Redox-Controled Formation, Preservation, and Interruption of Organic-rich Sapropel S1 sediments

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In Mediterranean marine deposits, distinct organic-rich units (sapropels) occur in a repetitive, climate-controled way. Their deposition is precession-related and associated with humid climate conditions. The most recent sapropel S1 formed between 9.8 and 5.7 ^{14}C ky BP thus simultaneous with a circum-Mediterranean humid period. (11 - 5 kyr ^{14}C). S1 deposition occurred syn-chronously at all water depths > a few 100m. Due to increased fresh water (monsoon) input, surface waters had a reduced salinity and concomitantly the deep (> 1.8 km) eastern Mediterranean was devoid of O_2 during 4,000 years of S1. This resulted in a differential basin-wide preservation of S1 determined by water depth, as a result of different ventilation/climate-related redox conditions above and below 1.8 km. A sedimentary,basin-wide, MnO_2-peak marks the abrupt re-ventilation of deep-water at 5.7 kyr. The subsequent oxic conditions resulted in a downward progressing oxidation-front that is not only marked by degradation of organic matter over its active pathway, but also by the built-up of a secondary Mn-peak below the first, ventilation Mn-peak. Apart from the major re-ventilation event at the end of sapropel S1 formation, also other, short-term ventilation events have occurred, notably the 8.2 ka event. This basin-wide event is particularly noticeable at relatively shallow near-coastal sites of high sedimentation rates. It marks a brief episode of not only re-oxygenated deep water thus reduced preservation, but also decreased primary productivity thus nutrient supply.

This 8.2 cal ka BP interruption event is related to enhanced deep-water formation in the Aegean or Adriatic due to a period of sustained cold air fluxes from Polar regions. The amount of precipitation thus stratified water column conditions is associated with N.African monsoonal system, whereas deep-water formation, thus disrupture of a stratified water column is related to the N-borderland climate system. Sapropel formation mechanisms, therefore, are related to a sensitive interplay between S- and N- borderland climate systems. Assessing distinct, sub-Milankovitch climate variability is vital for understandingand forecasting future climate change.