



EGUsphere, author comment AC2
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Reply on RC2

Xavier Crosta et al.

Author comment on "Antarctic sea ice over the past 130□000 years – Part 1: a review of what proxy records tell us" by Xavier Crosta et al., EGUsphere,
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The manuscript by Dr Crosta and colleagues provides an overview of the importance of Antarctic sea ice on the global climate system and oceanographic circulation, its present and past variations and a thorough revision of marine- and ice core-based sea-ice proxies for the reconstructions of sea-ice changes. Authors begin with a well structured and justified introduction, followed by a description of the processes and consequences of the sea-ice formation and an up-to-date description of the current trends in sea-ice dynamics in the Southern Ocean. Next, authors described with great detail the main proxies for the reconstruction of sea-ice changes in the past with particular emphasis on diatom valves and the key biomarkers produced by this group of organisms. Authors also dedicate a section to other microfossil groups used in sea-ice reconstructions and to geochemical and isotopic proxies. Lastly, authors summarize our current knowledge of past sea-ice changes, list the gaps in the knowledge and propose future directions for sea ice research in the Southern Ocean.

Overall, this manuscript is organized logically and well written, making it easy to follow. The figures are of high quality and the manuscript contains a wealth of information useful for the specialized and non-specialized reader. I enjoyed and learned much reading the manuscript and recommend its publication.

We thank Reviewer 2 for his very positive comments.

Next, I provide some minor points that authors may like to address:

Lines 88-90. Authors could underscore the importance of these waters fuelling primary production in lower latitudes (Sarmiento et al., 2004).

A sentence on the importance of AAIW/SAMW in the distribution of nutrients to low latitudes marine ecosystems will be added.

Line 112: Since diatoms are a critical proxy for sea ice reconstructions authors could

include a general description of the dominant phytoplankton groups in marine ecosystems under the influence of sea ice. Two or three lines describing the distribution of the dominant groups (diatoms, Phaeocystis, etc.) could be useful for the non-specialized reader.

We will specify that diatoms and phaeocystis are the main primary producers in sea-ice influenced environments (Wright and van den Enden, 2000, 2010), but elaborating on the distribution (for example : diatoms abundances are highest on the continental shelves and at the APF but species are different ; similarly, there are very abundant Phaeocystis blooms in the Ross Sea and around SAZ islands, Wang and Moore, 2011), the driving parameters (light, nutrient, water column stratification, grazing, etc... Nissen et al., 2021), and the seasonality of these two groups would take too many words and is beyond the scope of the present review.

Section 3.1 (lines 269-369). Diatoms are powerful tools for sea ice reconstructions but they experience important dissolution in the water column and sediments that can introduce important bias in the interpretation of the fossil/sedimentary record. Since this is a review authors could briefly mention the limitations/problems associated with dissolution (if any).

Lines 364-369 already describe such limitations, but few additional sentences on the biases resulting from dissolution in the water column will be added. For example, the preferential preservation of robust diatoms (*F. kerguelensis*, *T. lentiginosa*) may lead to over-estimated SST and under-estimated SIC estimates in sea-ice environments.

line 314 Could authors find an alternative term/wording for "martheginal" or provide a brief description between brackets?

The word « martheginal » does not exist. Its presence in this sentence results from several iterations and spurious corrections. It will be deleted.

Lines 365-367 Could authors specify where this selective dissolution takes place? water column, surface-sediment interface? both? which one is more important?

Building on sediment trap studies (Rigual-Hernandez et al., 2015,2016), a couple of sentences will be added to explain where selective dissolution occurs.