Organic carbon in Mediterranean sapropels: the interplay between anoxia, productivity and clay mineral association

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TITLE

Mechanisms of organic carbon preservation on Mediterranean sapropels: The interplay between anoxia, productivity, and clay mineral association.

RUNNING TITLE

Clay mineral, anoxia, productivity

ABSTRACT

Despite numerous studies conducted within the Mediterranean basin to understand the timing and climatic influences governing the formation of organic rich sedimentary layers, sapropels, a conclusion regarding the mechanisms behind the enrichment and preservation of the organic carbon (OC) within the sapropels remains elusive. As such, a significant flaw within our understanding of biogeochemical processes that influence the climate and oxygenation of the Earth's oceans and atmosphere exists. Current literature is dominated by two hypotheses which attempt to explain the enrichment and preservation of OC with no consensus between the two schools of thought. One of which highlights oxygen depleted, anoxic water conditions as a factor while the second relies upon increased productivity within the water column. As such, this study proposes a third hypothesis which states that an increase in organic matter (OM) preservation may be related to the increased presence of the high surface area mineral, smectite (Wehausen & Brumsack 1999, Foucault & Melieres 2000) at the time of sapropel formation. This study investigates the interaction between OM and the mineral matrix within core sample from the Ocean Drilling Program (ODP) Leg 160 site 967 using multiple methods including: SEM imaging, XRD analysis, EGME 'free surface' mineral area (MSA) testing, and geochemical testing for total organic carbon (TOC) and $CaCO_3$ content. From these methods, we falsified the hypothesis that MSA is a dominant factor in the preservation of OM by the lack of correlation present between MSA and TOC. Instead, results obtained during this study provide new evidence supporting the model presented by Kemp et al. (1999) which hypothesises siliceous productivity is the mechanism controlling OM preservation within sapropels. As such, this study presents Kemp's model of productivity as the preferred method of OC enrichment and preservation within the Mediterranean Basin, and subsequently furthers our understanding of the biogeochemical processes governed by OC. However, continued study of these OC rich sediments is required to better understand the burial and preservation of OC within this region.

KEYWORDS

Mediterranean, Sapropel, Anoxia, Productivity, Clay Mineral Association, Organic Carbon Preservation

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