

## ***Interactive comment on “Subsurface North Atlantic warming as a trigger of rapid cooling events: evidences from the Early Pleistocene (MIS 31–19)” by I. Hernández-Almeida et al.***

**Anonymous Referee #1**

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This manuscript presents new Mg/Ca and d18O results from IODP Site U1314 on the planktonic foraminifer *N. pachyderma* (sin) for the Early Pleistocene MIS 31-19. *N. pachyderma* was selected to reconstruct changes in subsurface water mass conditions. The records show warmer and saltier conditions just before and during the maximum occurrences of IRD deposition. These results are interpreted as representing a similar mechanism which was suggested for MIS 3 in the N-Atlantic that accumulated warmer and saltier water leads to instability of the ice sheets and accordingly to the release of ice bergs. The manuscript is well written and provides an interesting addition to the growing collection of records which show the link between subsurface warming in the N-Atlantic, rapid climate oscillations, and ice sheet instability. I only have a few

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comments, which are detailed below. In summary, I recommend this manuscript for publication in *Climate of the Past* after minor revisions have been made.

A first main question which came up is “Why MIS31-19?” What makes this interval specifically interesting to perform these reconstructions on?

In general I do agree that subsurface warming regularly occurs during IRD events, it nevertheless also seems to be quite random. For some events it fits perfectly, but for other maximum temperature events no IRD occurs or a maximum in IRD is accompanied by minimum temperatures (e.g. 960 ka). Even though intensity/duration of each separate event may have been different and therefore the responses may have been different, I wonder if this is not also a case of small age model mismatches and/or the result of the different responses which were found in Mignot et al. (2007). They argue that they only find subsurface warming when intermediate water formation also ceased along with NADW formation. As long as intermediate water formation continued no subsurface warming developed.

Mg/Ca on *N. pachyderma* has never been straightforward to interpret. Therefore, I think it is essential to include the actual Mg/Ca data into the paper/supplement. It is mentioned that Mn/Ca was <0.5 mmol/mol. Such values still seem relatively high. Was there a correlation between Mn/Ca and Mg/Ca or were any samples identified as outliers with high Mn/Ca?

Minor comments: Page 4034-13: Change to “Subsurface accumulation of warm waters” 4035/4043: I suggest adding a recent paper by Ezat et al. (2014) who used benthic foraminifer Mg/Ca to show warming during such stadials in the Nordic Seas. Also, Naafs et al. (2013) provide a review of IRD events since the Pliocene, including the studied interval in here. 4036-19: “allow” 4037-8: should be westwards 4037: Properties of the Irminger Current seem to contradict each other between the 2nd and 3rd paragraphs. 4037-24: “shell”; rephrase the sentence, it seems that it should be two separate sentences. 4038-3: delete “to”; “planktonic”; -6: “on a . . .” 4038-26: The

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reference “Hernández-Almeida et al., 2013b” is missing. 4039-13: “overestimate”; -16: delete “ratio”; -27: delete “the iceberg” 4041-7-10: Please rephrase; the order seems wrong; shouldn't it be that because of the accumulation of subsurface heat you destabilize the water column which then leads to the increased calving, and then finally AMOC speeds up again? 4042-3: “intensifications” -22: “orbital-scale”: It would be interesting to show this, is temperature changing similar to the other proxies as shown in Hernandez-Almeida et al. (2010)? 4044-9: “at the expense of” Fig.2-4: Add error bars, both on  $\delta^{18}O_{sw}$  and Mg/Ca of pachyderma these can be quite significant. Fig. 3: add MIS numbers to the plots.

Suggested References: Ezat, M., T. Rasmussen, J. Groeneveld (2014). Persistent intermediate water warming during cold stadials in the SE Nordic seas during the last 65 kyr. *Geology*, doi:10.1130/G35579.1 Naafs, B.D.A., J. Hefter, R. Stein (2013). Millennial-scale ice rafting events and Hudson Strait Heinrich (-like) Events during the late Pliocene and Pleistocene: a review. *Quaternary Science Reviews* 80, 1-28

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