Application of carbon isotope chemostratigraphy as a chronostratigraphic tool in Upper Devonian carbonate slopes: Lennard Shelf, Canning Basin, Western Australia

Kelly HILLBUN[1], David KATZ[2], Ted E. PLAYTON[3], Evan LEWARCH[1], Kate TRINAJSTIC[4], Eric TOHVER[5], Peter HAINES[6],Jeroen HANSMA[5], Roger HOCKING[6], Joseph KIRSCHVINK[7], Peter CAWOOD[8], Kliti GRICE[4], Maodu YAN[9], Ken RATCLIFFE[10], Sergei PISAREVSKY[5],Paul MONTGOMERY[11], Peter WARD[1]

[1]University of Washington, Seattle, Washington, khillbun@u.washington.edu;
[2]Chevron Energy Technology Company, San Ramon, California;
[3]Chevron Energy Technology Company, Houston, Texas;
[4]Curtin University of Technology, Perth, Western Australia;
[5]University of Western Australia, Perth, Western Australia;
[6]Geological Survey of Western Australia, Perth, Western Australia;
[7]California Institute of Technology, Pasadena, California;
[8]University of St. Andrews, St. Andrews, United Kingdom
[9]Institute of Tibetan Plateau Research, CAS, Beijing, China;
[10]Chemostrat Incorporated, London, United Kingdom;
[11]Chevron Upstream Europe, Aberdeen, United Kingdom

Chronostratigraphic correlations are integral for sequence stratigraphic frameworks and subsurface reservoir characterization, however the generation of such frameworks are challenging due to dataset limitations and depositional heterogeneity.The Canning Basin Chronostratigraphy Project documents the development of a high-resolution, integrated chronostratigraphic framework for an Upper Devonian carbonate outcrop dataset along the Lennard Shelf, Canning Basin, Western Australia. Here, we focus on the stable carbon isotope component of the multi-disciplinary approach.

A correlation framework was developed by integrating carbon isotope chemostratigraphy, biostratigraphy, magnetostratigraphy, and sequence stratigraphy,allowing for an improved understanding of carbonate heterogeneity when compared to precursor frameworks constrained by sequence stratigraphic concepts alone.In carbonate slope settings, where depositional variability has historically hindered our ability to recognize and correlate systems tracts, stable isotope chemostratigraphyproved to be a useful chronostratigraphic tool as primary marine $\delta^{13}C$ values are tied to sea level changes. The primary marineisotopic trends recorded in slope sedimentscorrespond with systems tracts, allowing enhanced sequence definition and higher confidence correlations through these heterogeneous settings that was not possible before.The preservationof primary $\delta^{13}C$ values reached its limit in platform-top settings due to the impacts of meteoric diagenesis;in such cases, sequence stratigraphic concepts and magnetostratigraphy were more heavily leveraged.

Here we focus on an important component within an integrated workflow that enableshigh resolution correlation and the development of chronostratigraphic frameworks in carbonate systems.The stable carbon isotope aspect of the approach proved especially useful for unprecedented correlation and sequence definition in these heterogeneous slope settings.