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Ocean productivity and bottom water oxygenation across the onset of the Cenozoic cooling trend

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The onset of the Cenozoic global cooling trend represents a major transition in Earth's climate from the extremely warm early Eocene 'greenhouse' towards much colder unipolar glaciation by the end of the Eocene. Data across this interval of profound climatic change have long suggested contemporaneous changes to marine biological productivity and the carbon cycle. Modern observations, conceptual models from the last glacial cycle and models documenting change at Cenozoic timescales, all predict heterogeneous biological productivity responses between high and low latitudes. We test for this heterogeneity between latitudes across the onset of the Cenozoic global cooling trend. Here we utilise bulk sediment elemental compositions, and concentration of benthic foraminifera and ichthyoliths to reconstruct changes in palaeoproductivity, export and preservation of $CaCO_3$ across the early-to-middle Eocene interval (~42 to 50 Ma) at multiple deep-sea sites in the Atlantic basin. We also present evidence of changes in bottom-water oxygenation across the Southern Atlantic sites. We find opposing trends in Biogenic barium (BioBa) versus benthic foraminifera accumulation rates (BFAR) and Ichythyolith Accumulation Rates (IAR) for many of our sites across the high southern latitudes. These trends could be explained by increased organic carbon flux to the sediment, which would have increased the BFAR and IAR while at the same time potentially causing oxygen depletion and reductive barite dissolution in the sediments driving our observed synchronous decreases in BioBa and Mn/Al. This trend of synchronous decreases in BioBa and Mn/Al is evident within the Atlantic Sector of the Sub-Antarctic Zone. Within the Antarctic zone, an opposing trend of decreasing BioBa coincides with increasing Mn/Al and BFAR, suggesting a differing mode of production, export and fate of marine $CaCO_3$. Ongoing work seeks to determine the nature of biological productivity responses across the high and low latitude oceans during the Eocene 'greenhouse' to 'icehouse' transition.

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