

Coeval Deposition and the Implications for Sequence Stratigraphic Correlations in a Structurally Controlled Area of the Viking Formation

Sarah K. Schultz¹, James A. MacEachern¹, Shahin E. Dashtgard¹ and Octavian Catuneanu²

¹Simon Fraser University ²University of Alberta

Summary

The late Albian Viking Formation is a stratigraphically complex unit that exhibits significant along-strike variability of paleoshorelines that developed in response to autogenic processes as well as allogenic controls that were active during deposition. Structural reactivation of Precambrian basement structures occurred during Viking deposition and led to changes in depositional environments along the paleoshoreline (Schultz et al., 2019). This tectonic activity influenced sedimentation patterns and the creation of anomalous zones of accommodation in localized areas of the basin. Across fault boundaries, both progradational and retrogradational stacking patterns occur within broadly contemporaneous deposits, complicating the correlation of stratigraphic units. These local structural controls that influenced deposition must be incorporated into the working sequence stratigraphic model.

Variability in accommodation and sedimentation rates within a basin generates significant deviations in the along-strike stratal stacking patterns of systems tracts. This variability can lead to coeval depositional units that record juxtaposition of transgressive (retrogradational) and regressive (progradational) stratal stacking patterns. In instances where transgressive and regressive units are deposited concurrently, problems arise when attempting to correlate the systems tracts and place their accompanying deposits into a sequence stratigraphic framework. In order to accurately incorporate these complex areas into a developing framework, a data-driven approach that integrates both allogenic and autogenic controls must be utilized when modelling the 3D architectural variability of subsurface units.

Few studies have documented the effect(s) of structural control on systems tract development. Coeval deposition of regressive and transgressive units can occur in multiple environmental settings including: i) tectonically active fault zones (leading to differential subsidence); ii) depositional environments wherein sedimentation rates may vary significantly along strike (e.g., deltas); and iii) areas where both sedimentation and accommodation rates are variable (Catuneanu, 2019; Schultz et al., in press). Under any combination of these depositional settings, conditions may operate wherein progradational and retrogradational stacking patterns are generated concurrently, leading to challenges when extending correlations at a basin-scale.

Coeval deposition of transgressive and regressive units is likely more common than has been documented in the literature to date. Modern marginal-marine examples highlight how variabilities in accommodation and sedimentation rates play a pronounced role in the development of shoreline architecture. Coeval deposition has likely occurred in other formations in the Western Canadian Sedimentary Basin, and it is therefore crucial to integrate this concept into future

stratigraphic models in order to generate high-resolution datasets even in well-explored areas of the basin.

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References

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