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Cretaceous high-resolution Carbon Isotope Stratigraphy: a Tool to decipher orbitally forced Changes in the global Carbon Cycle?

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Carbon isotope stratigraphy has evolved as a remarkable tool in Cretaceous stratigraphy. It overcomes problems inherent in biostratigraphy such as provincialism or diachronous first occurrence ages, which makes it useful for long-range correlation. New high-resolution carbon isotope stratigraphies from two basinal pelagic carbonate successions in northern Germany (Halle and Oerlinghausen, Münsterland Cretaceous Basin) resolve late Cenomanian to early Middle Turonian carbon cycle variations at timescales of less than 100 kyr. Beside the major positive carbon isotope anomaly of the Cenomanian-Turonian Boundary Event (CTBE), 11 small-scale distinct features are precisely resolved in the δ^{13}C carbonate curve and related to boreal macrofossil zonations. These small-scale carbon isotope events correspond to secular δ^{13}C carbonate variations identified previously in the English Chalk. In addition, the boreal high-resolution δ^{13}C carbonate curve shows a detailed coincidence with two Tethyan δ^{13}C curves from Italy, what demonstrates the interregional significance of the δ^{13}C events. The δ^{13}C events can be correlated within error limits of $\pm$40 kyr, and the new δ^{13}C curve enables the calibration of boreal and tethyan macro- and microfossil zonations. Accordingly, the Tethyan calcareous nannoplankton boundary NC13/NC14 corresponds to the boreal FO of *C. woollgari*, the index taxon for the Lower-Middle Turonian boundary.

Coccoliths are the main carrier of the bulk-rock δ^{13}C signal. The surprisingly common occurrence of small-scale δ^{13}C events at distant localities demands a mechanism for these carbon cycle variations. Results of spectral analysis of the δ^{13}C record at Oerlinghausen show the occurrence of two cycles with cycle lengths of 2-3 m and 9m. The cyclicity in the occurrence of δ^{13}C events can be related to the frequencies of short and

long eccentricity, which are modulations of precession. Although the causal linkage is not well constrained, an orbitally forced control of surface water productivity and organic matter preservation seems to be mirrored in the δ^{13}C signal of the inorganic carbon reservoir. In addition, the identification of five long eccentricity cycles in the Turonian part of the composite δ^{13}C record from the Münsterland Cretaceous Basin has implications for the current times scale.