

Aggradational Parasequences of the Imperial Formation at Imperial River, Northwest Territories

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West of Norman Wells, Northwest Territories, the Upper Devonian Imperial Formation is primarily a siliciclastic succession with local carbonate horizons. The formation overlies black shales of the Canol Formation and is erosionally truncated eastward by a sub-Cretaceous unconformity (Fig. 1). Shale is the principal lithology observed to the west of the study area, whereas interbedded sandstones and shales are more prevalent in the Mackenzie Corridor to the east. An outcrop 880 m thick, located west of Norman Wells along the Imperial River, was examined with the objectives to: (1) characterize the stratigraphy and sedimentology of the formation, and (2) tie the outcrop observations to equivalent strata in the subsurface (Fig. 1).

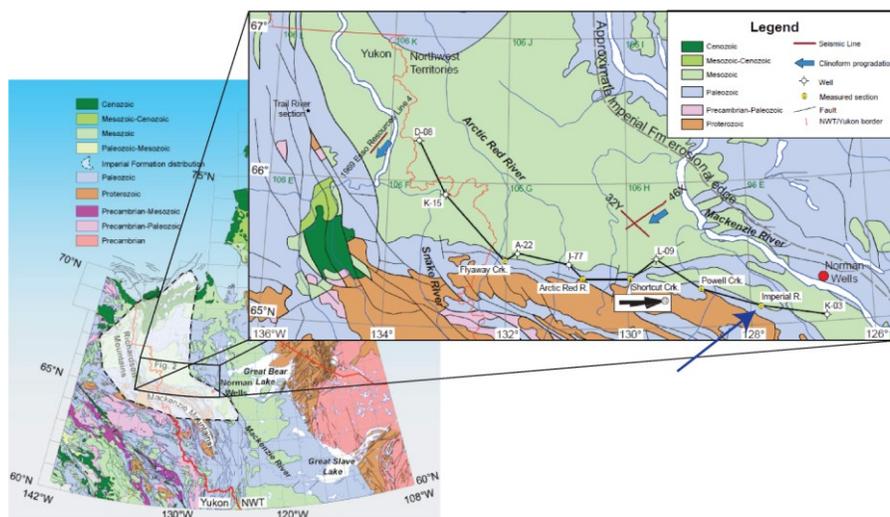


Figure 1: Map illustrating the study area and regional extent (within the dashed line) of the Imperial Formation. The blue arrow shows the Imperial River outcrop location. Modified from Hadlari et al. (2009b).

At the Imperial River section, the formation is divided informally into lower, middle and upper units, based on lithology (Hadlari et al., 2009a). The lower and upper units are predominantly siltstone and mudstone, whereas the middle unit, which is 400 m thick, consists of approximately thirty coarsening-upwards parasequences, which typically grade from mudstone to medium-grained sandstone. Parasequence thicknesses average 10 m, but can be as thick as 40 m. Each parasequence is characterized by a systematic shift in physical sedimentary structures up-section from planar or wavy laminated heterolithic beds to hummocky cross-stratification. High-energy planar tabular cross-stratification or trough cross-bedding, is only rarely present at the tops of the upwards-coarsening cycles. Cemented fossil debris locally characterizes the uppermost surface of the packages. The overall lack of facies typical of the upper

shoreface and foreshore, and the propensity of HCS-dominated sandstone at the tops of upwards coarsening cycles, suggests deposition on a storm-influenced shelf. Carbonate units with in-situ corals may record maximum transgressive conditions, where the setting was starved of clastic input. Due to the consistent characteristics of the stacked parasequences, including thickness and facies transitions, the middle unit of the Imperial Formation is interpreted to record an aggradational to slightly progradational shelf system. Long-term aggradation of the shelf, recorded through the 300 m thick middle unit at Imperial River, may have resulted from a sustained balance between sediment supply and subsidence in the basin throughout deposition.

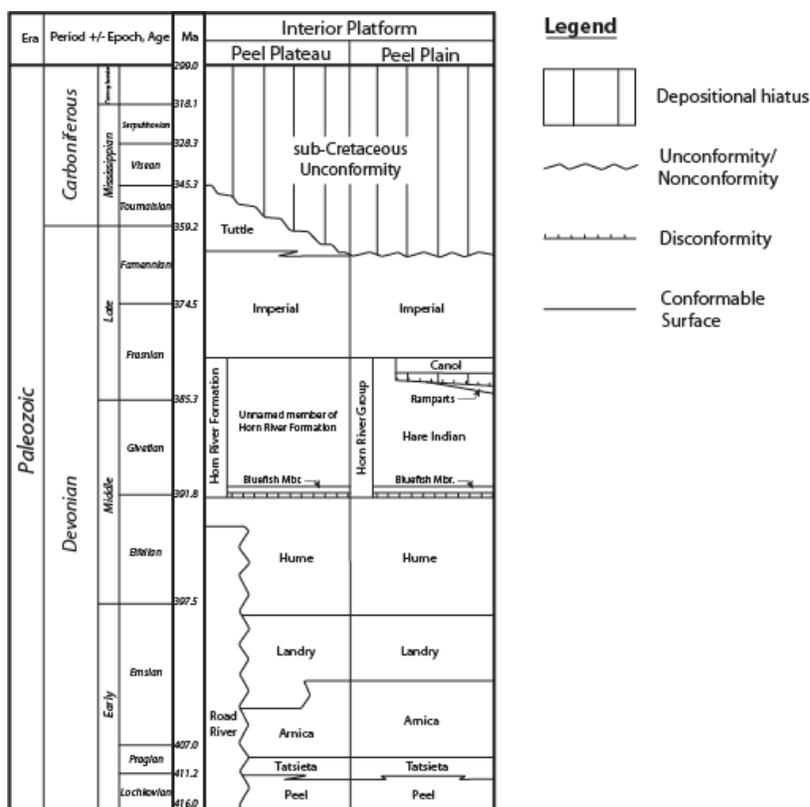


Figure 2: Stratigraphic column of the strata in the vicinity of Norman Wells and Imperial River. Modified from Hadlari et al. (2009b).

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