

The surface paleoceanographic regime offshore the Wilkes Land Margin: Results from Site U1356 and 269

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Abstract

During the Oligocene and Miocene (34-5 Ma), Earth experienced atmospheric CO₂ concentrations which exceed those of present-day, making this time interval particularly interesting to study the behavior of ice sheets during such warm climates. Available estimates of volume and variability of continental ice are foremost derived from benthic foraminiferal oxygen isotope records which come with critical assumptions on the isotopic composition of the ice and (variations in) deep-sea temperature. It requires ice-proximal records that directly recorded the ice sheet behavior to verify changes in ice volume independent of these assumptions. At present it seems that ice ocean interactions are foremost important for fast melt rates of Antarctic ice, but these feedbacks are poorly understood. Sedimentary records close to the ice sheets allow us to gain insight into past ocean structure and the presence of oceanic frontal systems during past warm climates. Such paleoceanographic reconstructions can be made with help of organic-walled dinoflagellate cysts, which are well preserved in polar sediments. At present, the assemblage composition is strongly related to the overlying oceanographic regime.

Integrated Ocean Drilling Program Expedition 318 drilled and recovered sediments from the Wilkes Land continental Margin to reconstruct the history of the East Antarctic ice sheet (EAIS). The integrated bio-magnetostratigraphic age model for IODP Site U1356 is quite robust for the entire stratigraphic record. We developed the first dinoflagellate cyst zonation scheme for the Oligocene-Miocene Southern Ocean based on the well-dated sediments from U1356. This allows us to put other hitherto poorly dated sedimentary sequences into a much improved time frame. We have done this for DSDP Site 269, and this allows us to interpret the paleoceanographic signals preserved in these sediments and put these into context of other paleoceanographic records.

We will present the integrated results of our dinoflagellate cyst studies on Site U1356 and Site 269 and what these have to tell about the paleoceanographic setting and the structure of the Southern Ocean during the Oligocene and Miocene. Today, sediments at the paleolatitude of both sites are well within the polar front, and are completely dominated by typical sea-ice related cyst species. Oligocene and notably Miocene dinocyst assemblages at both sites dominance of species which now thrive north of the Polar Front: these were able to proliferate close to the Antarctic Margin during the Oligocene and Miocene. This argues for a fundamental different oceanographic regime during that time. In the presentation, we will compare the assemblages at U1356 with the more northerly 269 and relate the patterns we see to existing knowledge on the strength of the Antarctic Circumpolar Current and ocean structure.

Keywords: Paleoceanography, biostratigraphy, Oligocene, dinoflagellate cysts