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Deconstructing the C/T OAE (∼94 Ma): the Plenus Cold Event/Benthic Oxic Event and its geochemical consequences

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The so-called Plenus Cold Event (M. geslinianum Zone: ∼94 Ma) occurred during the early stages of the Cenomanian–Turonian Oceanic Anoxic Event, as defined by the characteristic positive carbon-isotope excursion in carbonate and organic matter. The event is marked in Europe by the southward invasion of a boreal fauna, including the belemnite Praeactinocamax plenus, a shift to heavier oxygen-isotope values in bulk chalk, and evidence for a drop in pCO_2 based on the offset between carbon-isotope ratios in organic and carbonate carbon. TEX86 values from mid-latitude and palaeo-equatorial DSDP/ODP Atlantic sites suggest a cooling of ∼4–>5°C over this interval. In the Western Interior Seaway of North America, and in the equatorial proto-Atlantic, this interval was characterized by repopulation of the seafloor by benthic foraminifera (the Benthic Oxic Event), indicating regional re-oxygenation of bottom waters. Neodymium-isotope ratios from fish teeth from the English Chalk and the equatorial Atlantic indicate profound changes at this time in the composition of watermasses, whose derivation from Arctic regions is likely. Although data from south of the Equator are currently lacking, redox-sensitive geochemical species from a number of sections suggest profound regional changes in the dissolved oxygen levels of the sea floor at this time. These geochemical species include iodine (increase in I/Ca ratios as a response to increased availability of iodate as opposed to the reduced form, iodide, in seawater); sulphur-isotope ratios (decrease in δ34SCAS due to oxidation of marine pyrite in seawater and sediment) and local decrease in molybdenum-isotope ratios (δ98/95Mo) in sediment due to preferential adsorption of the lighter isotope into Fe–Mn oxyhydroxide phases stabilized under more oxygenated conditions. The predicted global increase in seawater δ98/95Mo over this interval remains to be established.