

Millennial-scale paleoenvironmental changes in the central Mediterranean during the Last Interglacial: comparison with European and North Atlantic records

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The occurrence and the meaning of high-frequency climatic fluctuations from the upper part of MIS 6 to the lower part of MIS 4 in Hole 963A (37°01.938'N, 13°10.896'E, central Mediterranean Sea) have already been discussed, on the basis of high-resolution planktonic foraminifera and calcareous nannofossil data (mean sampling resolutions, respectively, of about 80 and 160 yr), and of benthic and planktonic oxygen isotope records (Sprovieri *et al.*, 2006). Here we show the distribution patterns of other 8 planktonic foraminifera and 6 calcareous nannofossils with the aim to investigate the marine environment of the Sicily Channel during MIS 5, mainly in terms of temperature and stability of the water column.

Both calcareous plankton groups show a co-ordinated response to environmental changes, as demonstrated by significant correlation indexes among the main taxa. For instance, *Gephyrocapsa muelleriae* is anti-correlated to *Globigerinoides ruber* (-0.77, n = 401) and to *Florisphaera profunda* (-0.7, n = 401). MIS 5 is generally characterized by warm, oligotrophic and stratified waters, where coccolithophore communities developed a vertical zonation. In today's oceans, a similar vertical zonation is typical of the low-latitude gyres (Winter *et al.*, 1994). The temperate-subtropical assemblages of planktonic foraminifera and calcareous nannofossils repeatedly changed into temperate-subpolar assemblages during the suborbital cooling episodes C25-C18.

A comparison with European pollen sequences and North Atlantic cores over the interval between ~128 and 110 kyr BP has been performed. Records from this broad geographical area show a series of environmental changes that occurred at comparable times. However, the first cooling episodes were more severe at high-latitude (approximately north of 50°N), where an earlier end of interglacial conditions can be inferred (Sánchez-Goñi *et al.*, 2005). An objective definition of interglacial conditions at Site 963 appears difficult, given that planktonic organisms respond not only to water mass temperature, but to a wide range of physical-chemical conditions. Nevertheless, the slight increase of *G. ruber* and the new development of a vertical zonation in the coccolithophore community after the C25 episode, suggest the re-establishment of weaker interglacial-like conditions, which gradually degraded until the severe C24 event. Therefore, interglacial-like conditions were probably maintained for 16-18 kyr. A similar duration can be also deduced for the Alboran Sea. Such a long duration is similar to that reported from southern European continental records, but it is in contrast with the shorter duration of the Eemian, north of the Alps.

The similarity of European/Mediterranean and North Atlantic environmental changes during the last interglacial at about 122, 118 and 110 kyr BP, and an earlier end of interglacial conditions at higher latitudes, need to be interpreted in terms of an adequate climate-forcing model, able to affect such a broad region as well as to generate such a latitudinal pattern. Both the southward expansion of the Polar Vortex and disturbances in the meridional overturning circulation can explain the contemporary environmental changes across this area and the progressive involvement of lower-latitude sites in the glaciation process.

References

- Sanchez Goñi, M.F., Loutre, M.F., Crucifix, M., Peyron, O., Santos, L., Duprat, J., Malaizé, B., Turon, J.-L. & Peypouquet, J.-P. 2005. Increasing vegetation and climate gradient in western Europe over the Last Glacial Inception (122-110 ka): data model comparison. *Earth and Planetary Science Letters*, **231**: 111-130.
- Sprovieri, R., Di Stefano, E., Incarbona, A. & Oppo, D.W. 2006. Suborbital climate variability during Marine Isotopic Stage 5 in the central Mediterranean Basin: evidence from calcareous plankton. *Quaternary Science Reviews*, **25**: 2332-2342.
- Winter, A., Jordan, R.W. & Roth, P.H. 1994. Biogeography of living coccolithophores in ocean waters. In: A. Winter & W.G. Siesser (Eds). *Coccolithophores*. Cambridge University Press, Cambridge: 199-218.