



## ***Interactive comment on “Holocene sea level and environmental change at the southern Cape – an 8.5 kyr multi-proxy paleoclimate record from lake Voëlvlei, South Africa” by Paul Strobel et al.***

### **Anonymous Referee #4**

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Dear Editor, I have now finished my review of the manuscript “Holocene sea level and environmental change at the southern Cape, an 8.5kyr multi-proxy palaeoclimate record from lake Voelvrei, South Africa” by Paul Strobel et al.

Agree with reviewer 3, I am pleased that the concerns of reviewer 2 were adequately addressed and the position of the author clarified on the matter, and the matter is now resolved.

My overall thoughts on the criteria set out by CP are given below, comments follow:

This paper represents a substantial contribution to past climates in Southern Africa,

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providing novel, new data and a paper that fits well with the scope of the journal. Substantial conclusions are reached based on the data. The abstract could benefit from a sentence or two highlighting the significance of these findings, although

Approaches and applied methods are all valid, with good discussion linking to previous related work, with appropriate references. The scientific methods and assumptions chosen are valid and well outlined, although some contain an over-abundance of detail, and some standard procedures lack references.

Results are presented in a clear, concise way and are well structured. Some suggestions made are that certain elements of the text are restructured for emphasis of these important points. Figures are excellent, although concerns that they will be hard to read if published in their current form are expressed. Grammatical errors and alternative word choices in certain points are given, however the overall story is comprehensible. Some parts (highlighted in the comments) could be clarified or reduced.

Comments:

Title: -

Considering that this is a multi-proxy record reconstructing a range of environmental conditions of which climate is but one factor, it may be more appropriate to describe this reconstruction as a palaeoenvironmental record, rather than palaeoclimate.

Abstract.

The abstract is clear and concise. I suggest putting circa or c. before all dates to indicate the age uncertainty for these events, or to give the full range for the dates.

Line 24: 'Causing' not the right word here

Line 25: Where you say 'moisture', do you mean increased precipitation or wetter conditions? Consider replacing.

Line 28: “Westerly – “ is this hyphen supposed to be followed by something, like “-

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dominance"?

Line 29: "Climatic spikes". Can you be more specific about what these spikes represent, e.g. do they show climatic deterioration or amelioration?

Line 32: The abstract could use a short summary stating the significance of these findings and the contribution this new data makes towards understanding South African palaeoclimate studies.

Introduction:

Introduction is clear and comprehensive.

Lines 37-45: This section on SA circulation systems occurs a little too early in the manuscript, before the site and study region have been introduced. I suggest moving lines 37 - 45 towards line 50 and edit the text to fit.

Line 46: End the sentence ending with research with something like "in this region".

Line 53: You say "Impact", do you mean impacts, plural? (it would be good to list some, e.g. drainage, fires, grazing).

Line 55: "rock hyrax midden", Use plural "middens".

Line 63: instead of "grain sizes", say grain size analysis, and for pollen, consider changing to palynology.

Line 67: "However" might work better here.

I suggest moving lines 66 "the  $\delta^{2}\text{Hn}$ -alkane signal shows the potential to reconstruct the isotopic signal of precipitation and thus directly refers to the precipitation source..." (and similarly for  $\text{d}^{13}\text{Cn}$ -alkane) so the purpose of these proxies is then followed by their other qualities like preservation potential and past use in the literature for the region, as it is more important for the reader to first know what these proxies are used for.

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Line 80: "(in)organic-elemental Be more specific about what method you used here.

Line 82: Your writing tense changes a lot. In this case, you would follow "Specifically we aim to:" with the active tense "Establish". This is the same with the other underlying aims.

Site description:

Line 97: This sentence could use with restructuring, perhaps give specific family or species names for the dominant vegetation types. It is not clear what you mean by "potential", is that because you are unsure or because the vegetation changes from time to time? ps. I'd never heard of Fynbos before and they look incredible

Line 99: "Some pastures persist" This is redundant due to the preceding sentence.

Line 105: "The isotopic composition of precipitation. . ." It would be useful to separate this from the quite general discussions of the environmental conditions for the study region, as this has relevance to your proxy interpretations. Consider including this sentence at the end of that section or in your methods section.

3. Materials and methods:

My area of knowledge is in the age-depth modelling, chronologies and XRF and the methodologies described are sound.

This section needs a sentence stating how you report your ages. In this manuscript, it appears that you state the mid-age range (mean or median) and give the upper and lower 95% CL uncertainty in superscript. Can you clarify this. Also, consider that giving the mid-age range might unintentionally suggest that this is the most likely date for the whole sample. While it is great that you provide this information, it is oftentimes difficult to read.

When introducing each method, include a short sentence or couple of sentences explaining the rationale behind including each of these methods and what they indicate.

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It starts too abruptly otherwise.

Line 111: Put the core code-name in brackets. Also on this line, put the figure link (Fig 1:C) in the brackets for the grid reference or state specifically that it refers to the location. It is currently unclear that this does not lead to a figure describing the core.

