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Developing a new dinocyst biostratigraphy for NW Europe: integrating Cenomanian – lowest Campanian (Upper Cretaceous) carbon-isotope events and palynology of the Trunch borehole (Norfolk, England)

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The Trunch borehole, north Norfolk, was located on an outcrop of the youngest preserved in-situ Chalk in the UK, with an aim to provide a reference section for regional Upper Cretaceous stratigraphy, including correlation to the southern North Sea. The borehole penetrated 469 m of top Campanian to Cenomanian Chalk, thin Lower Cretaceous and Lower Jurassic sections, and terminated in Triassic Mercia Mudstone Group (Keuper Marl) at 651 m depth. The core provides the stratigraphically most extended single Upper Cretaceous onshore record in the UK. A high-resolution (1 m sample spacing) palynological analysis of the Cenomanian to Lower Campanian in the Trunch borehole is documented. This constitutes the most detailed continuous stratigraphic record of organic-walled dinoflagellate cyst (dinocyst) assemblages from a single Upper Cretaceous section to date. The Upper Cenomanian – Middle Turonian proved to be largely barren of palynomorphs, but recovery was otherwise excellent enabling quantitative counts based on 300 cysts. A total of 67 dinocyst bioevents are recognized in the Lower – Middle Cenomanian and Upper Turonian – Lower Campanian intervals. Key biostratigraphic events identified in the core are compared to published records with an emphasis on NW Europe, and a new bioevent stratigraphy is proposed.

Age constraints on the ranges of marker species at Trunch are provided by radioisotopic and astrochronological ages of biostratigraphic datums and global carbon-isotope events interpreted in previous studies. A total of 29 age-control points is applied to the study interval at Trunch. The age-depth relationships between these points are estimated using a piecewise cubic Hermite interpolating polynomial function (pchip). The individual age-control points are assigned uncertainties related to stratigraphic correlation, sampling resolution, and those inherent in the radioisotopic measurements and astrochronological interpretations. Between the age-control points, the uncertainties are linearly interpolated.

The palaeogeographic distributions of the marker dinocyst species, derived from an extensive literature review, are plotted on global maps (using GPlates) to identify provinciality and to determine the limits of their spatial usefulness. The new bioevent stratigraphy offers considerably improved resolution for the correlation and dating of Upper Cretaceous strata.