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CONIACIAN-SANTONIAN CLIMATE EVOLUTION INFERRED FROM MOLECULAR MARKERS OF PRIMARY PRODUCERS AND OCEAN WATER OXYGENATION: RESULTS FROM THE DEMERARA RISE (ODP LEG 207)

Britta BECKMANN[1], Peter HOFMANN[1], Nikolai PEDENTCHOUK[2,] Stefan SCHOUTEN[3], Jaap S. SINNINGHE DAMSTÉ[3] and Thomas WAGNER[4]

1. University of Cologne, Institute for Geology and Mineralogy, Zülpicher Str. 49a, 50674 Köln, Germany
2. Dept. of Geology and Geophysics, Univ. of Calgary, 2500 University Dr., Calgary, AB T2N 1N4, Canada
3. Dept. of Marine Biogeochemistry and Toxicology, Royal NIOZ, PO Box 59, 1790 AB Den Burg, Texel, The Netherlands
4. School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK

Oceanic anoxic events (OAEs), time envelopes of enhanced sequestration of marine organic carbon (OC), provide fundamental information on the functioning of biogeochemical cycles and their internal and external feedback mechanisms during the late Mesozoic climate evolution. The final Cretaceous Coniacian/Santonian OAE (OAE 3), which was restricted to marginal marine settings (Wagner et al., 2004), is investigated in cyclic sediments from the tropical Atlantic drilled at Demerara Rise off Suriname. Here we present results from organic geochemical analyses performed on OC-rich sediments covering OAE 3 from ODP Leg 207 at Site 1261. This data is utilized to address the composition of primary producers and the oxygenation state of surface and deep waters and infer the dynamics and controls of sedimentation leading to black shale deposition in the western tropical Atlantic.

The Coniacian – Santonian interval at Site 1261 consists of finely laminated calcareous black shales with approx. 2-15% OC. Hydrogen Indices ranging from 350 to 750 suggest the dominance of lipid-rich marine organic matter during the upper Cretaceous at Demerara Rise. Moreover, biomarkers from the aliphatic fraction reveal variable contributions of different organism groups including archaea, diatoms, and dinoflagellates, supporting changes in the community of primary producers that thrived in the oxic part of the photic zone. These changes likely occurred in response to fluctuations in ocean oxygenation and nutrient supply deduced from molecular (Lycopane*/n-C_{31} ratio, homohopane index, isorenieratane, C_{25} highly branched isoprenoids) and inorganic geochemical data (e.g. Ni/Al, Zn/Al ratios).

Different from black shales deposited in semi-sheltered sub-basins off tropical Africa (e.g., ODP 959), Demerara Rise was fully exposed to open marine currents throughout the study interval (Shipboard Scientific Party, 2004). Increasing ocean circulation along with the widening of the Equatorial Atlantic (Wagner & Pletsch, 1999) apparently had a significant effect on shallow ocean oxygenation at both sides of the tropical Atlantic, with temporal euxinic conditions off West Africa but constant oxic conditions off tropical South America.

To obtain more insights in the functioning of mechanisms and controls of black shale deposition on shorter timescales (i.e., in the order of thousands of years), we next plan to analyze selected intervals of the study section in 1cm increments. We expect that these high-resolution records will provide further information on timescales and mechanisms of fluctuations in the community of primary producers, surface and deep ocean oxygenation, and continental mineral and nutrient supply. Another major point of this work will be the determination of compound-specific carbon isotope values on leaf waxes (long-chain *n*-alkanes) and possibly hopanes and steranes (see Fig. 1). We expect that the stable carbon isotopic composition of individual biomarkers will help to constrain the carbon pathways in the Cretaceous equatorial Atlantic region and shed light on mechanisms and feedbacks of black shale formation from the atmosphere to land to the deep ocean.

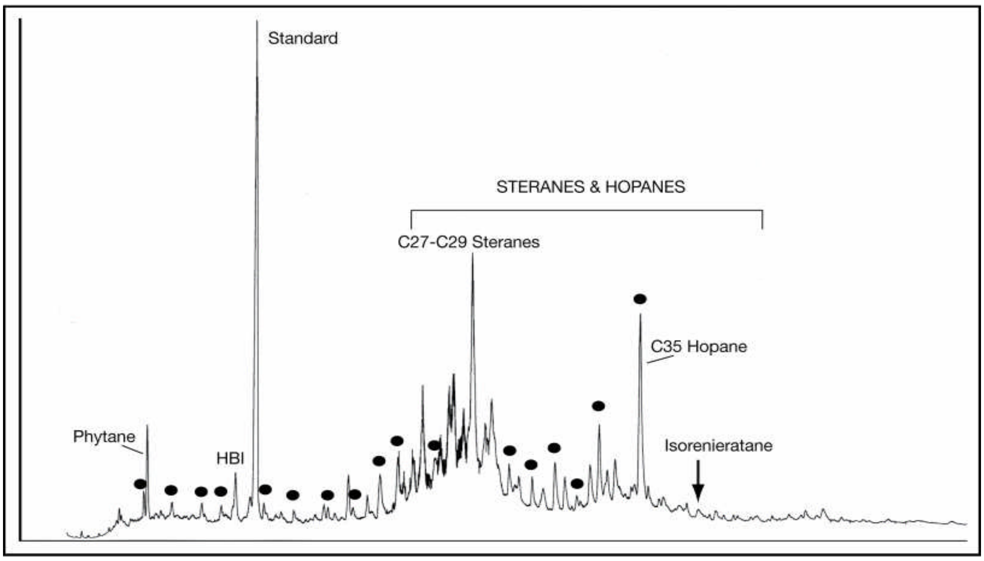

Figure 1. Total ion current (TIC) of the apolar fraction of a typical black shale sample at ODP Site 1261 with TOC of 9.1% (1261A43/5/105-106.5). Filled circles indicate the *n*-alkanes.

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