Late Burdigalian to Langhian (Early to Middle Miocene) planktonic foraminiferal high-resolution biostratigraphy from Walvis Ridge Site 1264 (south-eastern Atlantic Ocean).

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Abstract

The late Burdigalian to Langhian interval represents a crucial period in Earth's climate evolution, being characterized by a global warming event (Miocene Climatic Optimum) from 17 to 14.7 Ma, followed by a gradual decline in temperature (Middle Miocene Climate Transition) which culminates in the marked Mi3b cooling event at 13.8 Ma. The ocean-climate system changed to a colder mode and progressed to modern conditions marked by strong meridional and vertical thermal gradients, increased zonality and dominance of high-latitude deep water sources. This climatic evolution favoured the contraction of tropical and subtropical bioprovinces to lower latitudes also affecting planktonic foraminiferal assemblages, which started to differentiate between low- and mid-latitude regions leading to the erection of different biozonal schemes.

High-resolution quantitative biostratigraphic studies and a good age control (e.g., by the integration with magnetostratigraphy and/or cyclostratigraphy) are fundamental to enhance biostratigraphic resolution and the accuracy of bioevent age calibrations. All this improves the understanding of spatial and temporal distribution of biostratigraphic markers and the evaluation of synchronism/diachronism of biostratigraphic events at a global scale. As it concerns the late Burdigalian to Langhian interval, for instance, recent high resolution biostratigraphic studies from Mediterranean astronomically tuned deep marine successions highlighted discrepancies in age calibration of the main planktonic foraminiferal events with respect to the low latitudes. In particular, the evolutionary stages of the *Trilobatus-Praeorbulina-Orbulina* lineage resulted younger in the Mediterranean than at the low latitudes as reported in the literature.

Here, we present the results of high-resolution quantitative biostratigraphic analysis of the planktonic foraminiferal assemblages from the astronomically tuned Site 1264 (ODP Leg 208, south-eastern Atlantic Ocean, latitude _˜28◦S). The investigated stratigraphic interval, spanning from _˜ 17.5 to _˜ 13.5 Ma, consists of foraminifer-bearing nannofossil oozes containing well preserved planktonic foraminiferal assemblages. The quantitative biostratigraphic analysis was performed with a time resolution of _˜20 kyr, much higher compared to the previous studies, allowing us to obtain the quantitative distribution patterns of the marker species and to refine the stratigraphic position and the age calibration of the bioevents. Planktonic foraminiferal assemblages at Site 1264 are characterized by the presence

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of both taxa used as zonal markers in the (sub)tropical zonation (e.g., *Catapsydrax dissimilis*, the evolutionary stages of *Trilobatus-Praeorbulina-Orbulina* lineage) and taxa typical of temperate assemblages (e.g., *Globorotalia miozea* and *Globorotalia zealandica*), and by the absence of *Globigerinatella insueta* s.s. typical of the tropical assemblages. All these features indicate that planktonic foraminiferal assemblages at Site 1264 started to differentiate from those of the low-latitude regions since the late Burdigalian. Moreover, a comparison of the biostratigraphic record of Site 1264 with low-latitude distribution range of marker species and biochronology (literature data) highlighted: i) diachronism of some main events, such as the first occurrences of the evolutionary stages of *Trilobatus-Praeorbulina-Orbulina* lineage, *Globoratalia archeomenardii* and *G. praemenardii;* and ii) differences in the distribution patterns of marker species (e.g., *Paragloborotalia siakensis*).

Keywords: planktonic foraminifera, high resolution biostratigraphy, biochronology, Middle Miocene