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Testing the impact of calcareous nannofossil size evolution on pelagic carbonate burial over the past 17 million years

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Calcareous nannofossils (i.e., coccoliths and *incertae sedis* such as Discoasters) are the products of marine, unicellular calcifying algae. Calcifying phytoplankton play a fundamental role in marine ecosystems and global biogeochemical cycles. Their size and abundance determine the strength of the biological carbon and carbonate "pumps", which represent important feedbacks to the carbon cycle. Despite their small size ranging from 2 to 20 micrometer, they contribute about half of the total pelagic carbonate burial in today's oceans. An overall macroevolutionary decrease in the size of these carbonate producers is recorded over the Cenozoic, but the impact of this turnover on pelagic carbonate burial rates has remained unquantified. Here, we investigate the past 17 million years (Ma) to quantify the nannofossil flux (number of nannofossils/m2/yr) and the corresponding nannofossil carbonate flux (g/m2/yr) in 40 samples from five DSDP/ODP sites from the North Atlantic, South Atlantic, Eastern Indian, Western Indian and Western Pacific Oceans. Three different size assemblages are observed. From 17 Ma to 10 Ma, the assemblages were dominated by large coccolith species, mostly *Coccolithus pelagicus* and large reticulofenestrids. From 10 Ma to 5 Ma, the abundance of large-sized coccoliths diminished while medium-sized reticulofenestrids became the most abundant species. After 5 Ma, small-sized reticulofenestrids (<5 micrometer) dominated the assemblages in all ocean basins, and finally the "light-weights" *Gephyrocapsa* spp. and *Emiliana huxleyi* evolved to be the most abundant species. Meanwhile, nannofossil fluxes show a slight increase from 17 Ma to 5 Ma, followed by a slight decrease. The resulting nannofossil carbonate burial rates remained relatively stable from 17 Ma to 5 Ma. Therefore, it seems that the long-term trend towards smaller nannofossil size is compensated by higher nannofossil production until 5 Ma. After 5 Ma, at the climax of the small coccolith domination, the nannofossil carbonate burial rate significantly decreased.