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Centennial-to-millennial Variability of Silica Content in the Thermocline of the NE Tropical Atlantic during the Last Glacial Cycle: The Effect on Diatom Production

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Changes during last glacial maximum (LGM) followed by the rapid variations during deglaciation make this a critical interval in Late Quaternary history for exploring large-scale mechanisms of climate variability involving the tropics. Based on the well-dated gravity core GeoB7926-2 (20˚13'N, 18˚27'W, 2500 m), we describe the centennial-to-millennial variability occurred during the last 25 kyr BP off NW Africa, a climatically-sensitive area of the tropical NE Atlantic. We focus our high-resolution analysis on the siliceous signal and compare it with alkenone-derived SST, X-ray fluorescence, TOC, $CaCO_3$, and oxygen and carbon isotopes on planktonic foraminifera measurements (analyses carried out on a 1-cm resolution, each measurement representing ca. 70-90 yr on average, range of sedimentation rate=10-230 cm/kyr). Low diatom productivity during the LGM suggests a reduced supply of silicate and phosphate into the upwelling area off Mauritania, which derives its surface and thermocline waters from the North Atlantic Central Water (NACW) and South Atlantic Central Water. Given the usual pattern of high siliceous productivity during glacials in many regions of the ocean, this depletion might have been a consequence of the slowdown of NACW production and a decrease of freshwater import from the Northern Atlantic. Anti-correlated with the siliceous productivity, SST strongly varied on the centennial-scale during LGM, although no cooling occurred (range=19˚-21.5˚C). During Hein-

rich 1 and the Younger Dryas, opal contribution increased up to ca. 30%, extraordinary high for tropical oceans, while SST decreased by 2° to 3°C, reflecting different leading mechanisms than those operating earlier during LGM. The increase of $CaCO_3$ during Bølling-Allerød points to dominance of calcareous over siliceous production, similar to Holocene conditions. The anti-correlation between SST and Ti:Ca –wind proxy– is good even on the centennial time-scale, emphasizing the importance of regional factors, $i.e.$, the coupling of effects of land and offshore.

The fact that diatoms numerically dominate over silicoflagellates and radiolarians, and closely follow opal variations suggests that silica availability within the thermocline waters is an important parameter controlling production and accumulation of opaline microorganisms in tropical regions of eastern boundary currents systems. Since opal and diatoms are moderately correlated with TOC at GeoB7926-2, it appears that silica-related productivity responded more readily to climatic change than did overall productivity. This difference was possibly due to greater sensitivity of silica to changes in nutrient enrichment and depletion in thermocline waters, as compared with phosphate. We propose that the nutrient concentration of upwelled waters and, secondarily, wind intensity were likely the main mechanisms driving rapid changes in productivity between LGM and early Holocene off Mauritania. Our results contribute to the understanding of abrupt shifts of atmospheric and oceanographic systems off NW Africa and the juxtaposed low-latitude North Atlantic, and its teleconnections with the Northern Atlantic.