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Applications of the carbon stable-isotope record to refining the Cenomanian – Santonian (99.6 – 83.5 Ma) geological timescale

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Six representative Chalk sections in southern, eastern and northern England have been studied to develop an integrated litho-, chemo- and biostratigraphy that can be used as a reference for international correlation of the Cenomanian to lowest Campanian and be employed as a means to refine this portion of the Late Cretaceous timescale. The original calcite mineralogy, low organic carbon contents, shallow burial, negligible cementation, and minimal interaction with meteoric fluids, makes these sediments ideally suited to preserving a stable isotope record of Late Cretaceous environmental change. Prominent chalk – marl bedding couplets in Cenomanian chalks, and similar rhythms picked out by clay-content variation, marl seams and flint bands in younger chalks are believed to be the products of 20 kyr precession cycle climatic forcing. Individual beds can be correlated through the area, providing a basis for a refined stratigraphy with potential for a 10 kyr temporal resolution.

New carbon stable isotope analyses of bulk sediment samples have been combined with published data to generate a database of more than 1500 δ^{13}C determinations, which have been used to construct chemostratigraphic profiles for each of the study sections. A combination of macrofossil biostratigraphy and marker bed lithostratigraphy provides a tight correlation framework for the six sections that confirms the

synchronicity of shifts in the carbon isotope profiles. Significant δ^{13}C excursions and inflection points on the correlated English Chalk profiles have been used to define a formal carbon isotope event chemostratigraphy that enables more refined regional correlation. Substantial variations in thickness and facies are demonstrated between the localities, with no single section providing a complete record of the entire succession.

A composite δ^{13}C reference profile has been constructed using data from the most complete parts of each section. This has been compared with recently published high-resolution data for equivalent aged successions in Italy and Germany. Excellent agreement between δ^{13}C profiles throughout Europe confirms the likely global coherence of the isotope record through the Cenomanian – Santonian. However, major discrepancies exist in the placement of stages and substages and the location of magnetostratigraphic boundaries in the Boreal and Tethyan realms with respect to the chemostratigraphic correlation. These discrepancies will be discussed in relation to the development of an improved Late Cretaceous timescale.