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Stable-isotope chemostratigraphy: intercontinental correlation of organic carbon and carbonate records, and evidence of climate and sea-level change during the Turonian (Cretaceous)

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Carbon (δ13Corg, δ13Ccarb) and oxygen (δ13Ccarb) isotope records are presented for an expanded Late Cretaceous (Turonian – Coniacian) hemipelagic succession cored in the central Bohemian Cretaceous Basin. Geophysical logs, biostratigraphy, and carbon stable-isotope chemostratigraphy provide a stratigraphic framework. Similarities and differences between the δ13Ccarb and δ13Corg profiles are examined, and the time series compared to published coeval marine and non-marine isotope records from Europe, North America and Japan. All previously named Turonian carbon isotope events (CIEs) are identified and correlated at high-resolution between multiple sections, in different facies, in different basins and on different continents. The viability of using both carbonate and organic matter carbon-isotope chemostratigraphy for improved stratigraphic resolution, for placing stage boundaries, and for intercontinental correlation is demonstrated, although anchoring of the time series using biostratigraphic data is essential. An Early to Middle Turonian thermal maximum followed by a synchronous stepped cooling episode throughout Europe within the mid- to Late Turonian is evidenced by bulk carbonate and brachiopod shell δ18Ocarb data, and regional changes in the distribution and composition of macrofaunal assemblages. The Late Turonian Cool Event was coincident with a period of long-term sea-level fall, with significant water-mass reorganisation occurring during the mid-Late Turonian maximum lowstand. Falling Δ13C (δ13Ccarb - δ13Corg) trends coincident with two major cooling pulses, point to pCO_2 drawdown accompanying cooling, but the use of paired carbon isotopes as a high-resolution pCO_2 proxy is compromised in the low-carbonate sediments of our Bohemian Basin study section by diagenetic overprinting of the δ13Ccarb record. Carbon isotope chemostratigraphy is confirmed as a powerful tool for testing and refining intercontinental and marine to terrestrial correlations.