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Disentangling controls and orbital pacing of South-East Atlantic carbonate deposition since the Oligocene (30-0 Ma)

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The evolution of Cenozoic climate since 30 million years ago (Ma) has broadly chartered the transformation from a unipolar to a bipolar world. Highly resolved records of carbonate content (%$CaCO_3$) can provide insight into regional responses to shifting climate, cryosphere and carbon cycle dynamics. Here, we generate the first South-East Atlantic %$CaCO_3$ record spanning 30-0 Ma, derived from X-ray fluorescence (XRF) ln(Ca/Fe) data collected at Ocean Drilling Program Site 1264, located on the Angola Basin side of the Walvis Ridge (SE Atlantic Ocean). We present a comprehensive and continuous depth and age model for the entirety of Site 1264 (~316 m; 30-0 Ma), which constitutes a key reference framework for future palaeoclimatic and palaeoceanographic studies at this location.

We can identify three phases with a distinct orbital imprint on South-East Atlantic $CaCO_3$ deposition, broadly occurring across major developments in climate, the cryosphere and/or the carbon cycle: 1) strong ~110 kyr eccentricity pacing prevails during Oligo-Miocene global warmth (~30-13 Ma); 2) eccentricity-modulated precession imprints more strongly after the mid Miocene Climate Transition (mMCT) (~14-8 Ma); 3) strong obliquity pacing prevails in the late Miocene (~7.7-3.3 Ma) following the increasing influence of high-latitude processes.

The lowest %$CaCO_3$ (92-94%) occur between 18.5-14.5 Ma, potentially reflecting increased dissolution or decreased productivity, probably caused by widespread early Miocene warmth. Around 14 Ma, the increased sensitivity to precession at Site 1264 is associated with an increase in mass accumulation rates (MARs) and could reflect increased regional $CaCO_3$ productivity and/or an influx of less corrosive deep water following regional changes in surface and/or deep-water circulation after Antarctic reglaciation across the mMCT.

The highest %$CaCO_3$ and MARs indicate the late Miocene Biogenic Bloom (LMBB) occurs between

~7.8-3.3 Ma at Site 1264, which is broadly, but not exactly, contemporaneous with the LMBB in the equatorial Pacific Ocean. Global similarities in the expression of the LMBB may reflect an increased nutrient input into the global ocean resulting from enhanced aeolian dust and/or glacial/chemical weathering fluxes, whereas regional variability in the timing and amplitude of the LMBB may be driven by regional differences in cooling, continental aridification and/or changes in ocean circulation during the latest Miocene.