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The Cenozoic Diversity of Agglutinated Foraminifera – Evidence for a late Oligocene to early Miocene diversification event

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The agglutinated foraminifera are among the most abundant micro-organisms in the deep marine environment and have a diversity record extending back to the late Precambrian. We present an updated diversity curve for agglutinated foraminiferal genera based on the stratigraphic ranges of all the agglutinated genera recognized as valid in the classification of Kaminski (2014). The data set for this analysis is based on the stratigraphic ranges of agglutinated genera published in Foraminiferal Genera and their Classification, which has been subsequently updated based on published studies and our new observations. The mean standing diversity of agglutinated foraminiferal genera was compiled by counting the number of boundary crossers rather than the number of genera in each stage. In this study, we report the stratigraphic and geographical occurrence of a benthic foraminiferal diversification event that has previously received little attention.

In the latest Oligocene to earliest Miocene a number of trochospiral agglutinated genera with alveolar or canaliculate walls first appeared in the fossil record. Our studies of late Oligocene of the Congo fan, offshore Angola (Kender et al., 2008; Cetean and Kaminski, 2011) have revealed a diverse assemblage that includes new taxa of deep-water agglutinated foraminifera. In a biostratigraphic study of the Miocene foraminiferal assemblages Kender et al. (2008) noted steadily increasing diversity and proportions of infaunal agglutinated foraminiferal morphotypes over the lower Miocene interval. The proportion of infaunal agglutinated foraminifera assigned to the order Textularida increased dramatically in the lower mid-Miocene, suggesting expansion of the oxygen minimum zone into deeper waters. In addition to the trochospiral alveolar genera, several species of Reticulophragmium and Cyclammina display rapid diversification into numerous separate lineages that are at present not reflected in our generic diversity record owing to their poorly established taxonomy. Genera such as Alveovalvulina, Guppyella, Goesella, and Alveovalvulinella, are typical of assemblages found in subtropical oxygen minimum zones, especially in West Africa and the Caribbean. These agglutinated genera are not found in coeval assemblages from the northern high latitudes (Kaminski et al. 2005), suggesting they are restricted to the low-latitude OMZ.

It is likely that the global warming of the latest Oligocene to Early Miocene contributed to intensification of dysoxic conditions in low-latitude upwelling regions, possibly from enhanced productivity and reduced deep-sea ventilation, creating an expanded niche for these organisms that flourished in low-oxygen conditions with high particulate organic matter input. We believe a more detailed phylogenetic approach to these agglutinated genera would result in the description of new genera for individual lineages and refinement of the foraminiferal diversity record.