Adriatic hydrographic changes since 17 000 yrs as recorded by bioevents and foraminiferal stable isotopes

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It is becoming increasingly clear that variations in physical parameters of the sea water in conjunction with variations in the kind and availability of prey are major driving forces accounting for planktonic foraminiferal occurrences and abundances. The 8 ecozonations which have been identified within the last deglacial time interval in the Adriatic Sea (BORSETTI *et al*, this volume) invoke important hydrological changes. On the basis of these zonations, we propose the following hydrographic scenarios.

During the time interval corresponding to ecozone 8, the global sea level rise was rather weak (FAIRBANKS, 1989). Poorly stratified and cool waters still favoured the permanency of deep living species like *Globorotalia scitula* as well as other "cold" indicator species.

The successive ecozone 7 corresponds to the first deglacial freshwater discharge in the Adriatic and to an important global sea level rise. This situation may have induced a significant density stratification with nutrient rich waters from continental origin invading part of the basin. The surface production increased, favouring diatom blooms and foraminiferal species predating on them, such as *Globorotalia truncatulinoides*. The shoaling of the pycnocline and the formation of a deep chlorophyll maximum favoured the presence of abundant dextral *Neogloboquadrina pachyderma*.

Ecozone 6 corresponds to the classical Younger Dryas pause. In the Adriatic Sea, this climatic event appears strongly marked. The oxygen isotope record indicates that during this time interval freshwater discharges completely ceased. The permanency of Neogloboquadrinids however suggest that a deep chlorophyll maximum was still present. This may be explained by the fact that at that time, the Northern Hemisphere insolation reached its maximum at mid latitudes. The related seasonal stratification invoked the formation of a deep chlorophyll maximum.

Ecozone 5 corresponds to the beginning of the more recent fresh water discharge. Nutrient rich waters invaded again the Adriatic basin inducing an important surficial production, as suggested by the occurrence of foraminiferal species which predate on phytoplancton.This fact may have been associated with a seasonal shoaling of the thermocline, as suggested by the first entry of levantine species.

Ecozone 4 is marked by a rather important oligotrophism of surface waters. Only carnivorous foraminiferal species such as *Globigerinoides ruber ruber, Orbulina universa, Globigerina calida* and *Globigerina digitata* are dominant. The stratification of the water masses reached its maximum. Superimposed to the freshwater discharges, important precipitations may have occurred in the northern part of the Mediterranean basin . This in turn induced a strong salinity decrease, which prevented deep water formation in the Adriatic basin. This episod corresponds in fact to the deposition of Sapropel S1 in the Eastern Mediterranean and of low oxygenated levels in the South Adriatic basin.

During the time interval corresponding to ecozone 3, foraminiferal oxygen isotope data record a decrease in the freshwater discharge. The reappearance of species related to a deep chlorophyll maximum (*Neogloboquadrina pachyderma*) together with the last occurrence, in the Adriatic, of *Globorotalia inflata*, indicates a strong seasonal contrast with deep winter vertical mixing followed by the occurrence of a shallow pycnocline during intermediate season.

Ecozone 2 indicates important changes in the depth of the mixed layer. A good reoxygenation of the water column is supported by the presence of well diversified benthic associations.

Ecozone 1 corresponds to the present day hydrographic situation, withl a clear seasonal surficial oligotrophism.

The data, on their whole, suggest that foraminiferal associations with strong western affinities prevailed within the Adriatic basin throughout the entire deglaciation, until about 9.5 kyrs. After these date, they were replaced by species with clear levantine affinities which still dominate the present day association.

REFERENCES

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