Coiling directions in the mid Miocene paragloborotaliids (planktonic foraminifera): A correlation event for the base of the Langhian in the low latitudes

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Abstract

The sequential addition of chambers during growth in trochospiral planktonic foraminifera means they will coil in either a sinistral (left-handed) or dextral (right-handed) direction. The ratio of sinistral to dextral forms may change during the stratigraphic range of a species leading to a dominance of coiling direction. This prevalence in coiling holds biostratigraphic value with a number of bioevents being recognised in Recent to late Miocene (_˜0-7 Ma) biochronology. However, no such events have been applied beyond this age despite a number of species being known to adopt preferential coiling. One such example is the genus *Paragloborotalia* which has been shown to undergo a change from random to sinistrally dominated coiling in the mid Miocene (_˜15 Ma) in the tropical-subtropical realm.

We investigated sites in the equatorial Pacific Ocean (IODP Sites U1337 and U1338, ODP Site 871), equatorial and mid latitude Atlantic Ocean (ODP Site 925 and JOIDES-3 respectively), the Caribbean (Trinidad, Jamaica and Barbados) and high latitude Southern Ocean (ODP Site 747) to assess the global the global synchronicity of the coiling change. Our high-resolution analysis of *Paragloborotalia siakensis* at Site U1337 shows a change from random to sinistral coiling at _˜15.37 Ma within planktonic foraminifera Zone M5. This shows excellent correlation with our lower resolution *P. siakensis* records from Site U1338, JOIDES-3 and Trinidad. The preference in sinistral coiling is maintained up until the extinction level of *P. siakensis* in the late Miocene (_˜10.50 Ma; Site 925, Jamaica). In the high latitudes (ODP Site 747) the absence of paragloborotaliids through a portion of the mid Miocene prevents accurate dating, although random coiling trends are found in the older paragloborotaliids (_˜17.3-19.8 Ma) compared to the sinistral dominance within the younger forms (_˜13.5-9.0 Ma). The analysis of *Globorotalia* at Site 747 show two changes in coiling direction namely random to sinistral at _˜15.14 Ma and sinistral to dextral at _˜10.02 Ma.

We propose the recognition of the coiling change in *Paragloborotalia siakensis* as a secondary bioevent in the mid Miocene at _˜15.37 Ma, and a useful biostratigraphic means of recognising the base of the Langhian in the tropical-subtropical realm. The bioevent will be of particular use in regions where the historic base Langhian planktonic foraminifera event, namely the *Praeorbulina-Orbulina* lineage, are rare or poorly represented.

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