



Surface water temperature and productivity changes during MIS 9 to 19 off Portugal

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In order to better understand the climatic conditions in the upwelling system off Portugal during the late Pleistocene we produced centennial-scale Sea Surface Temperatures (SST) and productivity records for calypso core retrieved from the Estremadura Spur at 1895m water depth (MD03-2699). This core is 26.56m long and we have concentrated on the lowermost 13 m, equal to the period of 300 to 800 kyr B.P.. The core site is bathed by upper North Atlantic Deep Water. The surface water is mainly derived from the Portugal current, the descending branch of the North Atlantic's subtropical gyre. During the winter the Portuguese countercurrent, which transports subtropical Azores current waters northwards along the western Iberian margin is also present. Coastal upwelling of sub-surficial cold, nutrient-rich waters occurs from May to September as a response to the strong northerlies along the Portuguese coast. The SST record of this core, was obtained with the Uk'37 alkenone index. It displays millennial-scale variability of rapid warming and cooling events especially during glacial MIS 12 and 10. The SST profile shows clear glacial/interglacial transitions, with SST rise of 18°C during Termination V. The warmest SST, close to 20°C, was recorded during MIS 9 while prior to MIS 9 the warm periods lasted longer and the warmest SST was 2°C lower, but average SST increases towards younger interglacials. Glacial MIS appears as 14 a special case with relatively warm SST (16°C). Total Alkenones concentration was used as indicator for productivity change in the area. Peak productivity coincides with the coldest SST values and is as high as 2500ng/g during the Termination V, VI and VII. Increased productivity coincident with slightly colder SST is also observed during the first 10 kyr of MIS 11 and during MIS 15. All rises in productivity are interpreted as reflecting increased upwelling activity off Portugal. Within the glacial periods MIS 10 and MIS12 the rapid SST oscillations

are in phase with alkenone concentration peaks, pointing towards palaeoproductivity changes either associated with fluctuations in the water masses affecting the region and/or due to alterations in the subpolar front off Portugal. Core MD03 2699 SST record shows some similarity to the EDC dD record which could indicate that palaeoproductivity changes in this upwelling zone might be linked to the same, yet unknown, forcing mechanism(s) that drive the Antarctic dD variations.