P101-MO

A VERY WARM PROTO-NORTH ATLANTIC OCEAN DURING THE MID-CRETACEOUS OCEANIC ANOXIC EVENT 2: NEW INSIGHTS FROM DSDP SITE 386, BERMUDA RISE, AND ODP SITE 1276, NEWFOUNDLAND BASIN

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The Cenomanian/Turonian (C/T) Oceanic Anoxic Event (OAE-2) resulted in extensive deposition of organic carbon (OC)-rich deposits (black shales), which ultimately led to a massive perturbation of the global carbon cycle. Evidence for the overall impact of this OAE is provided by the enrichment in ^{13}C for marine carbonates and organic matter (OM), expressed as a positive stable carbon isotopic shift at the C/T transition (~93.5 Myr). This shift is likely due to the enhanced removal of ^{12}C, through the burial of ^{13}C-depleted OM from the ocean and atmosphere. Furthermore, a feedback mechanism is assumed between the OC burial-led sequestration of atmospheric CO_2, fluctuations of the pCO_2 in the ocean-atmosphere system and instabilities in the mid- Cretaceous greenhouse climate, which in addition are underlain by orbital control. These climate fluctuations may be expressed as oscillations in the paleo-sea surface temperature (SST) records. Recently, this was revealed in a high-resolution study on C/T marine black shales from equatorial Atlantic Ocean locations (ODP Site 1260, DSDP Site 367) (Fig. 1), by the application of two independent paleotemperature proxy techniques, indicating significantly warmer SSTs ($\geq$5°C) for the equatorial Atlantic Ocean than today (Forster *et al*., 2007). Furthermore, the onset of the OAE-2 coincided with a rapid shift to an extremely warm regime (~35-36°C), followed by an intermittent cooling (~4°C) within the early stages of the OAE.

Here we present a new high-resolution paleo-SST-record from ODP Site 1276, offshore Newfoundland, generated from C/T black shale intervals, based on the organic temperature proxy, the TetraEther indeX of 86 carbon atoms (TEX_{86}). In addition, high-resolution stable OC isotopic, bulk rock geochemical and biomarker records were generated. During the mid-Cretaceous this location was situated in the NE-most part of the proto-North Atlantic Ocean, at an estimated paleolatidude of ~32°N (Fig. 1). First TEX_{86}-based SST results generated from Upper Cenomanian black shale samples indicate extremely high SSTs (~35°C), comparable to values previously derived at equatorial paleolatitudes (Schouten *et al*., 2003; Forster *et al*., 2007). Combined with new TEX_{86}-based SST records from the NW

proto-North Atlantic Ocean at DSDP Site 386 and previous records at DSDP Site 603B (Schouten *et al.*, 2003), this implies a completely tropical proto-North Atlantic Ocean with a nearly flat latitudinal SST-gradient (Fig. 1), at least during the onset of the OAE-2.

Furthermore, the strong thermal stratification of the water column could have triggered the extension of bottom water anoxia and sulfidic conditions up to the photic zone. Evidence for photic zone euxinia was obtained by the presence of isorenieratene derivatives, originating from photo-autotrophic green sulphur bacteria. In the present study, the identification of these molecular fossils in samples from DSDP Site 386 is consistent with previous studies at the nearby DSDP Site 603B, as well as at sites in the S and SE part of the proto-North Atlantic Ocean (e.g., Sinninghe Damsté and Köster, 1998). These findings indicate an increased preservation potential for OC in a basin-wide part of the proto-North Atlantic Ocean, and estimations of the OC accumulation rates suggest that this basin was a hotspot for OC burial during the perturbation of the global carbon-cycle.

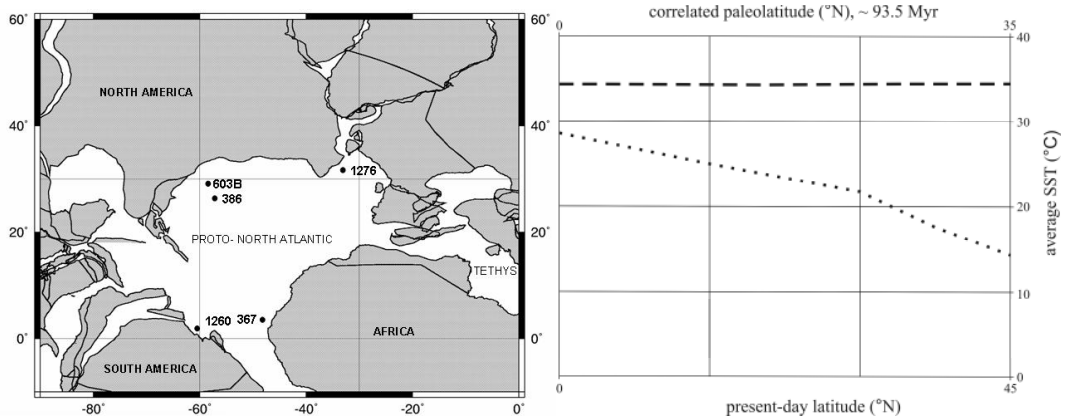

Figure 1. (*left*) Paleogeographic map of the proto-North Atlantic Ocean in a plate tectonic reconstruction for the C/T boundary (~93.5 Myr), showing the approximate locations of ODP Site 1276 and further sites containing uppermost Cenomanian black shales. (*right*) Reconstructed latitudinal SST-gradient (dashed line) for the proto-North Atlantic Ocean, based on TEX_{86} records from the indicated sites. The dotted line shows the present-day annual mean SST-gradient for the equivalent latitudes of the modern Atlantic Ocean.

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