

Terrestrial organic matter in marine sediments: analytical approaches and eolian-marine records in the central Equatorial Atlantic

Wagner, T. and Dupont, L.
Geowissenschaften, Universität Bremen
Postfach 330440, 28334 Bremen, Germany

Abstract

Terrestrial organic matter (OM) in pelagic sediments is discussed with regard to depositional processes and land-sea interactions in the modern and past glacial/interglacial Equatorial Atlantic. Special emphasis is drawn on a critical evaluation of different analytical approaches (C/N, Rock-Eval Pyrolysis, stable carbon isotopes, palynology, organic petrology, and selected biomarkers) which are currently used for the qualitative and quantitative assessment of terrigenous organic carbon. We found the most critical factor if mixing equations are used to be the accurate definition of terrestrial and marine endmembers since they may be biased by a great number of independent controls. A combination of geochemical methods including optical studies (organic petrology and palynology) is therefore suggested enabling a critical evaluation of each individual proxy.

Organic geochemical analyses performed on sediments from the modern and Late Quaternary Equatorial Atlantic evidence fluctuations in eolian supply of terrigenous OM related to changes in intensity of the trade winds. Quantification of this organic fraction leads to differing proportions depending on the approach applied, i.e. the organic carbon isotopic composition or maceral analyses. Modern distribution of terrigenous OM reveals a decrease in supply towards the basin contributing less than a fifth of the total OM in pelagic areas. Organic geochemical data indicate that sedimentation in the modern northeastern Brasil Basin is affected by lateral advection of reworked OM probably from southern source areas. Glacial/interglacial deposits from the pelagic Equatorial Atlantic (ODP Site 663), covering isotopic stages 12 and 11, reveal that deposition of terrigenous OM was higher during past glacial conditions in correspondence to generally enhanced dust fluxes. Proportions of terrigenous OM, however, never exceed 50% of the total OM according to maceral analyses. Other estimates, recently proposed by Verardo and Ruddiman (1996), are considered to be too high probably due to analytical reasons. Palynological records in the Equatorial Atlantic parallel dust records. Increased portions of grass pollen suggest the admixture of C4 plant material during modern and past glacial conditions. It is therefore assumed, as one possible interpretation, that C4 plant debris has an effect on sedimentary $\delta^{13}\text{C}_{\text{org}}$ and might explain differences between isotopic and microscopic quantitative estimates. Using the difference between these two records we calculate that maximum supply of C4 material remains below 20% of the total OM for the deep modern and past glacial/interglacial Equatorial Atlantic.

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