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Effects of midlatitude westerlies on the paleoproductivity at the Agulhas Bank slope during the penultimate glacial cycle: Evidence from coccolith Sr/Ca ratios

Luz Maria Mejia (1), Patrizia Ziveri (2), Marilisa Cagnetti (2), Clara Bolton (1), Rainer Zahn (2), Gianluca Marino (2), Gema Martinez Mendez (2), and Heather Stoll (1)

(1) University of Oviedo, Geology, Oviedo, Spain (hstoll@geol.uniovi.es), (2) Universidad Autonoma de Barcelona, Bellaterra, Spain

Because modern primary productivity on the Agulhas Bank, off South Africa, is linked to the mid-latitude westerlies, a paleoproductivity record from this area could be used to investigate past may changes in the westerlies dynamics. Coccolith Sr/Ca is a suitable productivity indicator to explore paleoproductivity from the penultimate glacial-interglacial cycle because it is independent of preservation changes that may accompany changes in deep-water circulation. In the Agulhas Bank slope core MD96-2080, the coccolith Sr/Ca record shows that phases of depressed productivity coincided with periods of stratification in the same core, indicated by high relative abundances of the coccolithophore Florisphaera profunda, and with low relative abundances of the upwelling indicator G. bulloides in the Cape Basin. This coherence suggests that upwelling regulated productivity throughout this region. As in the present, we infer that periods of low productivity result from northward positions of the westerlies which block the upwelling-promoting easterlies. Productivity minima also coincide with periods of increased ice-rafted detritus (IRD) deposition on the Agulhas Plateau, which also indicates extreme northward positions of the westerlies. The influence of the westerlies appears to be obliquity-conditioned, as productivity minima occur during low obliquity intervals. The dynamic connection between productivity and the westerlies is supported by coeval salinity changes in the South Indian Gyre that likewise respond sensitively to a poleward contraction of the westerlies.