Sequence Analysis of Middle Triassic Strata in the Subsurface of Western Canada Sedimentary Basin

James Dixon*
Geological Survey of Canada, Calgary, Alberta, Canada
jdixon@nrcan.gc.ca

Abstract
The Middle Triassic in the subsurface of the Western Canada Sedimentary Basin contains the siliciclastic Doig and Halfway formations. These strata consist of westerly to southwesterly prograding offshore to shoreface sediments deposited in a series of transgressive-regressive sequences (TR-sequences). Middle Triassic strata are bounded by major sequence boundaries that extend throughout the basin. The lower boundary with the Lower Triassic Montney Formation is a transgressive surface of erosion and overlying maximum flooding surface. Nowhere in the basin has a subaerial unconformity between the Doig and Montney formations been preserved - due largely to sub-Upper Triassic and sub-Jurassic eastward truncation of Montney strata. The exact age of the lower sequence boundary is not accurately known but from the limited fossil data it appears to be at or close to the Lower-Middle Triassic boundary. A major subaerial unconformity at the base of the Upper Triassic Charlie Lake Formation forms the upper sequence boundary. However, this contact has been the subject of some controversy, with some authors interpreting the upper Doig-Halfway-lower Charlie Lake interval to be a facies progression from offshore silts and muds (upper Doig Formation) through shoreface sands (Halfway Formation) into lagoonal and sabkha muds and evaporates lower Charlie Lake Formation). The age of the upper sequence boundary is also poorly constrained, but may be at or close to the Middle-Upper Triassic boundary.

Within this major Middle Triassic TR-sequence are more locally developed TR-sequences that are bounded by transgressive surfaces of erosion. These lower-order sequences are probably the result of shifts in the source of sediment and/or lobe switching. Within at least three of these local TR-sequences there occur some thick sandstone bodies encased in siltstone and mudstone beds - these have been called “anomalously thick sandstone bodies” by Wittenberg (1992, 1993). The ATSBs vary in size and shape from single well occurrences to long and narrow, to irregularly shaped. Sediment thicknesses ranges up to about 55 m.

Several interpretations for the origin of ATSBs have been published: 1) estuarine deposits (valley-fill), 2) deltaic, 3) low-stand shoreface deposits, 4) slope-slumps filled with turbidites, 5) growth-fault grabens filled with shoreface deposits, and 6) shelf slumps filled with shoreface sediments and formed during periods of relative sea-level fall. The internal facies and stratigraphic setting indicate that interpretation 6 probably is the most likely interpretation.

Eastward downcutting of Doig and Halfway strata at the base-Charlie Lake unconformity, and to a lesser extent at the Doig-Montney contact, plus eastward merging of erosion surfaces within the Middle Triassic succession point to uplift of the basin margin as the major cause of unconformity development. This is consistent with a similar origin for eastward-downcutting unconformities in

the Upper Triassic Charlie Lake Formation, also interpreted to result from basin-margin uplift and normal fault activity (Davies, 1997).

References

Davies, G.R. 1997. The Triassic of the Western Canada Basin: tectonic and stratigraphic framework. Bulletin of Canadian Petroleum Geology, v. 45, p.434-460.

Wittenberg, J. 1992. Origin and stratigraphic significance of anomalously thick sandstone trends in the Middle Triassic Doig Formation of west-central Alberta. Unpublished MSc thesis, University of Alberta, Edmonton, 290p.

---------- 1993. The significance and recognition of mass-wasting events in cored sequences, impact on the genesis of several anomalously thick sandstone bodies in the Middle Triassic Doig Formation of west-central Alberta. In: Carboniferous to Jurassic Pangea, Canadian Society of Petroleum Geologists, Core Workshop Guidebook, p.131-161.