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The time of origin of biogeochemically important marine diatoms and their association with climate change

Diatoms are a significant component of contemporary marine biological production. Their growth is particularly intense on continental margins and shelf regions that, while comprising only 7% of ocean area, contribute roughly 20% of total production and most of the world's fishery yield. Diatoms also contribute disproportionately to the transport of carbon from surface waters and are responsible for much of the ~9 GT carbon that the ocean's biological pump removes from surface waters each year. Thus, much of the ocean sink for atmospheric CO₂ can be traced to diatom growth and sinking and this makes diatoms important agents in the contemporary global carbon cycle. However, in addition to being a very successful phytoplankton form in the modern ocean, diatoms are also very diverse. The biogeochemical impact of diatoms on the marine carbon cycle is not evenly distributed among all extant representatives of this group. Rather, much surface carbon export is associated with certain genera that form dense blooms as part of their yearly life cycle. We will focus on these forms in the fossil record contained in marine sediments to estimate the time of their first appearance. We will then relate these appearances to the corresponding changes in climate during the same period. This work represents a potentially significant innovation in climate research because it addresses the interaction between biological evolution and climatically important biogeochemical cycles. This is a new and potentially very informative area of research and it builds on our prior success at combining paleo- and contemporary environmental information into a comprehensive analysis (Sambrotto and Burckle, in press). It will enable us to link with a small, but growing number of researchers who are also addressing climate - evolution linkages. One important collaborator will be Kevin Peterson from Dartmouth. Kevin has a graduate student working on diatoms and one of the main aspects of our collaboration will be through this student's participation in the research we propose here.