

Public justification (visible to the public if the article is accepted and published):

Dear Dr. Pesjak,

I believe that you answered adequately most of the reviewers' comments as well as my editorial comments. The manuscript improved strongly. I however still have some concerns on the main text and on the supplementary that must be taken into consideration before publication. Most of these comments relate to taxonomic issues and figures.

Thank you.

Main text

Lines 67-70 : For taphonomic processes, I would refer to Warnock and Scherer, 2015.

Answer: I have added Warnock and Scherer (2015) as suggested, and furthermore, it was added to the Discussion, line 491:

“The presence of a combination of robust species, e.g., *Eucampia antarctica*, and *Actinocyclus actinochilus*, suggests that some level of reworking of sediments (Shemesh, Burckle, and Froelich, 1989; Taylor and McMinn 1997) or dissolution (Warnock and Scherer 2015) influenced the assemblage composition. These species have been found within assemblages considered to have been influenced by reworking offshore Cape Darnley in Prydz Bay (Taylor and McMinn 1997) and the continental slope of the Ross Sea (Truesdale and Kellogg 1979).”

Lines 73-75 : If you want to be a bit more exhaustive and less regional, you can cite: Peck et al., 2015; Mezgec et al., 2017; Torricella et al., 2021 for a few references dealing with coastal Holocene diatom studies.

Answer: Completed as suggested.

Lines 165-168 : Please detail which calibration curve you used : Marine13 (or 20?) or SHCal13 (or 20?)

Answer: I used Marine13. This is now added, line 166:

“..The raw radiocarbon ages were calibrated using CALIB, version 7.1, Marine13 calibration curve (Reimer et al. 2013) and the regional variation to the global marine reservoir correction, ΔR , of 830 yrs \pm 200 yrs,..”

Lines 175-179 : Typo errors. Please change to «The age model of Tan_44 is based on the facies model and two radiocarbon dates from the top 25 cm of the core,

using the premises that variability in facies, including large changes in productivity proxies (biogenic silica, Si/Al and Ba/Ti) and IRD content, present glacial.... »

Answer: Completed.

Lines 198-207 (and elsewhere in the manuscript where applicable) :

- *Fragilariopsis rhombica* is not a sea ice species per se (Armand 2005 ; Esper 2010) rather a cold water species with a maximum relative abundance in modern sediments along a large sea ice range and presence even at no sea ice. I however reckon its presence in this group may not change much your interpretations.

Answer: As suggested, I have now removed *Fragilariopsis rhombica* from the sea ice *Fragilariopsis* group, in line suggested and elsewhere in text. It is present in trace amounts, and its removal does not influence relative abundance (%) of *Fragilariopsis* sea ice group species.

- Your taxonomy for the genus *Rhizosolenia* is outdated and questionable. *Rhizosolenia styliformis* is sea ice restricted, thriving on the continental shelf (Ligowski's papers). *Rhizosolenia antennata* with two processes is called *R. antennata* var *antennata* (and not *Rhizosolenia twin process antennata*). Your *Rhizosolenia antennata* is probably *R. antennata* var *semispina* (with one process and pointed otaria extending onto the process; Sundstrom, 1986; Priddle 1990; Armand 2001). I suspect you have confused *R. styliformis* with *R. antennata* var *semispina*. Please note that *Rhizosolenia hebetata* is not present in the Southern Ocean as it is restricted to the northern hemisphere (Hasle and Syversten, 1997). This is probably *R. simplex* or *R. species A* (Armand 2001, etc...). *Rhizosolenia setigera* is absent from polar waters (Hasle and Syversten, 1997). This is probably *R. simplex* or *R. species A*. Your *Rhizosolenia polydactyla* is probably *R. polydactyla* var *polydactyla* (rounded otaria extending onto the process). *Proboscia intermis* is *P. inermis* (wrong spelling).

Answer:

I have now corrected all, as suggested (line 202, 215, 334, 583, and 538, Fig. 3 caption, Table S1 and Table S5). Note, Armand (2001) cited online is Armand and Zielinski 2011 as written on paper itself. I cite this paper now in text, line 583 and in caption of Table S1.

