Levee Topography Formed by Horizontal Strata - An Outcrop and Synthetic Seismic Example from the Neoproterozoic Windermere Supergroup Canada

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Deep-water levees are commonly expressed as “gull wing” shaped elements in seismic images where the dip angle of reflectors typically steepen upwards and decrease laterally away from the channel. This distinctive morphology is generally thought to reflect the vertical stacking of individual beds that dip away from the channel at progressively less steep angles. Basal contacts of levee strata in the Neoproterozoic Isaac Formation, however, show no discernible change in bed dip over hundreds of meters laterally or tens of meters vertically and therefore are likely not the major source of levee topography. Notwithstanding, medium-bedded strata in the proximal levee thin appreciably over hundreds of meters laterally, causing their upper surfaces to form subtle topography. However this topography becomes later infilled and accordingly also does not likely contribute significantly to the overall development of levee topography.

An alternative model proposes that levee topography is formed mainly by thin-bedded turbidites that have a tabular geometry and terminate abruptly instead of tapering laterally. The upward, progressively more channelward (backstepping) stacking of these thin beds is interpreted to form an overall concave-up, lateral-thinning profile. This stacking pattern is a consequence of progressively diminished flow magnitude causing more limited lateral bed extent (i.e. flow run-out), which in turn reflects increased channel confinement related to levee growth and reduced overspill into overbank areas. This model was then used to generate a synthetic seismic model that forms dipping reflectors similar to those observed in many modern deep-water systems. Importantly, the reflectors produced in the model reflect a lateral change in lithofacies and not stratal dip.