

Interactive comment on “Oligocene–Miocene paleoceanography off the Wilkes Land Margin (East Antarctica) based on organic-walled dinoflagellate cysts” by Peter K. Bijl et al.

Anonymous Referee #2

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Oligocene-Miocene paleoceanography off the Wilkes Land margin (East Antarctica) based on organic-walled dinoflagellate cysts.

Bijl et al.

Climate Past

Review 19 Feb. 2018

This paper presents environmental interpretations of a new dinoflagellate cyst dataset from Oligocene and Miocene sediments from a drill core collected off the Wilkes Land coast. The environmental interpretations are partly underpinned by published studies

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on the distribution of dinoflagellate cysts in modern sea floor sediments. In particular, assemblages are identified that are interpreted to correlate with sea ice. The authors use these assemblages to conclude that sea ice was more prevalent during the earliest Miocene, and also following the Middle Miocene Climatic Optimum. They also observe that assemblages representative of interglacial conditions are similar to assemblages of modern temperate oligotrophic waters, and thus infer that this reflects a migration of the polar frontal system to the south of the drill site.

This is an interesting paper, and the dataset is important. It will be of interest to the research community.

I have four main comments on the approach used and the conclusions drawn

(1) The authors note that in modern settings, *Selenopemphix antarctica* is dominant in 'proximal sea ice settings south of the Antarctic Polar Front' (but also that these modern samples from Antarctic waters have a range of 10-90% *S. antarctica*). The authors then infer that the intervals in the Wilkes Land core containing the highest relative abundance of *S. antarctica* represent depositional environments proximal to sea ice. However, *S. antarctica* is never above ~15% in any of the samples reported in this study (Figure 7): this taxon is not dominant. For context, samples with concentrations of up to 20% *S. antarctica* occur in modern Southern Ocean samples as far north as the Sub-tropical Front (e.g. Zonneveld et al. 2013, doi.org/10.1016/j.revpalbo.2012.08.003). Even if high abundance (>80%) of *S. antarctica* were indicative of sea ice (which is itself not clearly demonstrated, partly given the poor modern correlation between the polar front and sea ice extent, and partly due to the very sparse coverage of modern samples south of the polar front), that high abundance is not the case in the samples reported in this paper. The modern analogue approach used by the authors to infer the presence of sea ice is inconclusive in this instance: the data presented could be just as easily used to infer a complete lack of sea ice for the duration of the record, as sea ice variability.

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(2) The authors conclude they demonstrate ‘variability on glacial/interglacial timescales’. This is possibly true, but it has not been illustrated in a convincing way. The key to their interpretation, I think, is figures 6 and 7, where the relative abundance of different dinoflagellate cysts are illustrated for different lithologies. However, there is no evidence presented in this paper that these lithologies are deposited under different glacial conditions. They instead refer to Salabarnada et al. (in review submitted to CPD). Salabarnada et al. describe a glacial ‘Facies 1’, and an interglacial ‘Facies 2’. Although the present authors rely on the cyclo-stratigraphy of Salabarnada et al. for their glacial-interglacial interpretation, they choose (confusingly) to apply a different lithological scheme in the present paper. Thus, in Table 2, the authors assign ‘Silty claystones and sandstones’ to (glacial) Facies 1 of Salabarnada et al., and ‘carbonated rich and pelagic clay lithologies to (interglacial) Facies 2. Notwithstanding this, the dinoflagellate cyst assemblages shown in Figures 6 and 7 do not vary in a consistent way between either the glacial and interglacial facies described by Salabarnada et al., or by the glacial and interglacial lithologies assigned by the authors (line 300-302). The different lithologies do contain different dinoflagellate cyst assemblages, but these differences do not appear to fall along the glacial/interglacial divisions proposed by either Salabarnada et al. or the authors. However the authors choose to respond to this comment, at a minimum the abstract should be adjusted to removed the implication that glacial/interglacial has been investigated for the entire record (line 46), as only Oligocene samples have been explored for this variability, and I strongly suggest marking clearly on Figures 6 and 7 which lithologies represent glacial and which interglacial deposition, or perhaps grouping samples together - the seven columns/lithologies do not communicate clearly the variability the authors claim to have identified.

(3) The authors rely on unpublished (submitted, in review) work to justify their division of the dinoflagellate cyst assemblage into in situ and reworked components. This is an important step in their data processing, and important to completely assess this paper, but the information is not available to review at present.

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(4) The discussion is fairly speculative/not well supported by the data presented – but is thought provoking, and should be retained.

Minor comments follow:

L299 relation not relations

L353 can the authors discount input of terrestrial nutrients instead of upwelling?

L422 replace 'a close position' with 'proximal'?

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