

## ***Interactive comment on “Effects of atmospheric CO<sub>2</sub> variability of the past 800 ka on the biomes of Southeast Africa” by Lydie M. Dupont et al.***

### **Anonymous Referee #1**

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The paper reports on a prominent and unique pollen record from an Indian Ocean core and provides interesting comparisons with relevant other records derived from different sources including proxies from the same core and others like the Vostok Ice core. The paper is in connection with the influence atmospheric CO<sub>2</sub> concentrations on eastern Southern African vegetation types and suggests that under the higher concentrations of pCO<sub>2</sub> woody plant growth thrives. I can't say I am entirely convinced by the cause and effect arguments that are proposed between pCO<sub>2</sub> and other factors like hydroclimate and temperature as is acknowledged by the authors, and therefore would suggest a more cautious approach. Proxies of these conditions seem to behave in concert but it is not that clear which one is the leading factor and how much they influence each another. Although the role C<sub>4</sub> sedges seem to be important, I feel the role of C<sub>4</sub>

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grasses are underplayed (discussed further below). This is nevertheless an important study worthy of publication provided that attention is given to the aspects listed below. Abstract P1, line 16. If possible, please mention to what degree and on what basis the effects of the factors, hydroclimate, temperature and atmospheric pCO<sub>2</sub>, can be disentangled. P1, lines 17, 18, 19. The statement could provide better insight if it can be more specific, e.g., do these different vegetation categories respond in the same way or differently to pCO<sub>2</sub>? The word “depended” might have to be reconsidered in view of the above concerns. Please insert (~430 ka) after Mid-Brunhes Event.

Introduction P1, line 24. If subscript is used in pCO<sub>2</sub>, why not in C<sub>4</sub>? P2, line 13. It is unclear what kind of event is meant here. P2, line 20. The phrase “to counter” could be seen as ambiguous or is it meant to be “is counter to”?

Material and Methods P4, line 29. Does “windows” mean sections? A question arises here why there are two older windows and not one continuous one. Is there a hiatus or another reason? P5 line 11. A definition of an endmember would be helpful here to keep the uninitiated reader informed. P5, line 30. There may be correlation between sedge pollen and leaf wax isotopes but it looks as if there is also correlation with Poaceae pollen (see also below in connection with P9, line 15). P6, lines 6,7. Why is this relevant? Won't one find C<sub>4</sub> sedges near any of these African lakes? P6, lines 19,20. I can't see why this is remarkable. In my experience dry conditions result in less ground cover hence relatively more woody elements.

Endmembers representing vegetation on land P6, line 23. In connection with the three endmembers, the reader would by now have seen from Figure 3 that there are 4 endmembers. Therefore, I suggest saying “characterized initially”. The word “so-called” should have been used when endmembers were first mentioned. A table in the text with the most prominent constituents of the endmembers will make it easier to understand the significance without having to go and look in the supplements. P7, line 2. Must be “endmember's”? P7, line 3. This “one endmember” is a little confusing. Say which one or say: one endmember had a counterpart in EM2. P7. Line 15. What kind

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of extremes? P7, line 30. "wide range woodland taxa" like Combretaceae? I see this important taxon in not mentioned except in the supplements. P8, line 8. This may be seen as ambiguous if "developed" is taken as originated. Did miombo not start much earlier?

Effects of atmospheric pCO<sub>2</sub> P9, line 15. Surely some C4 grasses also thrive under relatively moist conditions if it is not too cold. Seasonality or growing season moisture is a factor which was not evaluated enough in the paper. Is it not possible that apart from C4 sedges, certain C4 Poaceae also played a role? On high land, frost and winter seasonality might be a factor ruling out C4 grasses in favour of C3 grasses or small shrubs, but as long as there are summer rains and subtropical Africa is warm enough during the glacial periods, which will probably be the case on the low-lying coastal platform, C4 grasses will be supported. It might be worthwhile to consider Vogel's work on the distribution of C3/C4 grasses in Southern Africa in this study. There are also some arguments in this connection in Scott (2002). Vogel, J.C., Fuls, A., Ellis, R.P., 1978. The geographical distribution of Kranz grasses in South Africa. *S. Afr. J. Sci.* 74, 209-215. Scott, L. 2002. Grassland development under glacial and interglacial conditions in Southern Africa: review of pollen, phytolith and isotope evidence. *Palaeogeography, Palaeoclimatology, Palaeoecology* 177(1-2): 47-57.

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