Siliceous Plankton Response to the Southern Ocean Warming During the Late Middle Eocene: Results from ODP Site 748

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Intense, transient warming of surface and deep waters in the southern high latitudes is interpreted during the Middle Eocene Climatic Optimum (MECO; ~40 Ma). The climate and biotic effects of this event in Antarctica and the surrounding oceans, however, have not been documented in detail. Here, we report the results of a high-resolution, quantitative study of siliceous microfossils at ODP Site 748 (southern Kerguelen Plateau, Indian sector of the Southern Ocean). This study is the first to document the ebridian, silicoflagellate, and diatom reponse to the MECO warming event. Within a ~1.4 myr interval spanning the MECO, quantitative analysis of the rich and diverse siliceous microplankton assemblages shows a significant increase in biosiliceous sedimentation at Site 748.

The siliceous microfossil assemblages present in the MECO interval of Site 748 are unusual in that they are dominated by ebridians, with radiolarians as a secondary major component. Silicoflagellates and diatoms comprise only a minor fraction of the assemblage, in contrast to modern-day siliceous plankton assemblages of the Southern Ocean. As reported for the dinocysts and nannofossils from the same site, siliceous microfossils indicate a brief period of elevated nutrient availability in the Southern Ocean during the peak warming interval of the MECO. In addition, ebridian and silicoflagellate assemblages show an increase in endemism prior to, and immediately after the peak warming interval, confirming the patterns previously reported for other groups of fossil plankton. Peak warmth is characterized by high abundance of cosmopolitan silicoflagellates (e.g., *Naviculopsis* spp.) and ebridians (e.g., *Ammodochium* spp. and *Ebriopsis* spp.). In addition, large and unusual morphotypes of both silicoflagellates and ebridians are abundant within the MECO interval. In particular, the occurrence of a rich and extremely variable assemblage of the silicoflagellate *Dictyocha grandis* appears to be linked to the rapid rise in sea-surface temperatures immediately prior to peak warmth, and a pronounced turnover is observed in both silicoflagellate and ebridian assemblages at the onset of peak warming.

These observations lend support to the pattern and magnitude of temperature change indicated by geochemical proxy data at multiple Southern Ocean sites. Additionally, rapid assemblage changes in multiple autotrophic and heterotrophic siliceous microfossil groups indicate a reorganization of Southern Ocean plankton communities in response to greenhouse warming associated with the MECO event.