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Biogeosciences Discussions

Interactive comment on "Intense photooxidative degradation of planktonic and bacterial lipids in sinking particles collected with sediment traps across the Canadian Beaufort Shelf (Arctic Ocean)" *by* J.-F. Rontani et al.

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Dear Dr. Belt, responding to your comments, the text has been revised. Please find below our detailed responses to your comments and suggestions.

- Main comment: Finally, the article begins with a rationale for study that includes the potential impacts of climate change on the processing of POM and the influence(s) that reduced sea ice cover may have, in particular. It is a pity, therefore, that this is not re-visited in the conclusions, so that the analytical outcomes (which are very well

done) are not then placed in a wider context. Whilst this cannot be achieved definitely given the dataset obtained, and it would be unwise to encourage unhelpful speculation, it would be of interest to at least receive some suggestions of the significance of the outcomes in a wider context. For example, this may take the form of estimating what the impacts of changing oceanographic conditions might have on the preservation of OM in the water column (as alluded to in the introduction with reduced sea ice). Alternatively, the outcomes may be used to highlight the importance of considering selective (and variable) preservation of OM en route to underlying sediments, especially as such archived records are often used in the reconstruction of past climates.

- Answer: We agree with this comment, thus we added the following text at the end of the conclusions: 'In order to put the current global warming trend into the context of natural climate variability, it is essential to reconstruct sedimentary palaeoenvironments. Lipid biomarkers preserved in bottom sediments are particularly useful for this purpose, since they represent the ultimate signature of sympagic and pelagic productivity (e.g. Volkman et al., 1998; Wakeham et al., 1997; Rontani and Volkman, 2005; Bianchi and Canuel, 2011). However, reconstructions based on sediment biomarkers are incomplete without a careful consideration of particle alteration and/or preservation during their transport from the euphotic zone to the benthic boundary layer. It is thus critical to understand how biotic and abiotic processes may alter the environmental signal encoded by the biomarker proxy. This is particularly important for Arctic regions, which indeed provide the earliest and most dramatic manifestations of global change (Hansen et al., 2012). Here, we have observed an extraordinary efficiency of photooxidation processes acting on sinking particles collected during summer in the Beaufort Sea. These processes, which should gradually increase as ice-free waters increase in extent and duration (NSIDC, 2012), appear to destroy most of the unsaturated components of organisms initially present in the settling material – thus strongly altering their lipid signature. Although it is generally considered that sinking particles are the main contributors to the sedimentary record (Wakeham and Lee, 1989), it may be noted that zooplanktonic monounsaturated n-alcohols and their photooxidation products present

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in very high proportion in these particles, were totally absent in the underlying surface sediments (Rontani et al., 2012). The disappearance of those products as they transit through the aphotic layer of the water column might result from the involvement of free radical oxidation processes (induced by the cleavage of photochemically-produced hydroperoxides), rather than from biodegradation processes limited by the photochemical alteration of attached bacteria. In the future, it will thus be essential to take into account the effects of abiotic degradation processes (relatively ignored until now in the literature) within sedimentary palaeoenvironmental reconstructions.'

The following references were added in the reference list: - Bianchi (2011) - Forest et al. (2012b) - Hansen et al. (2012) - NSIDC (2012) - Rontani and Volkman (2005) - Volkman et al. (1998)

Interactive comment on Biogeosciences Discuss., 9, 7743, 2012.