

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

Ted Playton<sup>1</sup>, Roger Hocking<sup>2</sup>, David Katz<sup>3</sup>, Peter Haines<sup>2</sup>, Kelly Hillbun<sup>4</sup>, Eric Tohver<sup>5</sup>, Kate Trinajstić<sup>6</sup>, Maodu Yan<sup>7</sup>, Jeroen Hansma<sup>3</sup>, Sergei Pisarevsky<sup>3</sup>, Joseph Kirschvink<sup>8</sup>, Paul Montgomery<sup>9</sup>, Peter Cawood<sup>10</sup>, Kliti Grice<sup>6</sup>, Svenja Tulipani<sup>6</sup>, Ken Ratcliffe<sup>11</sup>, David Wray<sup>12</sup>, Samuel Caulfield-Kerney<sup>12</sup>, Peter Ward<sup>4</sup>, Phillip Playford<sup>2</sup>

<sup>1</sup>Chevron Energy Technology Company, Houston, Texas, USA, [tedplay@chevron.com](mailto:tedplay@chevron.com)

<sup>2</sup>Geological Survey of Western Australia, Perth, Western Australia

<sup>3</sup>Chevron Energy Technology Company, San Ramon, California, USA

<sup>4</sup>University of Washington, Seattle, Washington, USA

<sup>5</sup>University of Western Australia, Perth, Western Australia

<sup>6</sup>Curtin University, Perth, Western Australia

<sup>7</sup>Institute for Tibetan Plateau Research, Beijing, China

<sup>8</sup>California Institute of Technology, Pasadena, California, USA

<sup>9</sup>Chevron Upstream Europe, Aberdeen, UK

<sup>10</sup>University of St. Andrews, St. Andrews, UK

<sup>11</sup>Chemostrat Ltd, London, UK

<sup>12</sup>University of Greenwich, Kent, UK

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 2<sup>nd</sup>-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.