Geophysical Research Abstracts
Vol. 16, EGU2014-3829, 2014
EGU General Assembly 2014

A quantitative review of the Cenozoic diatom deposition history

Johan Renaudie and David B. Lazarus

Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt Universität zu Berlin, Berlin, Germany (johan.renaudie@mfn-berlin.de)

Marine planktonic diatoms play an important role today as one of the world's main primary producers, as the main organic carbon exporter to the deep sea and also as the main silica exporter balancing global chemical weathering. They were however a very minor component of the plankton at the beginning of the Cenozoic. Studies to date have focussed mainly on the evolution of their taxonomic diversity. Studies of changes in their actual global abundance over the Cenozoic are few, qualitative, and based on limited amounts of data. Reviewing their depositional pattern during the Cenozoic is therefore of interest in order to understand the modality, the context and, eventually, the cause of their rise; and to understand how diatom evolution affected the Cenozoic functioning of the ocean pump.
We present here, based on a review of the literature coupled with a new data analysis of the full global ODP-DSDP Initial Reports smear slides descriptions, a quantitative synthesis of the depositional history of marine diatoms for the last 60 Myr. We also place these data in their paleogeographical context in order to understand the changes in diatom biogeography and what it says about Cenozoic paleoceanography.
Diatoms first became widespread during the Middle Eocene. Two temporary major high-abundance events, one at the Eocene-Oligocene transition, another during the Late Oligocene were followed by decreases in the Middle Oligocene and Early Miocene. Diatom abundance in sediments shifted in the Mid-Miocene to globally higher values which have largely persisted to the modern day. Despite appearing initially during the Late Oligocene, the Southern Ocean circumpolar diatom accumulation belt only became a stable feature in the Mid-Miocene. At this time the main diatom deposition loci switched from the Atlantic to the Pacific and Indian Oceans, and mid-latitude upwelling zones appeared.
Our findings provide support for the idea that diatoms, through their ecological role in the ocean's carbon pump, are responsible at least in part for Cenozoic changes in atmospheric carbon dioxide pressure and therefore changes in global climate state. Additionally, correlations between diatom abundance peaks and shifts in seawater strontium and osmium isotope composition hint at a strong control of weathering on diatom deposition and therefore indicates that diatom abundance can be useful to reconstruct Cenozoic history of weathering intensity.