-*Rhizosolenia* (twin process) *antennata* is now changed to *Rhizosolenia antennata* var. *antennata*.

-*Rhizosolenia antennata* is now changed to *Rhizosolenia antennata* var. *semispina*.

-*Rhizosolenia styliformis* is now changed to *Rhizosolenia antennata* var. *semispina* (adding the old *Rhizosolenia antennata* does not change the overall percentage of former *R. styliformis*).

- Rhizosolenia hebetata is now changed to R. simplex.
- Rhizosolenia setigera is now changed to R. simplex.
(The joining of R. hebetata and R. setigera into R. simplex doesn't change their overall abundance, these are very rare species).
- Rhizosolenia polydactyla is now changed to R. polydactyla var polydactyla.
- The correct spelling of Proboscia inermis is added (line 204).

Lines 252 (and throughout the manuscript) : Please spell up the genus name when starting a sentence.

Answer: I haven't found this mistake at line 252. I have checked throughout the manuscript – and corrected at line 579 (Fragilariopsis kerguelensis).

Line 564 : Recent publication by Jones et al. 2022 in CP.

Answer: Reference is now added, line 620:

“This is consistent with gradual cooling reaching a maximum at the end of MIS 2, as seen in Antarctic ice cores (Jouzel et al. 1993) and Sea Surface Temperatures from global sediment cores (Kohfeld & Chase 2017), including records based on diatom assemblages from the Southern Ocean north of 56 °S (Crosta et al. 2004; Chadwick et al. 2022; Jones et al. 2022).”

Figures 2 and 3 : Facies 2A from 50cm to 25cm covers the 18-14 ka BP period on figure 3, but present ages between 22-16 ka BP in figure 2. And goes probably beyond 22 ka BP as the deeper date is 2/3 down this facies. Paradoxical.

Answer: Figures 2 and 3 are now aligned with respect to the age at 25 cm: it has been aligned with the 16 ka, C-14 date at 25 cm. The older line in Fig. 3 has been removed, consistent with Fig. 2.

Figure 3 : Please explain what are the two blue colors for the Eucampia index in the figure caption.

Answer: Added to caption to Fig. 3 as suggested, line 380:

“.. *Eucampia* index was also not included in statistical analysis, its distribution in dark blue shows where total *Eucampia antarctica* counts are >100 valves per sample, while the light blue areas show samples with <100 counts”.

Figure 5 : Relocate the Eucampia index X axis down the figure to lighten the text and scales presented in the upper part of the figure. Make sure that all labels are of the same police and font size. Some axes' labels are not even aligned.

Answer: I relocated Eucampia index X axis and made all the labels the same size (but left the sublabels i.e. more sea ice, smaller). I aligned other axes' labels better.

Figure 6 : Try to make the text a bit more readable as there is more text now in each box. Please use color.

Answer: I reduced the amount of text, and produced more legend to tell the story through illustrations (i.e., biodiversity, high productivity, increase in CDW). I also coloured the illustration, as suggested. However, I would prefer the black and white sketch, over the coloured version. I have presented both versions in the tracked version of manuscript but left only the black and white in the clean version.

Supplement material

Table S1 : Please define « op » in the footnote of the table (as done for W, etc...).
Fragilariopsis angulata is now F. rhombica. Change the Rhizosolenia species' names to accomodate my comment above.

Answer:

- op has now been defined.
- Fragilariopsis angulata has been erased from the table, as it no longer is within the Fragilariopsis sea ice group.
- Rhizosolenia species have been renamed as per suggested above, and an additional reference added.

Table S4 : Coscinodiscus vulnificus was renamed Thalassiosira vulnifica a long time ago (Harwood, 1992). Please use Thalassiosira oliverana or Thalassiosira oliveriana throughout the tables and main text, but not both. Change the Rhizosolenia species' names to accomodate my comment above.

Answer:

- Coscinodiscus vulnificus is now changed to Thalassiosira vulnifica (and shifted in alphabetical order);
- T. oliveriana was already written in S4, but I corrected this in Table S2 and in Table 3. I have now increased the font size in Table S4.
- Rhizosolenia species have been changed as per all suggested and shifted in alphabetical order.