Fossil chrysophyte cysts as a new paleoenvironmental proxy

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Most Neogene–Quaternary sediments in the Southern Ocean have high biogenic silica contents with large amounts of siliceous microfossils including chrysophyte cysts as well as diatoms. Fossil chrysophyte cysts are considered to be potentially useful paleoenvironmental indicators, however no general consensus exists about their paleoenvironmental significance. In this study, data on fossil chrysophyte cyst abundances of late Miocene to Pliocene (ca. 9–3 Ma) age are presented from two marine sediment cores, Ocean Drilling Program Site 689 and Deep Sea Drilling Project Site 513, both located in the Atlantic sector of the Southern Ocean. Changes in the chrysophyte cyst abundances are compared to those in the diatom abundances, and the potential of fossil chrysophyte cysts as paleoceanographic indicators around the Antarctica is discussed.
As a result, similarity in the fluctuation of freshwater diatom and chrysophyte cyst abundances were observed in both sites. In addition, occurrences of chrysophyte cysts similar to previously reported ones from freshwater habitats were recognized. These results suggest that the fossil chrysophyte cysts from Sites 689 and 513 were originated from terrestrial freshwater habitats. Since freshwater input into the Southern Ocean are mainly derived from Antarctic terrestrial freshwater (i.e. meltwater of glaciers or ice sheet), fossil chrysophyte cysts in the Southern Ocean sediments can be a new useful tool to reconstruct the Antarctic Ice Sheet's fluctuation history. In addition, comparison between changes in abundance of chrysophyte cysts and the δ18O stack of benthic foraminifera (Zachos et al. 2001) shows opposite trends: matching of increases of chrysophyte cysts corresponds to decreases of $\delta^{18}O$ values (i.e. decreased ice sheet volume), which also supports the possible relationship between the fluctuations of fossil chrysophyte cysts and Antarctic Ice Sheets. On the other hand, coexistence of chrysophyte cysts and sea-ice related diatoms (e.g. 4.4–3.3 Ma at Site 689) suggests that some of the chrysophyte cysts originated from sea-ice. Further taxonomic and biogeographic studies on fossil chrysophyte cysts are needed to provide a new approach for paleoenvironmental reconstruction.

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