Insights on Upper Devonian Reef Complex Depositional Heterogeneity and Architecture Unraveled Through Integrated Chronostratigraphy: Lennard Shelf, Canning Basin, Western Australia

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High-resolution chronostratigraphic correlations are integral to meaningful stratigraphic frameworks in depositional systems, but may be difficult to achieve due to biostratigraphic limitations and geological complexity. In steep-sided carbonate platform systems, such correlations are essential for platform-to-slope models, characterization of strike variability, and predictive sequence stratigraphy. The Canning Basin Chronostratigraphy Project (CBCP) integrates multiple independent signals extracted from exposed Devonian reef complexes along the northern margin of the Canning Basin to arrive at a well-constrained chronostratigraphic framework and predictive lithofacies model.

The resultant integrated framework allows for unprecedented examination of Lennard Shelf carbonate heterogeneity, depositional architecture, and sequence stratigraphy. For example, platform-top cycles with poor age control were successfully correlated to well-dated, yet poorly-cyclic, foreslope intervals, allowing for better tuning of cycle duration and definition of how accommodation changes are recorded downslope. Furthermore, the approach utilizes signals that are independent of lithological heterogeneity (i.e. magnetic polarity reversals and stable isotopes), thus recognition and correlation of slope systems tracts, and subsequent comparison of different slope types, was made possible. Additional insights include: 1) differential foreslope development related to paleogeographic and basement configuration; 2) non-tabular inner-to-outer platform cycle architecture; 3) shelf-to-slope correlation across a 2nd-order maximum flooding surface; and 4) development of a Famennian regional sequence stratigraphic framework, where little control was previously available. This study not only documents an integrated chronostratigraphic approach, but emphasizes the implications that arise from examination of facies within such frameworks; revealing correlations and insights that were not achievable with traditional sequence stratigraphic or biostratigraphic techniques.