Environmental controls of size distribution of modern planktonic foraminifera in the equatorial Indian ocean: A calibration study

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Abstract ENG :

Palaeoceanographic studies often rely on microfossil species abundance changes, with little consideration for species traits (e.g. size) that could be related to environmental changes. We hypothesize that whole-assemblage and species-specific planktonic foraminifera (PF) test size could be good predictors of environmental variables, and we test this using an Equatorial Indian Ocean (EIO) core-top sample set (62 viable samples). We use an automated imaging and sorting system (MiSo) to identify PF species, analyze morphology and quantify fragmentation using machine learning techniques. Machine accuracy was confirmed by comparisons with human classifiers. Data for 25 mean annual environmental parameters were extracted from modern databases and, through Exploratory Factor Analysis and regression models, we investigate the potential of PF size, at the assemblage and species level, for reconstructing oceanographic parameters in the Indian Ocean. Within our tropical dataset, we find that SST is not a significant driver of assemblage size, although thermocline-dwelling species *Globorotalia inflata* and *Globorotalia truncatulinoides* show a significant relationship with temperature. Our analyses indicate that deep carbonate ion concentration and core depth may be important factors influencing PF size, especially in species that are large-sized or bear calcite crusts such as *Globigerinoides conglobatus*, *Globorotalia menardii*, and *Neogloboquadrina dutertrei*. We propose that PF population size could potentially be useful to reconstruct bottom water carbonate concentrations and sea surface temperature. This approach will be tested on a new downcore record from the Arabian sea (ODP Site 722) during key Pleistocene glacial-interglacial transitions, where existing sea surface temperature and other paleo-reconstructions will allow meaningful comparisons.

Mots-Clés : Automated foraminiferal analysis, planktonic foraminifera, equatorial Indian ocean, Holocene, paleoceanographic reconstructions

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