Review on

Marine reservoir ages for coastal West Africa

by G. Soulet et al.

submitted to *Geochronology*,

Submission ID 10.5194/gchron-2023-5

Date: April 12, 2023

In this paper 30 new ^{14}C ages of pre-bomb bivalues from coastal West Africa with known ages between 1850 and 1950 AD are presented and discussed. The case is made that since the derived marine reservoir ages (MRA) follow Marine20 (which itself is a carbon cycle based interpretation of IntCal20) that carbon cycle and climate are responsible for the observed trend and not local effects.

While I find the data of interest and certainly worth publishing I disagree with the final conclusion. Furthermore, I believe some careful revision is necessary to explain certain details of the draft more closely in order to make the work repeatable.

1. **Trend in MRA:** Stated in the abstract and conclusions, and more widely in section 3.3 it is said that the trend in measured MRA is similar to the modelled global trend in Marine20, and since this is based on simulations with a carbon cycle model, the trend in the new data should according to the authors also be based on carbon cycle change. Unfortunatelxy, this is not the case. The trend in MRA in Marine20 between 1900 and 1950 AD is soley based on the decrease in IntCal20 (atmospheric Δ^{14}C), while Marine20 (global surface ocean Δ^{14}C) is constant. This is also seen in Figure 2. Furthermore, if one goes to details of the paper describing Marine20 (Heaton et al., 2020), Figure 7 contains model results in which CO_2 and climate are kept constant. In these runs the calculatd MRA changes similarly than in the full carbon cycle setup. This is not easily visible in this Figure 7b of the Marine20 paper, but one can check it by downloading the corresponding data from PANGAEA following the data link given in Heaton et al. (2020). I include a figure of these MRA in Marine20 (zoom-in of Figure 7b in (Heaton et al., 2020)) below. Thus, the sole

reason for the observed trend in MRA in West Africa seems to me to be the change in atmospheric $\Delta^{14}C$, which is also a global, and not a local, effect .

2. **Symbols and units:** I find it rather confusing that the authers choose to label the radiocarbon age with ^{14}C, whose units would be ^{14}C years. Normally (in physics), ^{14}C is the amount of radiocarbon with units "number of atoms" or "number of mol". Thus, I suggest to change this labelling. However, maybe this is also a community issues (data vs model), but it might help if the same symbols are used as in other papers, check, for example the symbols in the Marine20 paper (Heaton et al., 2020) or its recently published discussion on "how-to-use-Marine20" (Heaton et al., 2022). Also, if *time* is addressed it should always be stated if "^{14}C years" or "calender years" are meant, and using only "years" should be avoided in such a paper. One example, where this is missing is Table S1 in the SI, column M showing ^{14}C age, units should be "^{14}C yrs BP".

3. **Radiocarbon results (section 3.1):** I am not familar with data reporting, maybe this detailed description is common, but my feeling is, this section is just a long version of Table S1. Indeed, some information of the text is missing in the Table and I suggest to include them there (museums label, collector). However, I have the feeling it would serve the paper better, if a condensed version of the Table appears in the main text instead of the long description and an extended version is still published as SI. But as I said, I am no expert here, so do as common in the community and ignore this comment if you feel it is rather strange. If you keep the text, however, some changes are necessary: (a) the true measured value is $F^{14}C$, not ^{14}C age. So I believe, that $F^{14}C$ should be mentioned directly after the "radiocarbon laboratory number"; (b) the ^{14}C age now appearing after the "radiocarbon laboratory number" comes without label of what it is and the units are wrong (units are "BP", and should be "^{14}C yrs BP").

4. **Calculated mean values:** At the beginning of section 3.2. it is not clear which 25 samples are averaged, since there should be 30 new samples and the SI table contains 38 samples. I believe what was done is averaging only the new (own)

data without the outliers. However, this is not said so. Outlieres are discussed later, so I suggest to bring outlieres first and only thereafter make average values without them. The outlieres are also not marked in the SI table, so it is not possible for me to reproduce the stated averaging without a lot of digging in the relevant section on outliers. Furthermore, you average samples with errors, for which to my knowledge a weighted mean is best used as done also in calculations of mean values from the marine radiocarbon reservoir database (http://calib.org/marine/) See http://calib.org/marine/AverageDeltaR.html for details on errors. Even when weighted means are not taken (for which the reader might then want to be given an argument for this omission) it needs to state clearly on what the calculated error is based on. Is this only the error from the averaging or the mean error of the individual errors?

