A Stable Carbon Isotope Curve for the Middle Jurassic to Early Cretaceous: A New Chemostratigraphic Standard for Regional Correlation

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ABSTRACT

For the more recent geological past (i.e., Late Mesozoic and Cenozoic), stable carbon isotope ratios are often used as a tool for stratigraphic correlation. Perhaps remarkably, in exploration studies targeting deeper, often more complex intervals this tool is not routinely used. This is mainly because the expanded, continuous and magnetostratigraphically constrained reference successions that are provided through scientific ocean drilling are not readily available, beyond Cretaceous times. Nevertheless, through analysis and compilation of key sedimentary successions with sufficiently detailed biostratigraphic control, similar reference curves could theoretically be established.   Here, we present a novel biostratigraphically calibrated carbon isotope reference curve for the interval spanning Middle Jurassic (Callovian) to Early Cretaceous (Barremian). To this end, we have analyzed over 700 core and sidewall core samples from 13 biostratigraphically well-constrained wells from the Dutch offshore for their bulk organic-carbon isotope composition. Since all these samples are also analyzed in terms of quantitative palynology we were able to constrain and correct for the effect of substrate changes, particularly the changes in the ratio between marine and terrestrial organic matter. The resultant curve, which has a temporal resolution of approximately 25 data points/million year displays a number of significant 'shifts' and 'trends' that can be used as independent chronostratigraphic ties for subsurface correlation exercises. In this contribution we present the palynological zonation that underlies the chronostratigraphic calibration, discuss secular (global) and local controls on the dataset and illustrate the use of this reference framework by presenting two case-studies.