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A parallel drop in pCO_2 and sea surface temperature during a mid-Cretaceous Oceanic Anoxic Event

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The stable carbon isotopic compositions of various biomarkers and total organic carbon (TOC) were measured in black shales from various sites in the proto North and South Atlantic Oceans deposited during the late Cenomanian/Turonian oceanic anoxic event (OAE) to determine the response of phytoplankton to this major perturbation of the global carbon cycle resulting from widespread burial of marine organic matter. The average positive isotope excursions of TOC and biomarkers varied substantially and amount up to 8.3 ‰. For the Cape Verde basin (DSDP Site 367) the $\delta^{13}C$ values of both sulfur-bound phytane (derived from chlorophyll) and C_{35} hopane (derived from cyanobacteria) were used to independently estimate pCO_2 levels. Before the OAE burial event, pCO_2 levels are estimated to be ca. 1300 ppmv using both biomarkers and the independent maximum Rubisco fractionation factors. At times of maximum organic carbon burial rates during the OAE, reconstructed pCO_2 levels are estimated to be substantially lower at ca. 700 ppmv. However, compared to other Cenomanian/Turonian OAE sections the positive isotope excursion of sulfur-bound phytane is also affected by an increased production during the OAE. When we adjust our pCO_2 estimates for this, we arrive at pCO_2 levels around 1000 ppmv, a reduction of ca. 25%.

At three different sites in the proto North Atlantic Ocean, we have detected using the TEX_{86}palaeothermometer a substantial cooling of the very warm surface waters before the OAE (ca. 34ºC) that occurs in phase with the drop in pCO_2. In the southern tropical proto North Atlantic (DSDP Site 367 and ODP Site 1260) this drop is only

a few degrees but at the ODP 1276 site in the northern proto North Atlantic (New Foundland Basin) this cooling amounts to 8°C. These results indicate that burial of organic matter can have a large effect on atmospheric CO_2levels and, in turn, affects global climate.