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Marine Plankton in Neogene Oceans

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Biologically mediated fluxes of elements between the upper and deep ocean depend on calcification and silicification of microfossils and led, over geological time, to massive accumulations of calcite and opal in ocean sediments. Changes in the size of microfossils may influence the amount of material exported to the deep ocean. Since the size of carbonate producers is changing over geological time (Young, 1990; Schmidt et al., 2004) this has potential implications for modeling of pelagic export production. Climatic and tectonic events in the Neogene had a profound effect on marine pelagic environments. Here we investigate the relationship between tectonic/oceanographic changes in the Neogene and plankton size and carbonate mass accumulation.

We have analysed the size record of mid and low latitude Neogene planktonic foraminifers and compared it with existing data on size in calcareous nannoplankton and radiolaria. Our data show that the previously documented dramatic size increase in planktic foraminifers (Schmidt et al., 2004) was not unidirectional, but showed size reductions during the Late Miocene carbonate crash, the biogenic bloom event and the Pliocene climate optimum. From 4.1 Ma onwards, unprecedented large sizes are recorded in the oligotrophic tropical settings in assemblages. The changes in size do not reflect evolution of new, larger species, but they affect existing lineages, e.g. the *G. plesiotumida – tumida* (Malmgren et al., 1983) lineage.

Furthermore, during the Neogene large forms in coccolithophorids disappeared (Young, 1990) and radiolaria dramatically reduced their weight (Moore, 1969). As a consequence of smaller coccoliths and larger foraminifers the ratio of their contributions to pelagic carbonate production should have changed. Indeed, our data show that sand fraction accumulation rate, representing production of planktonic foraminifer shells, have doubled in the last 10 Ma with the largest change between 4-3 Ma. The

divergence of mid- and low latitude size evolution in foraminifers and reduction in size in coccolithophorids and radiolaria, point to a revolutionary change in the niches in the upper water column during the Neogene, the timing of which suggest a link to the unique oceanographic situation following the closure of the circum-tropical seaways.

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