Auxiliary Material Submission for Paper

Peak glacial 14C ventilation ages suggest major drawdown into the abyssal ocean

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Introduction

The Auxiliary Texts no. 1 and 2 contain two text paragraphs that provide supplementary information about details of evidence, which contribute to a better understanding of the main text.

Auxiliary Text # 1:

In contrast to conjectures suggesting errors in age control or reworking of old sediments as explanation for apparent high surface reservoir ages, we see robust arguments in favor of the very old planktic reservoir ages used in our study. First, similar age ranges result from independent lines of evidence based on 5 different techniques. Second, reworking of 'old' planktic foraminiferal sediments as cause for high planktic reservoir ages can be excluded for various reasons at the different core sites. (1) Over the last 12 years well dated tephra layers, such as the North Atlantic Vedde Ash, already served as stringent evidence at various sites. (2) Detailed inspection of sediment structures at the sites under discussion reveals an undisturbed hemipelagic sediment sequence free of turbidites, rarely interrupted by short-lasting stratigraphic gaps linked to stadial-to-interstadial changes in the sediment regime; (3) The selection of core sites on top of elevated submarine plateaus (e.g., the Detroit Seamount in the North Pacific; a promontory off northwestern Iceland; etc.) largely exclude a large-scale lateral input of reworked sediments. (4) Both surface and bottom water ages reached short-lasting maxima in the North Atlantic during HS-1. These extremes are just coeval with a minimum in NADW-linked bottom currents, that entails minimum particle transport at sediment drifts, as independently supported by a variety of other proxies ($\delta^{13}C_{be}$; Pa/Th; magnetic susceptibility records, silt modal grain sizes). (5) In many cases strongly oscillating benthic-planktic age differences show that high or low surface water ages do not necessarily covary with analogous changes in deep-water age (Thornalley et al., 2011). (6) To contaminate planktic ages by +1500/+2000 yr (equivalent to ~1/3 of a ^{14}C half-life) by reworked planktic foraminifera tests requires a significant lateral input of tests >60 ky / >20 ky older than the deposits used for reservoir age calculation. This input ranges from 17% - 22% of the total foraminifera number for an admixture that is 60 ky older, and from 19% - 24% for an admixture that is 20 ky older. These amounts are highly unlikely in view of foram census counts that resulted in pronounced and abrupt millennial-scale SST changes (e.g., Weinelt et al., 2003). (7) High planktic reservoir age levels obtained for a particular time slice from different sites turn out to be consistent within a particular sea region. (8) At two sites (GIK 17940, PS2644), a major lowering of the very high planktic ^{14}C reservoir ages in conjunction with the large benthic-planktic age difference would result in negative benthic reservoir ages physically impossible. At other sites in the North Pacific and South China Sea, a lowering of planktic reservoir ages would imply unreasonably low benthic reservoir ages, e.g., indicating transient deepwater formation in the South China Sea during B/A and the Younger Dryas.

Weinelt, M. et al. (2003), Variability of North Atlantic heat transfer during MIS 2. *Paleoceanography* **18**, PA 1071, doi:10.1029/2002PA000772.

Auxiliary Text #2.

Skinner et al. (2010) also discuss (lower) deep-water ventilation ages from a second core retrieved in the Atlantic sector of the Southern Ocean near South Africa. However, age control at this very deep site appears problematic, since it is affected by dissolution intervals. Moreover, reservoir ages derived from the ^{14}C projection method suffer from a broad uncertainty range. Thus, the youngest end member of LGM benthic reservoir ages from this core has a question mark in Fig. 3.