Fresh water discharges in the Adriatic Sea since 17 000 years: influence on organic carbon recycling and deep water ventilation rates

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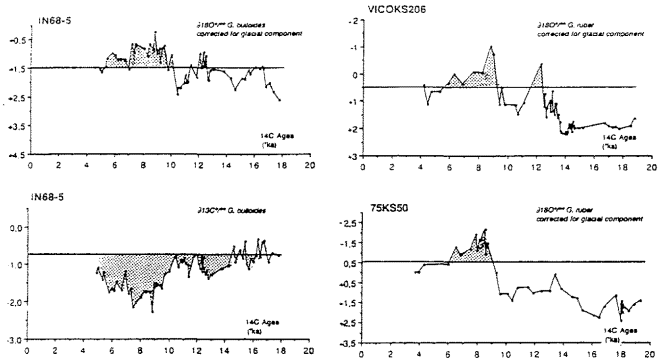
The open ocean deglacial sea level rise was not monotonic. In the Atlantic, in fact, it was marked by two intervals of rapid rise which also corresponded to important meltwater discharges dated at about 12 kyrs and 9.5 kyrs (^{14}C ages) (FAIRBANKS, 1989). Because of its negative water budget (E/P <0) the Mediterranean Sea as a whole, generally behave as an amplifier of the global climatic signals. An exception to the rule is the present day Adriatic Sea, with a positive water budget (E<P).

The oxygen and carbon isotope records of three cores located respecuvely within the central Adriatic Sea: core IN68-5 (41°14'N/18°32'E, 1030m water depth), south west of the Otranto sill: core 88KS206 (39°22'N/18°56'E, 950m water depth) and within the Levantine basin: core 75KS50 (34°41'N/27°00'E, 2290m water depth) have been compared for the period corresponding to the last deglaciation, since about 17 kyrs. The chronological frame is based on oxygen isotope stratigraphy and ^{14}C radiocarbon and AMS datings. The ^{18}O records have been corrected for the ice volume component (FAIRBANKS, 1989). The data show that in the Adriatic as well as immediately south off this basin, two important events of freshwater discharges can be correlated to the meltwater spikes reported for the Atlantic, at about 12 and 9.5 kyrs. The more recent event however lasted longer and ended at about 5 kyrs. A linear relationships between the $\partial^{13}C$ and $\partial^{18}O$ values recorded during these time intervals also supports the hypothesis of a freshwater contamination for both ^{18}O and ^{13}C decreases. By contrast, the first freshwater pulse at 12 kyrs is not recorded in the Levantine core 75KS50 whereas the second one is well marked and coincided in part with the deposition of sapropel S 1.

In addition, since 17 000 years, the surface and deep inorganic carbon (ΣCO_2) was repeatedly depleted in the heavy ^{13}C isotope. The $\Delta\ \partial^{13}C$ difference between *Cicibides pachyderrna* and *Uvigerina peregrina* in core IN68-5 has been used as a proxy record for the estimation of organic carbon fluxes to the sediment since 17 000 yrs, in the central Adriatic Sea. The data suggest that these fluxes were stronger between 16 and 14 kyrs, around 13 kyrs and between 8 and 5 kyrs. The maximal values correspond to the more recent flux. The $\partial^{13}C$ records of *G. bulloides* indicate that shallow water ^{13}C depletion was maximum between 14 and 11 kyrs and again between 9.5 and 5 kyrs. These ^{13}C decreases in the shallow water ΣCO_2 are also recorded in the Levantine basin by *G. ruber*. Whereas these two negative excursions are clearly separated by an episode of ^{13}C enrichment, occurring approximately in coincidence with the Younger Dryas in the Adriatic and Otranto cores, this interruption is less conspicuous in the Levantine basin.

These data highlight the complexity of the factors which controlled the surface water primary production, the downward fluxes of organic carbon to the sediment and the deep ventilation of the eastern Mediterranean basins. Freshwater discharges around 12 and 9.5 kyrs may have seriously hampered deep water formation in the Adriatic Sea (as it occurs today, during "low salinity years"), and consequently lowered the deep ventilation of the eastern mediterranean basin. In the same time, the increase in the Northern Hemisphere insolation which became maximal between 11 and 12 kyrs, caused the seasonal temperature stratification of the surface waters, which may explain that a significant part of the produced organic carbon could have occurred in surface waters. This, in turn, resulted in a ^{13}C depletion of the surficial ΣCO_2. The more recent surficial ^{13}C depletion, near 9.5 kyrs, which duration largely exceeded that of the Atlantic meltwater discharge, reflected the combined effects of important freshwater fluxes and precipitations on the Adriatic and neighbouring basins, with large nutrient inputs from the Po and other italian and yougoslavian rivers associated with- or causing- a low ventilation of the deeper part of the basin. This in turn induced the formation of the most recent sapropel S 1 in the eastern Mediterranean basin.

These data agree well with the recent hypothesis of TROELSTRA *et al.* (1991), that "adverse bottom conditions" in the Eastern Mediterranean may have lasted longer than previouly supposed, from 13.8 kyrs to 6kyrs, according to these authors.



Fresh water influxes in the three studied core during the last deglaciation and ^{13}C depletion in the surface dweiller *G. bulloides*, in Adriatic core IN68-5.

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