

Interactive comment on “Alkenone isotopes show evidence of active carbon concentrating mechanisms in coccolithophores as aqueous carbon dioxide concentrations fall below $7 \mu\text{mol L}^{-1}$ ” by Marcus P. S. Badger

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This manuscript is well-written and I expect that it will be a valuable addition to the ongoing discussion on CCMs in phytoplankton and coccolithophores in particular. There is something that I do not understand though. Based on Figure 2 I deduce that all of the sites used - with the exception of this Manop C site - have the same present-day CO₂ partial pressure anomaly. In addition, all of the sites are within 0-30 N/S. This then makes me conclude that the calculation of [CO₂]_{aq} using the ice-core pCO₂ estimates should primarily depend on SST and salinity estimates back in time right? I personally

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cannot see how SST and salinity back in time would be so much different for these very similar sites. I find this difficult to believe and it would be helpful if you could show the maps of the SST and salinity values used to calculate [CO₂]_{aq}. Also, I find it a bit of an easy statement to make that low CO₂ should trigger the CCMs in coccos if recent papers have convincingly shown that light level and nutrient availability are main triggers of CCMs (e.g. Wilkes et al., 2019). Last, I find it a bit of an overstatement to say that as CO₂ equilibrium should be better maintained at high atmospheric CO₂ into the Cenozoic, and as CCMs should likely not operate at high pCO₂; we can thus use the alkenone-pCO₂ proxy confidently throughout the whole Cenozoic. Could you discuss the uncertainty in this extrapolation? After all, pCO₂ through glacial-interglacial times never exceeds 280ppm. Furthermore, what about coccolith evolution through time? I hope these comments are helpful.

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