In this paper diatoms have been extracted from 4 ice cores from Antarctica covering the last *c*. 20 years and have been enumerated at annual and sub-annual resolution. Coastal and inland sites differ in the proportions of sea ice taxa and those from open marine environments, and there is a regional increase in the concentration of diatoms this is information that can be useful for environmental reconstruction.

The paper is clearly articulated and well-written and contains original interesting data making an important contribution to the literature. I have a couple of major points of clarification and discussion.

Non-marine diatoms
The presence of non-marine diatoms needs some further discussion throughout the paper.

Firstly, in the introduction. Here there needs to be more of an acknowledgement that diatoms are also abundant and diverse in lakes, streams and wet habitats (e.g. soils) in terrestrial environments of Antarctica as well as growing on ice e.g. in cryoconite holes (Verleyen et al 2021, Noga et al 2020, Cavacini 2001, Van de Vijver & Beyens 1998). Thus there are additional sources of diatoms which either can grow *in situ* or be blown onto the ice which need to be taken into consideration. The authors mention some of these sources later in the paper, but they need to be referred to in the introduction. Diatoms in cryoconites aren't mentioned at all, are these environments present in their sampled locations? could they contribute an additional source?

Secondly, the 'broad ecological affinities' of the *Cyclotella* group (L300) needs a bit more unpacking. Many of these species are associated with freshwaters; the *Cyclotella* group as defined here may be considered to have a broad affinity but within it specific taxa have much narrower niches. By grouping together in this way information has been lost. Given the authors' comments about good preservation (e.g L179) it would have been useful to know (perhaps in the methods) the constraints on greater taxonomic resolution. Why was it not possible to identify diatoms to species level? If species had been determined then these could be more confidently assigned to aerial, freshwater, brackish or marine categories – diatom species are pretty faithful, especially in terms of salinity. *Cyclotella* is an important component at ice cores JUR and SKBL so there needs to be a bit more discussion of the possible genera and species found in the ice cores and where these are found in present day communities.

The same point applies to the *Navicula* and *Achnanthes* groups (Table 3) as species from these groups/genera can be found in aerial or freshwater habitats as well as marine ones.

The fact that marine diatoms consist of just over half (58%) of the assemblages (L307, Table 3) at the 4 sites means you do have to spend a bit of time thinking about diatoms from non-marine environments too. It is misleading to say in terms of marine components that (L330) they are – 'almost exclusively dominated' or (L341) there are 'minor contributions' from exposed sediments and freshwater and brackish. Stating (L380) that ice cores from this region are uniquely situated to record marine transported diatoms over emphasises this importance of the marine diatoms.

Perhaps this is a missed opportunity? it's not binary i.e., an ice core could provide useful environmental interpretations from both marine and terrestrial sources if those sources can be well separated which they should be if high enough taxonomic resolution is employed. For example, questions re. extent of terrestrial sources could also be explored.

In sections 2.1 2.2 and 2.3 current conditions in terms of oceanographic, climate and sea ice are detailed but there is no mention of what is happening on the land...if we accept that there

is, or at least could be, a terrestrial signal in the ice cores then a brief discussion of recent terrestrial changes would be justified.

“Unclassified’ Diatom data

In Table 2 high proportions of diatoms are ‘unclassified’ e.g. in JUR 544 diatoms out of 1149 (i.e. *c.* 50%) but also high at other sites (e.g. SHIC *c*. 25%), I assume these are the (L157) “unidentified (obscured, undiagnostic or indistinct)” diatoms. With so many in this category (I acknowledge when doing diatom analysis allocating some diatoms to this category is inevitable, but in my experience, these would be unusually high proportions) there needs to be a bit more detail as to why and whether this has any consequences. For example, if they are obscured then by what? What is meant by undiagnostic? And indistinct? Most diatoms can be identified to species level (or if not identified with confidence to a described species at least put into separate taxonomic units) so is this an issue with the technique, for example the use of SEM rather than light microscope? Some comments would be useful. What I am worried about here is some sort of systematic bias, for example if some genera are more undiagnostic than others due to being say harder to identify.

The percentage diatom assemblage data presented in Figures (2 -4) are “normalised” to the main species (i.e. recalculated to 100%) but when you have varying amounts of unidentified species it makes it difficult to compare between sites. Ideally, you need to look at the whole assemblage if not then there is an assumption that all the unidentified diatoms are a random subsample (not biased) of the assemblage? Is that a reasonable assumption?

I assume that as with light microscopy fragments are counted e.g. a fragment of a raphid diatom central area is usually distinct enough to assign to a genus if not a species. But if fragments form part of the ‘indistinct’ category then there is a need to square this with the pristine nature (ornamentation and chains are mentioned L409) of the diatoms. Again, this could be covered with more detail on what constitutes the ‘unclassified’ portion.

Minor issues

Fig 1 the locations of the ice cores aren’t particularly clear – an inset would help here (like that of Figure 6..or just refer to that) and the caption needs to include the names of the ice cores. Locations such as Amundsen-Bellinghausen seas, Ellsworth Land need to be added.

What is the justification of the decadal subsets? if these are ”to assess the consistency of the assemblage” (L160) there might be better ways to do that e.g. DCA axis scores to see if there are changes in ‘turnover’. Subsequently there is more emphasis on using the decadal data sets to examine changes in diatom concentration (number per L) between the 2 time periods (L404) and these are compared directly but the time intervals aren’t the same e.g. JUR is 1992-2001 and 2002-2012 whilst SHBL and SHIC are 1999-2008 and 2009-2019. So I am unclear as to the justification for these decadal means when all 3 cores show positive trends over the whole sampled period and section 2 doesn’t discuss climate/sea ice changes at these time intervals.

Line 267 S. gracilis (not gracilics)

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