A Sedimentological and Sequence Stratigraphic Approach to Correlating Clinoforms Within Shale Dominated Clastic Wedges and Implications for Shale Gas Exploration: Upper Colorado Group Shales, Wildmere Area, Central Alberta

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Clinoforms have long been recognized within shoreface and deltaic sandstones. Despite the plethora of research into sequence stratigraphy, well log correlations within shale deposits are still primarily based on lithostratigraphic methods. Lithostratigraphy yields interpretations which do not accurately depict the depositional architecture, and thereby the facies and reservoir architecture, of shale dominated strata leading to erroneous mapping of shale gas fairways. The upper portion of the Colorado Group in the Wildmere area of east-central Alberta is mainly comprised of shale with minor interbeds of siltstones and sandstones, carbonaceous shale, shell lags, bentonites and rare pebble lags. These units provide a useful case study for correlating clinoforms within fine grained clastic wedges.

Clinoforms within the upper Colorado Group shale units are correlated in cross-sections using induction logs from closely spaced wells. A well spacing greater than 3 km can lead to miscorrelations of log markers and flooding surfaces which define the clinoforms. Cross-sections commonly need to cover a minimum of 50km to observe the clinoforms, but stratigraphic relationships from cross-sections longer than 100 km tend to give better results. These relationships reveal stratal geometries interpreted according to seismic sequence stratigraphic principles and divide the succession into “system tracts” bounded by sequence boundaries, transgressive surfaces and maximum flooding surfaces. Whether these system tracts and surfaces represent fluctuations in eustatic sea-level, sediment supply, tectonic influence or a combination of these or other forces remain in question.

The geometric relationships of the clinoforms demonstrate that the internal configuration within these shale dominated clastic wedges is complex. Correlation of these clinoforms provides important constraints on shale gas exploration; these surfaces demarcate the boundaries of individual sedimentary bodies. A proper understanding of these clinoforms improves our understanding of lateral and vertical facies variations, crucial for shale gas exploration. The observation of clinoforms and sedimentary facies within the shale dominated clastic wedge of the upper Colorado Group could serve as an analogue for other similar gas bearing shales.