Perennial River Deltas of the Montney Formation: Alberta and British Columbia Subcrop Edge

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Paleostrandline facies of the Montney Formation along the subcrop edge of west-central Alberta and northeastern British Columbia are predominately feldspathic, dolomitic, litharenites as coarse siltstones and very fine-grained sandstones with minimal authigenic or detrital clay. This petrographic composition is consistent with an interpretation of the Montney having been deposited on an arid coastline in a mid-latitudinal setting (~(30°N). The source of the sediment in the Montney has been the topic of some discussion with aeolian sourcing inferred in many studies. Lacking has been the evidence of fluvial sediment transport and/or point sources of deposition.

However, two potential deltas have been identified: the Dixonville delta in west-central Alberta and the Ring-Pedigree Delta on the Alberta-British Columbia border. The Dixonville delta (T86-87, R25W5-R1W6) is interpreted to be a wave-dominated delta preserved within the topographic low formed by syndepositional movement of high-angle normal faults bounding the Hines Creek Graben complex. In contrast to the NNW-SSE strike -parallel linear geometry of the regional Montney shoreface trend, deltaic facies in the Dixonville area display a lobate geometry with a depositional thick that forms an E-W oriented protuberance relative to the paleostrandine. Sediment isopach trends infer that deposition at Montney time was constrained by drainage and sediment transport in the low established by the Hines Creek Graben.

The Ring-Pedigree Delta (T96-103; R10-13W6; 94-H-09; 94-H-16) is also interpreted to be a wave-dominated delta preserved on the Montney subcrop edge in the vicinity of the Hay River Fault Zone.

Delta front facies display common soft sediment deformation in the form of convolute bedding as a product of rapid and/or differential rates of sedimentation. Overthickened sandstone bodies, indicating mass sediment transport on the delta front, characterize both deltaic complexes. Normally graded, sharp-based beds characterized by planar bedding grading up to climbing ripple laminae infer a waning of flow from episodic sedimentation, interpreted as hyperpycnal flows emanating from the mouth of a distributary channel. These event deposits are often interbedded with hummocky cross-stratified sandstones capped by symmetrical ripples, inferring storm and wave processes. Although both deltaic complexes have narrow grain size profiles, both are also characterized by texturally immature sediment including anomalously high authigenic and detrital clay content (e.g. illite, chlorite, mixed layer illite-smectite) in fine-grained intervals inferring a level of feldspar degradation through hydrolysis and /or surface fluid interaction at the time of deposition. The presence of authigenic / swelling clays is particularly unusual for the Montney Formation.

Modern analogues for the Montney coastline include arid areas such as the South-Africa-Namibia coast and the west Moroccan coastline. In these areas perennial rivers are rare, and ephemeral rivers dominate. The Montney coastline was characterized by few permanent rivers with most sediment delivered to the coastline during short-lived flash flood (ephemeral episodic discharge ?) events through seasonal river systems. The low abundance of clay in most of the Montney is interpreted to reflect the dominance of mechanical weathering and the short duration of subaqueous submersion of sediments in

fluidal feeder systems (channels?). The Dixonville and Ring-Pedigree deltas, separated from each other by nearly 200 km, are interpreted to be among the very few perennial deltas of this ancient coastline. The anomalously high clay content of the Dixonville and Ring-Pedigree deltas reflects enhanced chemical weathering of sediments during long-term aqueous submersion in these perennial rivers.

This core display includes core from both the Dixonville and Ring-Pedigree deltas and provides the sedimentologic evidence for deltaic processes of deposition and discusses the architecture of coastlines characterized by both ephemeral and perennial fluvial systems sourcing sediment to the coastline.