A CAUSAL LINK BETWEEN RE-ORGANIZATION OF OCEAN CIRCULATION PATTERNS DURING OCEANIC ANOXIC EVENT 2 AND EXTINCTION OF ROTALIPORIDS

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Abstract

The Cenomanian–Turonian Oceanic Anoxic Event 2 (OAE 2) is a severe perturbation of the global carbon cycle induced by enhanced volcanic activity within one or more Large Igneous Provinces (LIPs) that injected huge amounts of volcanogenically derived greenhouse gases in the ocean-atmosphere system and likely coincided with the highest sea-surface temperatures of the Late Cretaceous. The greenhouse mode of OAE 2 was temporarily interrupted by a 5 to 11∘C drop in sea-surface temperatures known as Plenus Cold Event (PCE) recognized in several European epicontinental basins, in the Western Interior Seaway (WIS) and in the Atlantic Ocean. Broadly coeval to the PCE, a repopulation event of benthic foraminifera (Benthonic Zone) in the WIS and a geochemical fingerprint for oxidation in several European epicontinental basins suggest a re-oxygenation phase of bottom waters that temporarily interrupted dysoxia/anoxia at the sea floor.
Planktonic foraminifera extinctions during OAE 2 involved the large-sized, deep-dwelling rotaliporids, which were common in late Cenomanian, oligotrophic tropical-subtropical assemblages. The cause(s) for this extinction is still poorly constrained. Candidates include expansion of the oxygen minimum zone (OMZ), ocean acidification, collapse of the thermocline under global warming during OAE 2, or cooling and water-mass reorganization in northern Europe during the PCE combined with expansion of the OMZ at lower latitudes.

This study documents quantitative changes in planktonic and benthic foraminifera from two European key-localities, Eastbourne (Anglo-Paris Basin, SE England) and Clot Chevalier (Vocontian Basin, SE France). Results are combined with published micropaleontological (planktonic and benthic foraminifera) and geochemical data (e.g., TEX, δ^{1}O, ϵNd) resulting in a highly-resolved reconstruction of biotic and oceanographic changes in sea-surface and at the water-sediment interface at upper bathyal depth within OAE 2. The data demonstrate synchronicity between sea-surface cooling (PCE), oxygenation of bottom waters (Benthonic Zone), changes in sea-surface and intermediate circulation patterns (ϵNd shifts) and extinction of rotaliporid planktonic foraminifera throughout the European epicontinental seas,

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Tethyan, Atlantic Ocean, and WIS. We suggest that the southward expansion of cool, relatively low saline and mesotrophic Boreal waters in the Northern Hemisphere during the PCE disrupted sea-surface thermal stratification at tropical latitudes and critically contracted the ecological niche occupied by rotaliporids playing a fundamental role in their extinction.

Keywords: Oceanic Anoxic Event 2, Plenus Cold Event, Benthonic Zone, foraminifera, rotaliporids, Eastbourne, Clot Chevalier