# Reconstructing Alboran Sea hydrography during the last organic rich layer formation

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A high resolution study of core MD95-2043 provides the basis for analyzing the hydrography of the Alboran Sea (W Mediterranean) for the last 24 kyr BP. Both TOC and total $C_{37}$ alkenone records show an interval of relatively high concentrations with very well defined boundaries. The age model is well constrained, locating it at 14.5-9.0 cal. kyr BP, significantly older than the last sapropel in the E Mediterranean Sea (~10.5-6.0 cal. kyr BP). This ORL formed while the benthic layer was populated by deep stress infauna (*Globobulimina* and *Chilostomella*), while the species related to well oxygenated deep water masses (*Cibicidoides* and *Gyroidina*) only dominated just below or above the ORL. Alkenone temperatures during this interval monitor the warming corresponding to the last deglaciation, including a pronounced cooling (4ºC) for the YD stadial and a short cooling phase (1ºC) right at the end of the ORL. Mg/Ca temperatures estimated on *G. bulloides* agree with the alkenone values except for the YD. In contrast, Mg/Ca ratios from the deep-dwelling species *N. pachyderma* (d) show a broad cooling at the time of the ORL formation. This thermal anomaly is the largest recorded by *N. pachyderma* (d) during the last 50 kyr, indicating that this record is responding to severe changes in the environmental conditions where *N. pachyderma* (d) calcified, rather than representing a general climatic cooling. A significant $\delta^{18}O$ offset between *G. bulloides* and *N pachyderma* (d) started with the onset of the ORL formation and continued across the full interval. Both Mg/Ca and $\delta^{18}O$ records from *N. pachyderma* (d) may be explained by the dominance of a deep thermocline during the ORL formation. The final warming observed in *N. pachyderma* (d) would mark the establishment of the frontal structures which dominate present day circulation. A change in the dominance of *G. inflata* in the planktonic assemblage also occurred at this time. This event is also well documented in the literature and its interpretations further support the hydrographic change. The deglacial sea level rise should change the thickness of the surface inflow of Atlantic water and thus produce a restructuring of the surface-subsurface layers. However, this process may operate in combination with atmospheric forcing to drive changes in the deep ventilation of the Western Mediterranean Sea.

# Timing of $CO_2$ and temperature change across termination-III from argon isotopes in trapped air from the Vostok ice core

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The study of the isotopic and elementary composition of air bubbles from ice cores allows to access to a precise record of atmospheric greenhouse gas concentration in the past. In this study, a record of isotopic composition of argon during the climatic transition-III (240 ky B.P.), obtained from Vostok ice, Antarctica, creates a qualitative temperature record in the gas phase that can be compared directly with greenhouse gas concentrations which have been measured in the same media. It is thus possible to show that $CO_2$ concentration increased 800 ± 250 years after the warming of the deglaciation. The originality of the method used allows to considerably improve the precision of the phase relationship and therefore firmly confirm its sign. Thanks to this result, we clearly confirm that $CO_2$ does initiate the climatic system, which is in agreement with the scenario according to which, during the sequence of climate forcings occurring during termination, the orbital forcing precedes the $CO_2$ increase. Moreover, the obtained time lag is short in comparison with the total duration of temperature and $CO_2$ increases during termination, and confirms that $CO_2$ have a fundamental role in system by significantly amplifying the glacial-interglacial cycle.