake McConnell dynamics

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The lower Athabasca River valley in northeastern Alberta contains a complex sedimentological record of deglacial dynamics and glacial lake drainage during the Late Quaternary. Pioneering works in the early 1990's linked catastrophic discharge from the northwestern outlet of glacial Lake Agassiz to the stratigraphic architecture in the lower Athabasca River valley. The existing model suggests a single Late Pleistocene flood was responsible for the formation of proximal boulder gravels and a distal braid delta built into glacial Lake McConnell. Recent stratigraphic mapping from 17 exposures along the lower Athabasca River suggest an alternative interpretation. Here, we present a conceptual model for the evolution of the lower Athabasca valley and its relation to glacial Lake Agassiz flooding and the evolution of Lake McConnell.

Following initial late Pleistocene deglaciation, the Laurentide Ice Sheet (LIS) briefly re-advanced into the valley, deforming deglacial sediments and depositing a distinctive pink diamict north of the Firebag Moraine. Rhythmically bedded silts and sands overlying glaciotectonized sediments are attributed to local proglacial lake development – interpreted to be the last indication of proximal glacial activity in the valley. Flood sedimentation dominated the landscape as the retreating LIS enabled meltwater passage, though incised into and at a lower elevation than the ice-marginal deposits. Along with the boulder gravel deposits, a flood-derived lowstand delta was likely built into a proto-Lake McConnell. Subsequent development/transgression of Lake McConnell resulted in deposition of the sand-dominated braid delta in the lowermost portion of the Athabasca River valley. A re-examination of the sedimentology within this delta suggests that continuous flow, rather than catastrophic drainage, was responsible for its formation at ca. 10,000±600 14C yrs BP. In short, the absence of clear flood sedimentation below the Fort Hills suggests that the lower Athabasca valley was incised and graded to a lower stage of Lake McConnell during Agassiz flooding that subsequently transgressed to the 10,000 14C yrs BP level. This proposed hypothesis would benefit from future works observing the sedimentological signature of glacial Lake McConnell in other tributaries such as the lower Peace and Liard valleys along with cosmogenic dating of the moraine complexes in the area.

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