

Author's Response

1. *I agree with the first reviewer that the issue of marine vs. terrestrial carbon uptake in the pondbottom sediments is important. Please thoroughly discuss this issue in the revised MS.*

The revised manuscript includes a detailed description in section 3.3 of the stratigraphic and ecological evidence in support of terrestrial carbon uptake. This discusses the sedimentology and diatom assemblage counts reported by Simms et al. (2022) and covered during our conversations with Dr. Simms.

2. *I found it confusing to refer to the "primary" production rate calibration data set of Borchers et al. as also "global". To me, "global" (and "globally averaged" in line 335) implies something more like using all production rate calibration data sets that have been reported from anywhere on Earth. I know the idea is to communicate that you are supposed to apply the Borchers calibration globally, but I think it would be clearer if you just used "primary production rate calibration data set of Borchers," and maybe subsequently just "Borchers calibration data set," and leave off the 'global'. Anyway, think about this. Maybe somewhere at the beginning you could note that the idea was that the Borchers production rate was supposed to be applied globally.*

We have made this change throughout the manuscript; the dataset in question is now referred to as the Borchers calibration dataset.

3. *I suggest not using "schemes" to describe scaling methods, for reasons described here:*

<https://cosmognosis.wordpress.com/2016/10/22/production-rate-scaling-devious-plots/>

The term 'scheme' has been replaced throughout with the term 'method' as requested.

4. *In line 40, it is not true that the "range" has decreased. The range couldn't decrease unless you somehow caused existing measurements not to exist any more. I think you probably just want to say that the estimate has improved.*

We have made this change.

5. *I suggest slightly rethinking your use of "direct" and "indirect" in section 1 and related areas. If you are classifying calibration SITES themselves into direct and indirect categories, what this implies to me is the distinction between a site where there is some kind of an independent exposure age estimate (direct) and a site where there is not, for example if you were to determine the He-3 production rate by measuring the Be-10 production rate at one site with independent age control and the He-3/Be-10 ratio at a different site without independent age control -- that would be an indirect estimate of the He-3 production rate. In contrast, what you are really talking about here is whether the independent AGE, not the calibration SITE itself, is direct or indirect. It would be more clear if you revised this and related sections to make clear that all these calibration sites are equivalent in that they all have independent age estimates -- the distinction you are making pertains to the*

independent age estimate being direct or indirect.

We agree that our original terminology was confusing and therefore have specified that we mean calibrations based on surfaces for which independent age control has been derived either directly or indirectly.

6. In 2.2, you should state clearly somewhere that the summary of all this description is that the pondbottom ages are minimum limiting age constraints on the true exposure age of the boulders. You never actually say this explicitly.

We have made this addition on Line 144.

7. Also in this section, it would be helpful to state whether the boulders are or are not above the marine limit.

This information is now also given on Line 144.

8. In Table 1, the '9Be added' column appears to have a units problem. This should be 0.25 mg, not ug, no? Also, assuming that the 9Be column is the mass of 9Be in mg, not the mass of carrier in g (please check this), it would probably be more helpful if the final column (carrier concentration) gave the name of the carrier, not its concentration. Also, please add a column with the blank correction that was applied for each sample, as suggested by the reviewers. If you want more space, you can move the density and shielding columns to the caption, because they are all the same value.

Table 1 has been revised so as to include all carrier data. In addition, we added a further table (the new Table 2) that provides all carrier and beryllium data pertaining to the process blanks, so that readers can now replicate and/or recalculate the surface-exposure ages fully.

9. Line 270. Clarify that the 2.7% applies to the Rannoch Moor production rate estimate.

We have made this change.

10. I am having trouble understanding the sentence at line 408. What are you trying to say here? Just that it's better to have direct age control than indirect age control? Because some of the sites with direct age control don't seem to be working very well either. Consider rewriting some of this.

We have re-written this sections (starting on Line 460) to avoid confusion.

11. In line 415, "fit agreeably" is an odd word choice. Perhaps just "agree"?

Agreed.