Geophysical Research Abstracts
Vol. 19, EGU2017-10143-1, 2017
EGU General Assembly 2017

Oligocene sea water temperatures offshore Wilkes Land (Antarctica) indicate warm and stable glacial-interglacial variation and show no 'late Oligocene warming'

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At present, warming of the waters below the Antarctic ice shelves is a major contributor to the instability of the Antarctic cryosphere. In order to get insight into future melt behavior of the Antarctic ice sheet, it is important to look at past warm periods that can serve as an analogue for the future. The Oligocene (∼34-23 Ma) is a period within the range of CO_2 concentrations predicted by the latest IPCC report for the coming century and is characterized by a very dynamic Antarctic ice sheet, as suggested by benthic δ18O records from ice-distal sites. We suspect that, like today, environmental changes in the Southern Ocean are in part responsible for this dynamicity. To gain more insight into this, we have reconstructed sea water temperatures (SWT) based on Thaumarchaeotal lipids (TEX86) for the Oligocene record obtained from the ice-proximal Site U1356 (Integrated Ocean Drilling Program), offshore Wilkes Land. Part of our record shows a strong coupling between the lithology and SWT, which we attribute to glacial-interglacial variation. Our data shows that both glacial and interglacial temperatures are relatively warm throughout the Oligocene: 14°C and 18°C respectively, which is consistent with previously published estimates based on UK'37 and clumped isotopes for the early Oligocene. Our SST records show only a minor decline between 30 and 24 Ma, and thus show no evidence for a 'late Oligocene warming' as was suggested based on benthic δ18O records from low latitudes. Instead, the discrepancy between our SST trend and the δ18O trend suggests that the late-Oligocene benthic δ18O decrease is likely related to a decline in ice volume. After 24 Ma, however, glacial-interglacial temperature variation appears to increase. In particular, some large temperature drops occur, one of which can be related to the Mi-1 event and a major expansion of the Antarctic ice sheet.