

Interactive comment on “Enrichment in ¹³C of atmospheric CH₄ during the Younger Dryas termination” by J. R. Melton et al.

Anonymous Referee #2

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General comments

Melton et al., present a very interesting d13C record of atmospheric CH₄ over the dramatic YD-Preboreal transition. A problem they have to deal with is that Pákitsoq CH₄ record is altered by unknown (?) processes. Generally there is excess CH₄ with occasional large spikes. The methods section compares the data to existing data and here the “reliable” data points are handpicked. This is not a problem per se, the authors present evidence that there is no systematic shift by the contaminant over the time period of interest. I believe that the shift in the isotopes they see is reliable but it could be systematically offset from the true value. The discussion of the data can be much more straight forward starting by stating at the beginning that the record is altered and that data have to be selected following by the arguments that the shift in

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the isotope ratios is reliable. A lot of the methods section can go to the supplement. What I am not so convinced of is that there is no constant offset by the contaminant.

The finding that thermokarst lakes and biomass burning are the dominant sources changing over the transition is conflicting with earlier findings. This has to be discussed in depth. What is missing specifically is the finding based on the pole to pole gradient (Chappellaz et al., 1997; Dällenbach et al., 2000) that there was a large increase in tropical sources at the YD transition. Further the documented change in the gradient may be important for the interpretation of the data and it should be taken into account. The manuscript should be restructured focusing more on the results and setting the new finding into context to previously published estimates. As the authors state on page 3310, line 1: This data needs to be confirmed and I could not agree more.

Specific comments

Page 3290, lines 7-12: Wetlands in higher latitudes should be discussed here. They are a player on at glacial interglacial transitions.

Page 3290, lines 13-21: Recent evidence point to methane released below 200m below surface not reaching the ocean surface. Solomon, E. et al., I.: Considerable methane fluxes to the atmosphere from hydrocarbon seeps in the gulf of Mexico, *Nature Geosci*, 2, 561-565, 2009.

Page 3291, lines 7-9: Where is the 5% blank originating from? 5% is quite a lot. How was the blank determined?

Page 3291, lines 29: Why is it not possible to take the atmospheric variations into account by using the NOAA network data?

Page 3292, line 24 and elsewhere: Eurocore and GISP2 are not the same thing! Eurocore is a core drilled by a European conglomerate at Summit in 1989, a few meters away from where GRIP was drilled later. GISP2 was drilled 30km to the west of GRIP. What is referred to as Summit today is actually not Summit but where the old GISP2

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camp was located.

Page 3298, equations: add that $\sum \Delta Q_n = 1$.

Section 3.4.4: I cannot follow here. The authors hint that the conclusions in those papers are incompatible with their findings. If so they have to discuss why this is.

Page 3305, lines 3-13: CO has a lifetime of 2 months in the atmosphere. Therefore the Antarctic CO data show at most increased biomass burning in the southern hemisphere but not globally.

Section 3.5.1: The deuterium discussion can be removed down to citing Bock et al., 2010.

Technical corrections

Page 3297, line 22: Either write "epsilon = alpha-1" or add that epsilon is in ‰.

Interactive comment on Clim. Past Discuss., 7, 3287, 2011.