

Pliocene Warm Period Upwelling in the Southern Benguela Region

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Abstract

The mid-Pliocene has been proposed as a possible analogue for understanding future climate change and testing climate models. Previous work has shown that during the Pliocene the major upwelling systems were relatively warm, and thus either inactive, contracted, or upwelling warmer waters than present. Here we examine evidence from a core site located on the margins of the modern Benguela upwelling system, to test whether the upwelling cells had migrated or contracted relative to present during the Pliocene. We applied several organic geochemistry proxies and foraminiferal analyses to reconstruct the Pliocene history of ODP site 1087 (3128S, 1519E, 1374m water depth), including the UK37 index and TEX86 index (for reconstructing sea surface temperatures), chlorins (for estimating primary productivity) and planktonic foraminifera assemblages (for inferring water mass changes). These proxies show that between 3.5 and 3.0 Ma the southern Benguela region was significantly cooler than the northern Benguela region, the latter where the main upwelling cells are found today. Coupled with higher primary production, a shift in planktonic foraminifera assemblage, and an offset between the UK37 index and TEX86 index, we infer that more extensive upwelling was present in the southern Benguela region during the Pliocene. We infer that the main Benguela upwelling cells had shifted southward relative to today, as a result of changes in the local wind field. We find evidence for pronounced cooling and a shift in the planktonic foraminifera assemblage during the M2 and KM2 glacial stages, showing a sensitivity of Benguela upwelling to these short-lived climate events.