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Reconstruction of Middle Eocene - Late Oligocene Southern Ocean paleoclimate through calcareous nannofossils and stable isotopes

Giuliana Villa (1), Chiara Fioroni (2), Davide Persico (1), Laura Pea (1), and Steve Bohaty (3)

(1) Dipartimento di Scienze della Terra, Università di Parma, Italy (giuliana.villa@unipr.it), (2) Dipartimento di Scienze della Terra, Università di Modena e Reggio Emilia, Italy, (3) School of Ocean and Earth Science, National Oceanography Centre, University of Southampton, UK

The transition from the ice free early Paleogene world to the glaciated conditions of the early Oligocene has been matter of discussion in the last years. This transition has not been monotonic but punctuated by numerous transient cooling and warming events. Here we present a summary of recent studies based on Nannofossil response to climatic changes during the Eocene and Oligocene.
Collected data issue from high latitudes ODP Sites 748, 738, 744, 689 and 690.
Based on a detailed revision of the biostratigraphy carried out through quantitative analysis, we conducted paleoecological studies on calcareous nannofossils through the late middle Eocene to the - late Oligocene interval to identify abundance variations of selected taxa in response to changes in sea surface temperature (SST) and trophic conditions. The nannofossil-based interpretation has been compared with detailed oxygen and carbon stable isotope stratigraphy confirming the climate variability in the Southern Ocean for this time interval.
We identify the Middle Eocene Climatic optimum (MECO) event, related with the regional exclusion of Paleogenic warm-water taxa from the Southern Ocean, followed by the progressive cooling trend particularly emphasized during the cooling events at about 39 Ma, 37 Ma and 35.5 Ma. In the earliest Oligocene, marked changes in calcareous nannofossil assemblages are strikingly associated with the Oi-1 event recorded in perfect accordance with the oxygen isotope records. For most of the Oligocene we recorded a cold phase, while a warming trend is detected in the late Oligocene.
In addiction, a marked increase of taxa thriving in eutrophic conditions coupled with a decrease in oligotrophic taxa, suggests the presence of a time interval (from about 36 Ma to about 26 Ma) with prevailing eutrophic conditions that correspond to an increase of the carbon stable isotope curve.
This interval well corresponds with the clay mineral concentration that shows at Site 738 a higher concentration in illite (Ehrmann and Mackensen, 1992). This result can be interpreted as a major influx of weathering in the basin, bringing more nutrients to the surface water.
Our data confirm a strong climate variability in the Southern Ocean during the middle Eocene - late Oligocene and nannofossils demonstrate to be useful tools for paleoclimatic and paleoceanographic reconstructions.