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Were the Iberian Peninsula Environmental Changes Triggered by the Marine Changes of the Last Glacial Period?

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Palaeoclimatic high resolution studies in the Mediterranean region suggest that this region was strongly affected by the climatic and hydrological changes of the North Atlantic basin during the LGP, i.e. the Heinrich events and the Dansgaard-Oeschger oscillations (Cacho et al. 1999). These climatic changes must have had an impact on terrestrial environments. However, very few studies have shown a direct correlation between terrestrial and marine palaeoclimatic data for the LGP in the Mediterranean region. The goal of this work is to answer the following questions: How did the continent react to this high climatic variability? What were the leads and lags between the Iberian Peninsula, the Mediterranean sea and the high-latitude North Atlantic region during the Last Glacial Period? Pollen, foraminifer, isotopic and alkenone analyses have been carried out on the IMAGES core MD95-2043 collected in the Alboran sea (western Mediterranean, 36º 8'N, 2º 37'W; 1841 m water depth). Application of the transfer functions to pollen data allow us to reconstruct palaeoprecipitations and palaeotemperatures for the Iberian Peninsula. The age model for this core is based on twenty-one calibrated AMS radiocarbon ages, on correlation with the oxygen isotope stratigraphy and on comparisons of SST in MD95-2043 with the GISP2 $\delta^{18}O$ ice core. This is the first time that terrestrial precipitations and temperatures are directly correlated with the sea surface temperatures (SST) estimated from alkenone analysis. This correlation shows that the steppic phases on land are contemporaneous with the Heinrich and the Dangaard-Oeschger cold events reflected in the Alboran sea. During the Heinrich events the minimum temperature of the coldest month (MTCO) is ca. -7 ºC and the SST of the Alboran sea is 9 C. The interstadial phases are contemporaneous with the development of an open deciduous and evergreen *Quercus*-forest with the MTCO reaching 6 ºC. During these temperate periods, the comparison of the pollen and SST records with the GISP2 isotopic curve shows a time lag between the sea-land environmental response and the climatic signal reflected by the ice. The atmospheric temperature maximum on Greenland is reached at the onset of the interstadial and then it gradually decreases. On the contrary, the SST warming of the Alboran sea occurs in the second part of the interstadial, that is 1000 years later than in the North Atlantic high latitude regions. The vegetation follows the same pattern as the sea-surface temperatures. Pollen data shows that the maximum warming of the Iberian Peninsula occurs in the second half of the interstadial synchronously with an increase of 1 ºC in the marine surficial waters. In conclusion, the climatic and hydrological changes of the Alboran sea cannot be considered the first cause of climatic changes in the Iberian Peninsula since marine changes are contemporaneous with the terrestrial ones.

Cacho, I., Grimalt, J.O., Pelejero, C., Canals, M., Sierro, F.J., Flores, J.A. & Shackleton, N., *Paleoceanography*, **14**, 698-705, (1999).