UPPER WATER COLUMN VARIATIONS IN THE SOUTH AEGEAN SEA DURING CLIMATE CHANGE EVENTS IN THE LAST 19.000 YEARS

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Abstract

The Late Quaternary palaeoenvironmental evolution and the main palaeoceanographic changes of the south Aegean Sea was reconstructed using high resolution micropalaeontologic and geochemical data ($\delta^{18}O$ and $\delta^{13}C$ isotopes, AMS ^{14}C datings, C_{org} content) obtained from the sediments of a high sedimentation rate gravity core north of Kimolos Island.

Keywords: Aegean Sea, Stable isotopes, Sapropel, Sea level

An integrated high resolution study based on a high sedimentation rate gravity core (KIM 2A, length 197 cm collected from a submarine depression located north of Kimolos Island, south Aegean, 640-m water depth), was carried out in the frame of "YPOTHER" project, funded by the National Strategic Development Program EE. New data concerning climatic, eustatic and paleoenvironmental changes during the late Quaternary are provided. The stratigraphic framework, based on a combination of Accelerator Mass Spectrometry (AMS) radiocarbon (^{14}C) datings, additional control points of planktonic foraminiferal bioevents and the oxygen isotope record, spans from the last deglaciation to the Holocene. Herein we focus on findings from the last glacial to interglacial transition and the sapropel S1 deposition. The results based on high-resolution micropalaeontological data (planktonic and benthic foraminiferal assemblages, pteropods), stable isotopes ($\delta^{18}O$, $\delta^{13}C$) and other indicators of sea-surface hydrology (stratification and productivity indices), allowed the recognition of palaeoceanographic/sea-level changes of the last 19 kyr.

Marking the transition from glacial to present-day interglacial conditions, the late Pleniglacial/Late Glacial interval (coeval with late Marine Isotope 2; MIS2) was characterized by a series of millennial-scale climate oscillations that affected the ocean-atmosphere system. During the glacial period (19.0–14.8 kyr; Fig. 1), the heaviest $\delta^{18}O$ values, accompanied with low values of Planktonic Palaeoclimatic Curve (PPC), the highest values of the stratification index (S-index) and the absence of oligotrophic species, suggest low SST and high eutrophication levels. An abrupt shift to warmer conditions connected to the Bølling-Allerød (B-A) interstadial is indicative by all records (e.g. abrupt high percentages up to 60% of the PPC, lighter $\delta^{18}O$ values, Fig. 1C, B) representative of temporal climatic amelioration (Termination T1a).

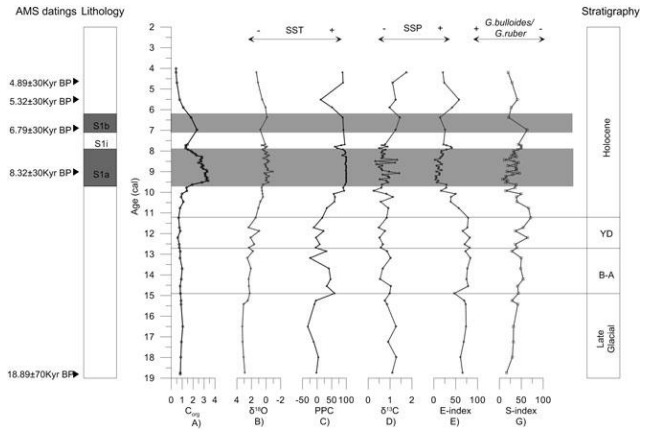

Fig. 1. Results of the GC KIM2A showing the downcore variation of the: A) Total Organic Carbon (C_{org}), B) $\delta^{18}O$ isotope values, C) Sea Surface Temperature, D) $\delta^{13}C$ isotope values, E) Sea Surface Productivity (E-index), G) *G. bulloides/G. ruber* ratio (S-index).

This short deglacial event (14.8-12.7 kyr) also played an important role in the sea-level rise that produced changes in benthic foraminiferal assemblages, favoring the proliferation of shallow water species of the inner shelf. The abrupt rise of the palaeoclimatic curve during this time period is characterized by the higher abundances of *G. ruber alba*, *G. bulloides*, and *G. inflata*, which are indicative of changing conditions of deposition, suggesting temperate and mesotrophic waters, with strong seasonal mixing and local upwelling. An abrupt switch to cool, arid climatic event of Younger Dryas (YD) suggests a strengthening of winter convection around 12.7 kyr. This climate response of south Aegean depression to the YD event (12.7-11.2 kyr) seems to be in accordance with relevant signals from the north and central Aegean sub-basins [1-3]. The latter oscillation precedes the final transition to the interglacial conditions of the Early Holocene (Termination T1b).

The Holocene started with a sharp warming of sea surface water, reaching present-day levels and probably associated with a reduction in salinity. The most warm and humid Holocene conditions coupled with a relatively productive and stratified water column enabled the deposition of the two sapropel sub-layers: S1a (9.7-7.9 kyr) and S1b (7.1-6.2 kyr) as witnessed by their high organic carbon (C_{org}) content (1.8-3.3%). During S1 deposition, depleted values of $\delta^{18}O$ are recorded (-0.9‰ to 0.6‰), warm water species domain, and oligotrophic conditions are observed. The sapropel interruption (S1i; 7.9-7.1 kyr) is marked by the decreasing content in C_{org} (1.3%) and in heavier $\delta^{18}O$ and $\delta^{13}C$ values (Fig. 1A, B, D). In this interval a brief cooling event at 7.8 kyr can be recognized mostly by the negative peak of PPC. This brief cooling event has also been recorded in other Aegean cores [1-6]. From 6.2 kyr to the top of the core, slightly heavier $\delta^{18}O$ values are recorded and represent the modern water column of central Aegean Sea.

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