

**RAPID CHANGES IN OCEAN STRATIFICATION DURING THE
CENOMANIAN/TURONIAN OCEANIC ANOXIC EVENT AT DEMERARA RISE**

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Mid-Cretaceous climate was characterised by high global temperatures because of extreme greenhouse conditions, with CO₂ levels possibly up to 8 times pre-industrial values. During this period the oceanic anoxic event (OAE-2) at the Cenomanian/Turonian boundary (C/T; 93.5 Ma) resulted in extensive burial of organic matter (OM) as marine black shales. Enhanced OM burial was either caused by oxygen-deficient conditions in marine settings or high fluxes of OM to the ocean floor or a combination of these factors and is reflected in a large positive carbon isotope excursion in marine carbonate as well as OM.

A complete, well preserved record of OAE-2 was recovered during ODP Leg 207 off the coast of Surinam on Demerara Rise. Organic material from this site proved to be thermally immature, with high organic carbon contents (up to 20 %). A high degree of OM-sulfurisation favoured preservation, making the recovered sediments excellently suited for detailed biomarker studies. After laboratory desulfurisation of the polar fraction of the extractable OM, phytane was the predominant compound. Isorenieratane, a biomarker for euxinic conditions in the photic zone, was found in significant concentrations only within parts of the positive $\delta^{13}\text{C}$ excursion. It seems therefore that at Demerara Rise bottom waters experienced long-term anoxia while the base of the photic zone only became euxinic episodically during OAE-2. This is most likely due to stronger upper water column stratification during OAE-2 since primary productivity was probably already high as shown by the occurrence of black shales prior to the OAE.

We measured the compound specific carbon isotopes of isorenieratane ($\delta^{13}\text{C}_{\text{isor}}$) and phytane ($\delta^{13}\text{C}_{\text{phytane}}$) present in the desulfurised fraction and compared these records to the carbon isotopes of bulk organic carbon ($\delta^{13}\text{C}_{\text{org}}$). The amplitude of the excursion is exceptionally large in both the $\delta^{13}\text{C}_{\text{phytane}}$ (~ 8 ‰) and the $\delta^{13}\text{C}_{\text{org}}$ record (~ 6-7 ‰). The high amplitude of the $\delta^{13}\text{C}_{\text{phytane}}$ excursion suggests that the isotope excursion at this location is not only the result of globally enhanced carbon burial, but also of changing local conditions, probably increased productivity.

Within OAE-2 we observed two distinct platforms in both $\delta^{13}\text{C}_{\text{phytane}}$ and $\delta^{13}\text{C}_{\text{isor}}$ (grey shaded intervals in Fig. 1). In between these platforms carbon isotope ratios show a rapid decrease, almost back to pre-excursion values. This decrease in isotope values together with the simultaneous absence of isorenieratane and a drop in sea surface temperatures as reconstructed with the TEX_{86} proxy (Fig. 1) suggest that in between the two isotopic plateaus upper water column stratification was reduced temporarily within OAE-2. This shows that even within OAEs oceanographic conditions can vary substantially.

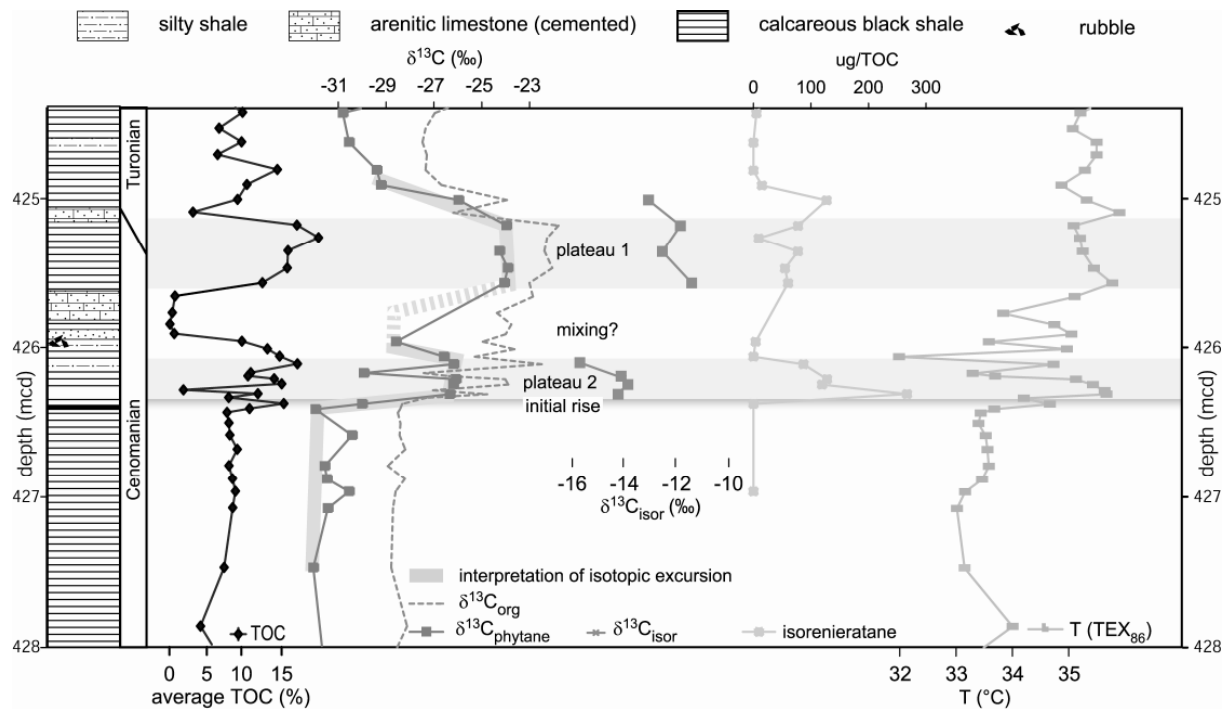


Figure 1. Lithology, stratigraphy, biomarker and stable isotope data for the Cenomanian/Turonian boundary interval at Demerara Rise ODP Site 1260. From left to right: total organic carbon content (TOC) in weight %, isotope values of bulk organic carbon ($\delta^{13}\text{C}_{\text{org}}$) and S-bound phytane ($\delta^{13}\text{C}_{\text{phytane}}$) and isorenieratane ($\delta^{13}\text{C}_{\text{isor}}$) in ‰ vs. VPDB, isorenieratane concentrations in ug/g TOC, TEX_{86} temperatures in °C. Grey shaded areas mark the range of the two isotopic plateaus characterised by enriched $\delta^{13}\text{C}$ values.