

Interactive comment on “Improving accuracy and precision of ice core $\delta D(CH_4)$ analyses using methane pre- and hydrogen post-pyrolysis trapping and subsequent chromatographic separation” by M. Bock et al.

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The manuscript presents a new technique for measuring δD of CH_4 from ice cores documenting new improvements in accuracy and precision. The manuscript is extremely well written and concise. I recommend publishing with minor changes.

Pg 11285, L3: slope threshold is not a universal term. I understand but common reader will need clarification.

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Pg 11287, L5-12: The absolute VSMOW calibration. This section is unclear. I suggest your remind us how CIC and MPI get to VSMOW. There should be a way to assess uncertainty in the Bern dD scale for CH₄ by adding uncertainties in the original calibration to VSMOW to the uncertainties in the Alert/Air Controlle calibration.

Pg 11287, L17: Please add depth interval to age interval . 181-191mbs corresponding to gas ages between X and Y.

Pg 11287, last paragraph: The variability in dD over this 10m depth interval is very interesting. Another way to think about this is whether the rate of dD change over time is unrealistic. How much time represents 190-191m? I'd guess it is short such that the ddD/dt is enormous. Compare with anthropogenic signal to make the case. Any thoughts about why the ddD/dt is so large? Could we be talking about in-situ production (Rhodes et al. 2013)? If this core was used for d¹³CH₄ development/standardization, one would suspect similar excess variability if the root of the problem is in-situ production. Hopefully not. ...

Pg 11288, first paragraph: This paragraph seems a bit out of place and I'd argue superfluous in the context of accuracy. As we don't know the real interpolar dD gradient, this paragraph point more to the biogeochemistry of atmospheric CH₄ than to the accuracy of the new technique. I vote to remove the entire paragraph and include in next paper dealing with the interpolar gradient.

Pg 11290, L11: Replace "as in Bock" with "compared to Bock"

Table 2: Can you add gas ages here?

Figure 6, text box insert, first line should be using only pre pyrolysis trapping.

Finally, I read the comments from Reveiwer 1 on this manuscript. I think that changing the notation from dD to d₂H will cause confusion for those of us who think about dD of CH₄. While correct IUPAC notation is sometimes preferred, I believe there will be more confusion using the d₂H notation than dD. If we had to remember the chemical formula

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for Freon-11 and write it every time we used it, the world would be awash in chemical formulas that our politicians would never understand. There is a place for non-IUPAC terminology in literature. Keep the dD notation.

References:

Rhodes, R. H., X. Faïn, C. Stowasser, T. Blunier, J. Chappellaz, J. R. McConnell, D. Romanini, L. E. Mitchell and E. J. Brook (2013). "Continuous methane measurements from a late Holocene Greenland ice core: Atmospheric and in-situ signals." *Earth and Planetary Science Letters* 368: 9-19, 10.1016/j.epsl.2013.02.034.

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