

### Revision summary and replies to anonymous Referee #3

We appreciate the positive and constructive comments by Referee #3. We have addressed the overall raised concern that there is somewhat an imbalance regarding the level of detail we describe the different data by adding some more information, rather than removing. In particular, we have previously per request of Referee #2 added more information on the sediment core stratigraphy.

Below follows point-by-point how we dealt with the additional comments and questions raised by Referee #3. However, before this, a summary is provided how we dealt with the main points raised by Referees #1 and #2.

#### Summary

The revised version of the manuscript use the term “Bering Land Bridge” consistently, which also implied a title change of the manuscript to “Post-glacial flooding of the Bering Land Bridge dated to 11 cal ka BP based on new geophysical and sediment records”. Referees #1 and #2 both raised concerns regarding how the age model was described, specifically the effect of assigning different reservoir corrections. To clearly show the sensitivity of assigning different  $\Delta R$  values for the age of the flooding of Bering Land Bridge, we included scenarios with  $\Delta R=300$  and 500 years in a specific figure. When replying to Referee #2, we suggested to include this figure as Fig 3C, but we now have decided that it is better to include as a self-standing supplementary figure in our final revision. This exercise provided the following median ages for the Bering Strait flooding:  $\sim 11.1$  cal ka for  $\Delta R = 50$  years,  $\sim 10.8$  cal ka for  $\Delta R = 300$  years,  $\sim 10.5$  cal ka for  $\Delta R = 500$  years. We believe this clearly illustrates the effects of applying different  $\Delta R$ . It is emphasized that assigning larger  $\Delta R$  yields younger ages for the flooding. The specific comments by Referees #1 and #2 are previously addressed in the separate detailed replies.

#### Detailed point-by-point replies to Referee #3 comments:

1. An introduction of the importance of section 3.1 is proposed:

First, we find that the detailed description is motivated by the critical importance of where the cores are placed in Herald Canyon in order to be able to record the history of Pacific water influx. In the revised version, we emphasize this importance by opening section 3.1 with:

*Herald Canyon topographically steers the western branch of Pacific water flowing into the Arctic Ocean (Pickart et al., 2010; Woodgate and Aagaard, 2005) implying that Cores 2-PC1 and 4-PC1 are strategically placed to record this critical component of the Arctic Ocean paleoceanography.*

2. Referee #3 raised that there seem to be differences in timing between the shifts of different parameters. We present the various parameters in section 3.2 and with the added short description of the lithology, we hope that the relationships should be clearer. We believe that we emphasized that we picked the time for the transition in section 3.2. based on  $\delta^{13}C_{org}$  by stating:

*The transition in sedimentary regimes is based on  $\delta^{13}C_{org}$  occurring between 412 and 402 cm, thus closely similar to the observed change in sediment physical properties.*

However, we agree with Referee #3 that we did not comment on that the parameter that does stick out is magnetic susceptibility. Therefore, we have added the following to the revised manuscript to underline that this is observed and not of significance for the timing of the first flooding event.

*Magnetic susceptibility generally follows the bulk density trend although with greater internal variability down core and a major shift from higher to lower susceptibility occurring at about 40 cm up-core from where bulk density changes, i.e. the susceptibility change occurs within the upper section of the core characterized by lower  $\delta^{13}C_{org}$  values.*

3. On line 25-26 we write “the opening may have well boosted primary production and enhanced the productivity of higher trophic organisms for instance along the American west coast”.

This was a pure error, it should of course be “North American east coast”. This is changed in the revised manuscript.

4. Referee #3 raise that we should look for evidence for changing AMOC and higher productivity as an effect of our new timing of the flooding of the Bering Strait at about 11 ka BP. This is perhaps the only point raised by Referee #3 we disagree with as we do not find it appropriate to expand the manuscript by looking further for data that may show some changes that could be related to the opening of Bering Strait. Instead we have raised these points as questions, and hope it inspires the community to place observations/results in the context of a new timing of the flooding of Bering Strait. We prefer to keep the focus on the event itself.

5. Some more recent references regarding sea level data should be included (e.g. Abdul et al 2016, paleoceanography).

We had simply missed this important study, which naturally must be referenced. We have added both the reference and data to figure 2, and in addition, we include the following sentences at the end of the discussion:

*In the most recent sea-level reconstruction by Abdul et al. (2016) based on Barbados reef crest coral *Acropora palmata*, MWP1b is seen as a  $14 \pm 2$  m sea-level rise, reaching a rise of  $40 \text{ mm yr}^{-1}$ , beginning 11.45 ka BP and ending at 11.1 ka BP.*

In order to account for the comments by Bard et al. (2016), we continue with:

*However, it should be noted that this result has been questioned because the Barbados sea-level record may have been affected by local tectonic movements throughout the Late Glacial period and the living depth of the coral *A. palmata* may not be able to capture rapid sea-level rises accurately (Bard et al., 2016). However, if there was a rapid sea-level rise associated with MWP1b it fits well in time with our age estimate of the post-glacial flooding of Bering Land Bridge and a subsequent re-establishment of a Bering Strait throughflow, which in turn may have affected the AMOC by causing a greater amount of fresher water being exported out of the Arctic Ocean.*

6. Referee #3 raises that the relationship between the two studied cores should be made clearer and that the age model, including different reservoir ages should be further discussed.

The addition of more information on the two sediment cores' lithostratigraphies implies that we also illustrate further how the cores hangs together. The age model and the effect of different reservoir ages has been addressed already in responses to the two additional referees. We have included the new supplementary figure and accompanying text as described above in the revision summary.

7. We follow the recommendation and open the discussion of the seismic stratigraphy with:

*The seismic stratigraphy provides the broader spatial context of the two studied cores and helps us to use the results of the detailed core studies when addressing the post-glacial development of the Bering Strait region.*

8. Referee #3 suggest that on page 9, the discussion of age constraints (line 19-20) should be moved below the discussion of the geochemical changes, i.e., before the last sentence of this paragraph.

We prefer to keep the location since we already revised this part and we find that it sets the scene well for the continued discussion.

### **Detailed editorial comments mainly concerning the figures**

We prefer not changing the order of the figures since this will complicate how we revised the manuscript also considering the comments by Referees' #1 and #2.

An age depth plot for the critical part of the cores is now included in the Supplementary Figure 1.

Figure 4: Revised as suggested, directional arrow is added. The last sentence in the caption is also removed as suggested.

Figure 6: Labels A and B are included. We prefer to keep the overlay of the core data as it provides information. Resample is changed to resampled.

Figure 8. We disagree on this point and prefer to keep it as the last figure.

P2, L 21. Fixed and changed to 10,300 and core names are no consistent

P4, L. 31. Based on standard measurements the  $\delta^{13}\text{C}_{\text{org}}$  values were analysed with an error of +/- 0.1‰. This was added to the manuscript text.

P.6, L9-12: No, the ARDEM is simply a very coarse model and based on spares data in comparison to our survey lines.

P.7, L. 7: Fixed

P.7, L. 8-9: Fixed

P. 7, L. 10: Fixed

P. 7, L. 17-18: Checked, but assumed to be fixed during publication

P. 7, L. 30: We mean higher, which has been added

P. 9, L. 22: Both actually.

P. 11, L. 23: New wording " Furthermore, the opening of Bering Strait provides a transport route of Pacific surface water to the North Atlantic through the Arctic Ocean with potential implications for the ecosystem"