Constraints on TEX_{86} temperatures: Insights from Oceanic Anoxic Event 2 from the Central North Atlantic

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Transient episodes of extensive marine black shale deposition during the Mesozoic, such as Oceanic Anoxic Event 2 (OAE-2; ~93.5 Ma), illustrate the Earth system response to extreme greenhouse climatic perturbations. OAE-2 has been linked to LIP volcanism, global warming, increased ocean stratification, and the onset of anoxia and euxinia. A thermally stratified ocean with sluggish circulation might have resulted from a markedly reduced latitudinal geothermal gradient, as suggested by TEX_{86}-derived elevated SSTs (33-42°C) at mid-latitudes [1]. However, these SSTs contradict Earth system models for greenhouse conditions [2] in reconstructing too-high values in O_2-depleted settings, possibly because other variables affect this proxy [3].

High-resolution (2-5 mm scale) TEX_{86}-derived temperature estimates and GDGT distributions from sediment cores recovered from IODP Expedition 342 at Site U1407, South East Newfoundland Ridge (~32°N) indicate values of ~36°C during OAE-2. Notably, a large (~10-15°C) cooling trend was observed following OAE-2, but none during the event as previously reported [1]. However, the cooling trend is associated with a marked change in the distribution of isoprenoidal and other GDGTs, suggestive of changes in the sources of these biomarkers due to variations in water column redox conditions and terrestrial input, rather than SST. Our results implicate marked changes in oxygen-deficiency that affect the sources and distributions of GDGTs, thus altering TEX_{86}-derived temperatures, consistent with modern observations in oxygen-depleted settings [3].

[1] Sinninghe Damsté *et al*., (2010) *EPSL* **293**, 97-103. [2] Hollis *et al*., (2012) *EPSL* **349-350**, 53-66. [3] Schouten *et al*., (2012) *Geochim. Cosmochim. Acta* **98**, 228-243.