5. **Figure 2:** Here radiocarbon age (left y-axis for IntCal20 (green) and Marine20 (blue)) and MRA (right y-axis for Marine20 (black) and magenta data points) are mixed. I strongly suggest to split the figure in two to make it easier for the reader to see which axis needs to be used for which data sets.

References

Heaton, T. J., Köhler, P., Butzin, M., Bard, E., Reimer, R. W., Austin, W. E. N., Ramsey, C. B., Grootes, P. M., Hughen, K. A., Kromer, B., Reimer, P. J., Adkins, J., Burke, A., Cook, M. S., Olsen, J., and Skinner, L. C.: Marine20 — the marine radiocarbon age calibration curve (0–55,000 cal BP), Radiocarbon, 62, 779–820, doi: 10.1017/RDC.2020.68, 2020.

Heaton, T. J., Bard, E., Bronk Ramsey, C., Butzin, M., Hatté, C., Hughen, K. A., Köhler, P., and Reimer, P. J.: A response to community questions on the Marine20 radiocarbon age calibration curve: marine reservoir ages and the calibration of 14C samples from the oceans, Radiocarbon, pp. 1–27, doi:10.1017/RDC.2022.66, 2022.

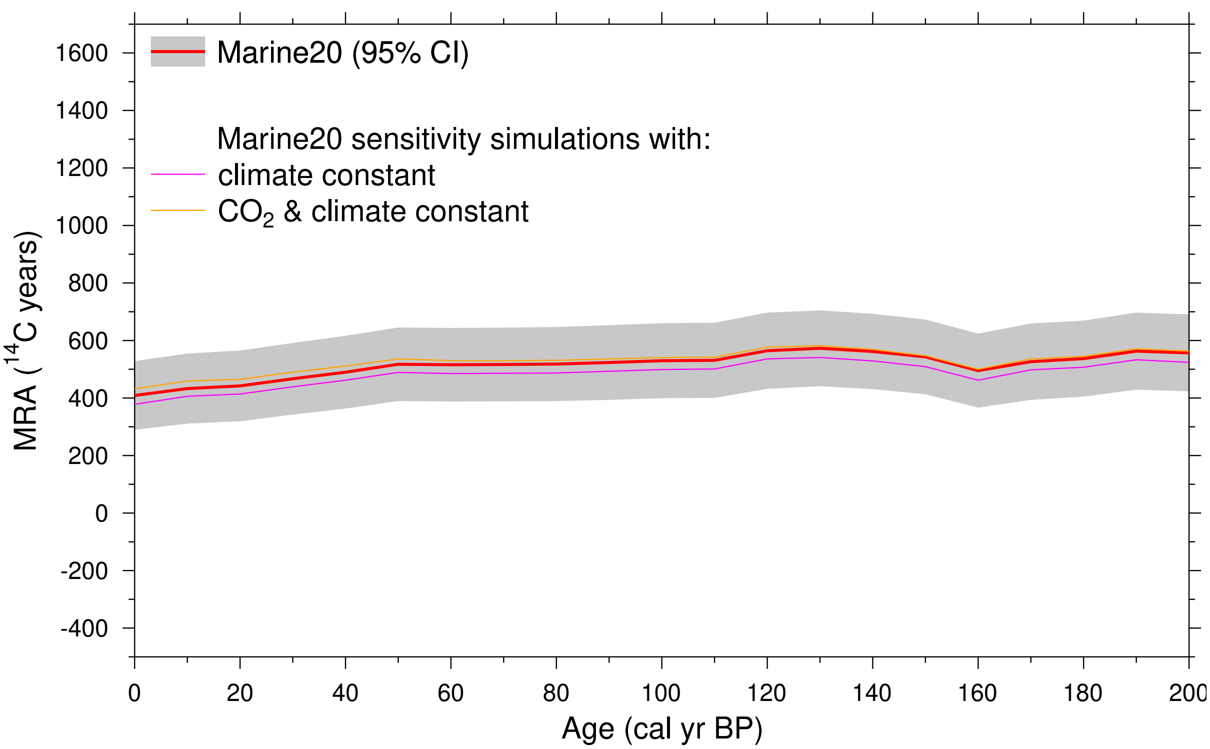

Figure 1: Zoom-in on Figure 7b of Heaton et al. (2020).