Line 112: "motor hammer" do you mean a percussion corer?

Line 114: "dark and cool" replace with something like: "under dark and cool (~4degC) conditions..." and change the plus sign to either a c., ~ or <. Also "split", suggest providing a little detail here. Were they split with power tools and cleaned prior to sub-sampling? Consider saying they were "opened".

Line 115: "sedimentological properties" What method was used, Troel-Smith or an alternative? Perhaps useful to state or cite the standard used. Same as with the sediment colour.

Line 118: "organic macro" do you mean plant-macro? Replace if so.

Line 120: "the AMS. . ." remove the "the". Its best to spell out abbreviations the first time and put AMS in brackets after and henceforth. Maybe here say "AMS Radiocarbon Facility" or similar.

Line 121: "extraction prior to measurement". Do you mean pre-treatment?

Line 129: "Dose rate analysis" Please provide a reference for this methodology or explain in slightly more detail what this means.

Lines 125-135: Provide a reference for the protocol used or explain the rationale behind each pre-treatment step taken.

Line 135: "Dry-sieving". Give sieve fraction(s).

Line 136: "using the remaining core material" delete this line as it is not needed.

Line 141: "using standard methods"- give methods.

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Line 143: "as-measured water content was appropriate" - give a rationale for this assumption.

Line 150: Replace "more than" with >.

Line 164: "results were used". Replace "results" with "dates".

Line 172 "The final age-depth relation was calculated" instead state "profile was modelled..."

Line 192: "Those macrofossils are all snails. . ." consider replacing with "molluscs", whether terrestrial, freshwater, brackish or marine.

Line 195: "All palaeontological material. . ." Writing tense changes with this sentence. Is this level of detail necessary? Consider just stating that they will be stored permanently at the Cape Town NHM.

Line 206: What elements are being scanned for? What is your procedure for selecting which elements to use, and what elemental ratios will you use? (provide a rationale and a source for each one). Another method often used is to normalise core-scanning XRF data is to divide the data against the incoherent+ coherent scatter (INC+COH), which are a direct measure of scatter due to these factors. I have not heard of Zr being used before (but I do not work on lakes). Is it not likely that Zr would be affected by these things as much as any other element?

Line 218: State that TOC and TC is reported as percentages.

Line 231-244: Because this is your key proxy, it might be worth bringing this nearer to the top of your methods section.

Line 245: Consider if you need these equations or whether a reference to their source is sufficient

Line 279: Can you explain why these samples gave young ages to justify their exclusion whilst samples deemed stratigraphically correct were retained. Otherwise it comes

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across as 'cherry-picking'. What percentage of the dates overlapped with the model? This information is given in Rs console following the model run in Bacon

Results:

The results are clearly described and the figures used to support them do so well (but see comments).

Line 282: It seems from this (and the figure) that a considerable number (6) of the dates do not overlap with the age-depth model

Line 303: What are these ratios used to indicate? Include something about this in the methodology (See: [https://www.researchgate.net/publication/281968354\\_MicroXRF\\_Core\\_Scanning\\_in\\_Palaeo](https://www.researchgate.net/publication/281968354_MicroXRF_Core_Scanning_in_Palaeo))

Line 305: - Remove word "contents". Line 314: "high values in the lower parts" Provide the range of depths, lower parts is too arbitrary

Line 359: "foraminifers" Plural is Foraminiferas or foraminifera, not foraminifers Lines 341-361: It is redundant to keep referring to the figure each time. Just state once that changes in macro and microfossil abundance are illustrated by figure 5.

Discussion:

Discussion based solely on results.

Line 370: "Indicating that sediments were. . ." Consider using "suggesting" as you cannot be certain based on this evidence alone.

Line 389: Ensure that the abbreviation "MAM" is explained at some point within the text.

Line 409: "Summarising" – replace with "in summary. . ."

Line 486: "occasional events" can you be more specific about what is meant by occasional events; "amounts" do you mean increased amounts?

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Line 540: 'moister' is not a word that is commonly used in this context, typically "more moist" is used but you may want to consider a different word entirely, e.g. wetter

Lines 561- 565: The dating for the youngest flooding event (10 +/- 10 cal BP) would need to have taken place between 1940 and 1960 in order to match with the age-depth model, even considering the dating error. Without using a method specifically designed to accurately date recently deposited surface sediments (e.g. 210Pb or SCPs) this date is highly tenuous and you might want to emphasise this, or state that your age-depth model is likely to be inaccurate towards the top of the profile.

Conclusion: Clear and in line with discussion.

Figures:

Figures are all very informative

Ensure figure 3 & 7 will be readable in a journal article. The current version appears to be low-resolution and it is difficult to make out the detail in the curves, particularly for TIC% which is also very pale for figure 3. Figure 7 is very difficult to read.

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2020-130>, 2020.

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