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The Cenomanian-Turonian boundary event, biotic turnover, and global environmental change: evidence from boreal chalks and tethyan black shales

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Cenomanian-Turonian boundary (CTB) times, around 93.6 Ma, were a period of dramatic palaeoenvironmental change associated with an episode of significant biotic turnover. The boundary interval is characterized globally by a large positive excursion of δ^{13}C in marine carbonates, and both marine and terrestrial organic matter, indicating a major change in the dynamics of the global carbon cycle. The latest Cenomanian – early Turonian saw perhaps the highest post-Early Palaeozoic eustatic highstand of sea level, and the deposition of black shales in basinal and oceanic areas, generating one of the World's most important petroleum source rock intervals. Increased primary productivity and sluggish oceanic circulation caused widespread oxygen depletion in oceanic water columns that led to one of very few truly global oceanic anoxic events (OAE2).

Organic-walled dinoflagellate cyst (dinocyst) and geochemical records across the Cenomanian-Turonian boundary (CTB) are compared between a NW European boreal Chalk reference section in southern England, and a north tethyan hemipelagic black shale-bearing succession in the Vocontian Basin, SE France. High-resolution correlation between the sections has been achieved using planktonic foraminifera, calcareous nannofossil, and dinocyst biostratigraphy, integrated with carbon isotope chemostratigraphy. The sections show remarkably similar stratigraphic trends despite representing different palaeolatitudes and different biotic provinces (boreal versus tethyan), and contrasting lithofacies associations (pelagic chalks and marls versus organic-rich shales and limestones).

Dinocyst fertility indexes indicate that an upwelling-driven productivity pulse accompanied a eustatic sea-level fall that preceded the rise in δ^{13}C values marking the onset of OAE2. A marine productivity collapse in the Chalk Sea and tethyan marginal basins during the latest Cenomanian is evidenced by the falling absolute and relative abundance of peridinioid dinocysts, believed to be the product of heterotrophic dinoflagellates. This biotic change accompanied transgression and sharply rising sea-surface temperatures, following an Atlantic-wide episode of short-lived cooling. CTB biotic turnover in epicontinental and marginal seas was driven largely by water mass changes rather than oxygen depletion.