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Interactive Comment

Interactive comment on "The 8.2 ka cooling event related to extensive melting of the Greenland Ice Sheet" *by* H. Ebbesen et al.

Anonymous Referee #2

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General comments

The title of this paper sounds very promising and exciting, but unfortunately I was rather disappointed by the presented evidence to substantiate the conclusion in the title. In the paper, the authors claim to provide evidence for 'widespread presence of a thick and cold, low-salinity melt-water layer offshore Greenland and north-eastern Canada from well before 8200 cal yr BP to shortly after that time' (Page 1225, lines 5-7). They further claim that this led to 'slowdown of high-latitude deep convection and thus contributed to North Atlantic cooling' (Page 1225, lines 16-17). As I explain below, these claims are in my view not supported by the presented data. I therefore recommend rejection of this manuscript.

Main comments

The first claim is based on the assumption that high values of magnetic susceptibility represent high levels of meltwater discharge from the Greenland Icesheet (GIS). The idea behind this relationship is that peaks of magnetic susceptibility (MS) are related to high percentages of silt in the sediment cores, and that this silt originates from meltwater plumes. However, this relationship is not explored or verified in this paper, and in my view it is very doubtful if there is a simple linear relationship between MS and meltwater volume discharged into the ocean. The trends in percentages silt in the cores are not presented and thus unknown to the reader. If we assume that the MS maxima are related to high volume percentages of silt, then it is still unclear if these high silt levels are due to enhanced discharge. The authors seem to assume that the availability of silt remains more or less constant, but in my view it could very well be that the sediment availability varies along with the melt rate in Greenland. For instance, if glaciers retreat, as would be expected in the early Holocene, the area covered formerly by the glaciers represents a new sediment source. So in short, it is not clear that the MS is a valid proxy for meltwater discharge.

A second problem that I have with the first claim is related to the timing and the levels of the MS maxima in Figure 2. The authors write (page 1221, lines 25-26) ‘In fact all cores show massive silt deposition with maximum values of magnetic susceptibility in the period immediately prior to 8200 cal yr BP (Fig. 2c, d, e)‘. This is only true for core DA00-06 (Fig. 2C), and not for the other two cores. In core DA00-04 (Fig. 2d), maximum MS peaks are after 8000 cal yr BP, and in core DA04-41P, two MS maxima are visible in Fig. 2e at around 8.7 cal kyr BP and 7.9 cal kyr BP. So the timing of MS maxima is definitely not immediately before 8200 cal yr BP in all cores. Further on (Page 1222, lines 4-5), it is stated ‘After these maxima in melt-water discharge in all three cases the MS values gradually decreased during the centuries following 8200 cal yr BP.‘ Again, this is not indicated by Figure 2, as the MS measurements from cores DA04-41P and DA00-04 show maxima after 8000 cal yr BP.

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Concerning the second claim, the authors do not present any evidence that the supposed ‘excessive meltwater production‘ resulted in the weakening of deep convection associated with the 8.2 ka event. Again the claim appears to be based on an assumption that is not substantiated. Work by the GEOTOP group (Hillaire-Marcel et al., 2001, 2007; DeVernal and Hillaire-Marcel 2006) has shown that deep convection in Labrador Sea started around 7 cal kyr BP, i.e. around the time when the Laurentide Icesheet (LIS) was gone. It is thus likely that the ocean surface freshening associated with background melting of the LIS suppressed deepwater formation in the Labrador Sea. Consequently, the 8.2 ka BP event cannot be linked to a weakening of deep convection in the Labrador Sea. Several studies have argued that the catastrophic drainage of proglacial Laurentide Lakes was responsible for the weakening of the ocean circulation resulting in the 8.2 ka event. If the authors want to argue that GIS melting significantly contributed to the 8.2 ka event, they have to show that the meltwater volume from Greenland is substantial compared to the volume of background LIS melting plus the volume of the Laurentide proglacial lakes. Estimates for the latter two volumes have been published by e.g. Licciardi et al. (1999) and Leverington et al. (2002).

Other comments

- Page 1222. Figures 3h and 3i (XRF values) are missing.

- Page 1222, line 22, Page 1225 line 7. What arguments do the authors have for saying that the meltwater layer was thick?

- Page 1223. The change in fauna after 7800 cal yr BP is interesting, but I do not see how these observations contribute to the idea that the 8.2 ka event is related to extensive GIS melting.

- The reference list is not in alphabetical order.

Additional references

Licciardi, J. M., J. T. Teller, et al. (1999). Freshwater routing by the Laurentide ice sheet

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during the last deglaciation. In: Mechanisms of global climate change at millennial time scale. P. U. Clark, R. S. Webb and L. D. Keigwin (Eds.). Washington, DC, American Geophysical Union: 177-201.

Interactive comment on Clim. Past Discuss., 4, 1219, 2008.