



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

Gert J. De Lange, Rick Hennekam, Marie-Louise Goudeau, and Amalia Filippidi
Utrecht University, Geosciences, Utrecht, Netherlands (gdelonge@geo.uu.nl)

Distinct, organic-rich units (sapropels) occur in Mediterranean sediments in a repetitive, climate-controlled way. Their deposition is thought to be precession-related and to be associated with humid climate conditions. The last humid period from 11 - 5 kyr 14C ago, occurred simultaneous with a sustained circum-Mediterranean wet period. Within that period, the most recent sapropel (S1) formed synchronously between 9.8 and 5.7 14C ky BP at all water depths greater than a few hundred metres. As a consequence of increased fresh water (monsoon) input, surface waters had a reduced salinity and concomitantly the deep (> 1.8 km) eastern Mediterranean Sea was devoid of oxygen during 4,000 years of S1. This has 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.

The end of this period is marked by a basin-wide high sedimentary manganese-oxide peak that represents an abrupt re-ventilation of the deep-water at 5.7 kyr. The sustaining oxic conditions thereafter have resulted in a downward progressing oxidation-front that is not only characterized by the degradation of most organic matter over its active pathway, but also by the built-up of manganese oxide. The latter has resulted in a secondary Mn-peak below the first, upper, ventilation Mn-peak. Apart from the major re-ventilation event at the end of sapropel S1 formation, also other, short-term ventilation events appear to have occurred during its formation, notably the 8.2 ka event. This potentially 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 thought to be 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 seems associated with the N.African monsoonal system, whereas deep-water formation, thus disruption of a stratified water column seems mostly related to the northern borderland climate system. Sapropel formation mechanisms, therefore, are related to a sensitive interplay between N-African monsoonal and northern climate systems. Assessing distinct sub-Milankovitch interruptions and related climate variability are vital for understanding future climate change