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Octavian Catuneanu, Ahmed Khidir, and Rabindra Thanju, University of Alberta, Edmonton, AB, Canada

External Controls on Fluvial Facies: The Scollard Sequence, Western Canada Foredeep

The Scollard-age (Late Maastrichtian – Early Paleocene) strata in the Western Canada foredeep form a fully nonmarine depositional sequence bounded by regional subaerial unconformities, and include the conformable successions of the Scollard, Coalspur and Willow Creek formations. The paleo-depositional environment was dominated by fluvial systems sourced from the adjacent Cordilleran belt, with additional sedimentation in high watertable floodplains and lacustrine environments.

In the absence of syn-depositional marine influences, we have studied the relative effects of climate and tectonism on the observed geometry and facies of the Scollard sequence. The extent of the tectonic control was investigated based on reconstructions of paleo-slope gradients, changes in the direction of syn-depositional tilt, and variations in the burial depths of the sequence across the foredeep. The shift in fluvial styles from gravel- and sand-bed braided, at the base of the sequence, to sand-bed and fine-grained meandering towards the top suggests a decrease in slope gradients with time, as expected from a stage of thrusting in the adjacent Cordilleran belt. Changes in the direction of syn-depositional tilt, induced by differential subsidence along the strike, are also documented from paleo-current data. Differential subsidence rates are independently confirmed by the study of late diagenetic clay minerals, which indicate increasing burial depths to the south, towards the center of loading.

Superimposed on the effects of tectonism, several cycles of climatic fluctuations between wetter and drier conditions controlled the composition of sandstones in terms of framework and early diagenetic constituents, as well as the occurrence of coal seams.