

Interactive comment on “Sedimentary record from the Canada Basin, Arctic Ocean: implications for late to middle Pleistocene glacial history” by Linsen Dong et al.

Anonymous Referee #1

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General comments

This manuscript focuses on a sediment core record (ARC4-BN05) from the Canadian Basin of the Arctic Ocean and addresses Pleistocene glacial history of this region. A large dataset is presented, providing a significant contribution to marine geological studies in the Arctic Ocean. However, interpretation of the results, i.e. the principal component analysis, is not clearly outlined and some of the assumptions should be revised. The structure of the paper could be improved by rearranging and making changes to some of the figures and tables.

Specific comments

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3 Materials and methods XRF data (counts) could be normalized using Al to discriminate between terrigenous and biogenic contributions of Ca and Mn. As Ca concentrations include both biogenic and terrigenous components, they do not need to be reported in this paper (or there should be a discussion on the presence of forams etc., also see comments below).

Principal component analysis (PCA) is not clearly outlined and difficult to follow throughout the paper. More motivation could be provided in Ch. 3 Methods (lines 194-198) to explain why this analysis was undertaken (e.g. to distinguish between potential components in the sediment composition). Consequently, the selection of variables (sediment characteristics) should be explained. PCA is meant to restructure the dataset into several independent components. In this paper, mineral assemblages in bulk and clay fractions, contents of different grain-size fractions, and foraminiferal numbers were included in the PCA. If looking for potential forces/sedimentary environments, factor analysis would be a better choice over the PCA. Alternatively, the selection of variables to be included in the PCA could be reduced to mineral assemblages, for example. Then Fig. 7 and Fig. 8 could be combined to show the downcore PC scores. The procedure could be described stepwise (in Ch. 3 Methods or in Ch. 4.6 Results, PCA): 1) variables (sediment properties) are positively or negatively correlated with each of the identified PCs, 2) loadings of the variables on PCs 1-3 are used to group these variables.

4.6 Principal component analysis Fig. 6, Table 3 and Fig. 8 should be revised. As stated by the authors, the PCs 1-3 contribute only to 54% of the total variance. Hence, interpretation of the PCA results is not straightforward (also see comments above). For example, clay mineral abundance is not grouping with the clay abundance (also see Ch. 5.2.4). In Fig. 6a, variables of groups 4 and 5 have very insignificant loadings on PC 1 and PC 2. In Fig. 6b, variables of groups 1,5,6 have very insignificant loadings on PC 2 and PC 3.

5.1 Stratigraphic framework What about absence of forams in B12 and B13? If this is

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due to dissolution, should you use abundance of forams as a variable with interglacial meaning in the PCA?

5.2.2 North American provenance It is stated in line 477 that “dolomite is the main contributor of Ca in sediment cores from western Arctic Ocean”. However, it is not clear from the paper if this is true for core ARC4-BN05. There are several prominent peaks of forams observed, and calcite contents sometimes exceed those of dolomite (Table S1). Therefore, Ca elemental concentrations should not be attributed only to dolomite and used as an indicator of the NA provenance. This also applies to the comment about the PCA.

Technical corrections 4.4 Grain size Check the grain sizes of silt and clay fractions (lines 253, 257, and Fig. 4). Tables Table 1. Footnote should be added stating the references used. Table 3. Footnote should be added explaining how the groups were identified (from Fig. 6). Table S4 (PCA loadings) can be included as one of the main tables for clarity. Figures Fig. 4. Stratigraphy could be shown, as this figure is discussed in Ch. 5.2.1. Fig. 7 should follow Ch. 5.1. Stratigraphic framework, as you start to discuss the proxy records vs. age in Ch. 5.2. Annotated pdf containing more comments is attached.

Please also note the supplement to this comment:

<http://www.clim-past-discuss.net/cp-2016-139/cp-2016-139-RC1-supplement.pdf>

Interactive comment on Clim. Past Discuss., doi:10.5194/cp-2016-139, 2017.

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