

Insights into Basin Architecture from the Stratigraphy and Sedimentology of the Lower Cretaceous in the Mackenzie Corridor, Northwest Territories, Canada

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Lower Cretaceous strata in the Mackenzie Corridor of northern Canada are poorly understood and under-explored, yet represent potential hydrocarbon exploration targets relatively close to the Mackenzie River. Outcrop sections, wire-line logs, core, palynology, seismic, and petrographic analyses were utilized to better constrain the paleogeographic setting.

Seismic and wire-line log correlations suggest that the study area is comprised of westerly dipping strata, with the Cretaceous deposits forming a clastic wedge overlying progressively older strata eastward. Two paleotopographic highs, the Keele Arch and the Mahoney Arch, were interpreted within the basin during the deposition of the Martin House Formation. The Martin House Formation has the greatest sandstone accumulation along the Mackenzie trough and in Great Bear Basin. A mapable surface identifies the Tukweye Member terrestrial facies from the overlying marine and marginal marine facies of the Martin House Formation.

Outcrops of the sub-Cretaceous unconformity were assessed along a west-east transect from the Mackenzie Mountains to Great Bear Basin. The western strata are interpreted as marine to marginal marine with bioturbated, glauconitic fine-grained quartz sandstones incised by channel sandstones and interbedded with smaller transgressive/regressive packages. East of the Keele Arch, strata were characterized by trough-cross bedded fine to medium grained cherty, quartz sandstone. In Great Bear Basin, strata were trough-cross-bedded, very coarse-grained, cherty lithic sandstone. These strata are interpreted as Tukweye Member fluvial deposits. The most westerly core is interpreted as a transgressive sequence from lower shoreface to off-shore facies. Other westerly cores have rooted sandstones, coals and incised channel deposits of the Tukweye Member overlain by bioturbated marine sandstones of the Martin House Formation. The cores in the Great Bear Basin are interpreted as fluvial, tidal, deltaic and pro-delta deposits. Palynology suggests the Tukweye Member is Aptian to Early Albian and the Martin House Formation is Early to Middle Albian.

Results suggest that basin topography imparted a significant control on the distribution and lateral continuity of units with several diachronous transgressive shorelines. The Western Canadian Sedimentary Basin may provide analogues for exploration in the Mackenzie Corridor given comparable stratigraphy, sedimentology and foreland basin structure.