



Relationship between TOC and $\delta^{13}\text{C}_{org}$ in DSDP Leg 43, Site 386, Core 44: Implications concerning atmospheric CO_2 and biogenic sources

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Geochemical studies of Cenomanian strata at Site 386, Core 44 reveal several interesting relationships between amount of organic carbon, microfossil content, and carbon isotopic composition of the organic carbon. Total Organic Carbon (TOC) values range from <0.1% to >6%, with an average value of <0.5%. Levels rich in TOC contain predominantly marine planktonic organisms (radiolarians, nannos) and tend to be isotopically lighter compared to most Tertiary samples. The average $\delta^{13}\text{C}_{org}$ values for organic matter in core 44 are between -25 and -27 per mil while most Tertiary organic carbon rich strata of marine planktonic origin are between -16 and -23 per mil, with an average of -20 per mil. Although the $\delta^{13}\text{C}_{org}$ values for core 44 are within the ranges of terrestrial values, which are mostly between -23 and -33 per mil, with an average of -28 per mil, the microfossil record of DSDP Site 386 implies only the presence of marine organisms. These results are thus more compatible with previously suggested influence of higher CO_2 values in the atmosphere during the middle Cretaceous due to tectonovolcanic events. Greater availability of CO_2 may have been responsible for the lighter $\delta^{13}\text{C}_{org}$ values of the Cenomanian marine organic matter compensating for fractionation by photosynthesis of marine planktonic organisms.

Levels with lower organic matter (TOC values of <0.5%) in core 44 show positive $\delta^{13}\text{C}_{org}$ excursions up to 4 per mil, preceded by a small negative $\delta^{13}\text{C}$ excursion of 1.5 per mil. The increase in $^{13}\text{C}/^{12}\text{C}$ ratios for organic matter may imply that the 4 per mil positive isotopic shift in bulk $\delta^{13}\text{C}_{org}$ values can be largely attributed to a change in source of the organic matter, from predominantly marine protista to one where marine prokaryotes became much more prevalent.