Dear Dr Akob,

Please find attached a reply to the comments. We thank you and the anonymous reviewers for the thorough and constructive comments and appreciate the time and effort that you have invested in improving this manuscript.

Thank you again for a thorough and efficient review process. We will be glad to answer any further questions, please see our reply to specific comments below.

Sincerely,

Nimrod Wieler

Comments

1. Please modify the organization of the paper to present the materials and methods before the results section. I agree with the comments from Buckeridge et al that this order would be more effective for understanding the study and approach. Further, this structure is more consistent with others papers in Biogeosciences.

A: The structure has been revised.

2. L. 13: please correct the spelling of archaeological and comparable

A: Spelling correction was made.

3. L. 26: please capitalize taxa names when referring to the formal taxonomic designation

A: Taxa names are now capitalized

4. Figure 2: I find it extremely hard to reach the text on panels B, C, D, and E. The scale bars are not apparent in the PDF and the text is too small for the units. Further, the red text for the BRC thickness is not readable. One option might be to reproduce the panels as a full page in the supplemental material so that the reader can see the images enlarged. Or maybe the labels/text need a white box behind them.

A: The figure was modified following your comments.

5. L. 84 and elsewhere: it's a bit unclear to me (and the reviewers) why a range of calculations are not presented. I also don't agree with your response that choosing an older age is a more conservative approach. I think adding a few sentences to present calculation of the growth rate for both 1700 and 1400 years ago would be valuable and not outside the scope of the project. Also, make the uncertainty in the site age clear – folks reading this paper might not be familiar with the uncertainty in archaeological dating.

A: Dating Shivta site is mainly associated with the early-middle Byzantine period (4th-6th centuries CE) (1700-1500 years ago) as was recently validated by Tepper et al., (2018). As a result, dividing our observed BRC thickness over the site age suggests BRC growth rate of 0.06-0.35 mm 1000 yr-1. We modified the thickness measurements paragraph to further clarify this point.

6. Figure 3: please define the dotted line in the figure description. I also suggest using the same axis range for panel A and B.

A: The dashed lines mark the border between the BRC at the top and the host rock at the bottom. This is now added to the figure caption.

7. Section 1.2.2: I'd really like to know more about who the dominant OTUs are or even just the most abundant OTUs that had significant changes in abundance (e.g., corncob). Right now the data is being presented at a really high taxonomic level and nothing is stated about the potential life strategies for these organisms. It would be interesting to know on a lower taxonomic level if there are typical arid soil organisms or super tolerant species. Maybe even going to just a family level would be sufficient.

A: We have now added a brief discussion about the identity of the top OTUs in lines 227-232 and lines 262-267 and an addional supplementary table. These OTUs turned out to be typical for hyperarid desert soils. However, we kept the discussion here relatively short because our anaysis indicates that which exact OTU is dominant is strongly affected by stochastic processes (founder effect).

8. L. 141-142: is this meant to be a standalone paragraph? Seems like this should be part of the paragraph above.

A: The lines were added to the paragraph above.

9. L. 151: similarity

A: The line was added to the paragraph.

10. L. 153: can aeolian processes be introduced earlier in the paper? Expanding on this process and its influence would be helpful

A: The possible impact of aeolian processes on BRC formation is further added to the introduction section to better suggest the possible matrices (soil, dust) which may lead to BRC formation.

11. L. 183: use BRC here to be consistent with the rest of the paper

A: Correction has been made.

12. L. 184: this value differs from that presented in the abstract. The range should be used in the abstract for consistency.

A: Similar range of values are now presented both at the abstract and at the conclusion sections.

13. Section 1.4: I still find the conclusions section to be short. I think it would be valuable to broaden the discussion here and talk about the broader applications of the study.

A: The conclusion section was modified so that it further discuss the possible origin of the BRC.

14. Section 1.5.1: its unclear to me what the actual age of the buildings are. If there is a range, please state that explicitly so its clear to the reader.

A: Shivta site was found to be most prosperous in the early-middle Byzantine period (4th-6th centuries CE) (1700-1500 years ago) as was recently validated by Tepper et al., (2018). Therefore, most archeologists agree that this is the building age. This is now clarified in lines 209-210.

15. Table 1: can the footnotes be included as an entry in the table? They are data that are important to the study. Correct the superscript for host rock density units

A: The footnotes (geological formation names) were added into the table, the superscript was corrected.

16. Sampling: can more detail on how the samples were collected be included? Were whole rocks removed or rock cores collected then subsampled in the lab?

A: All rock samples taken from the slopes and site walls included whole rocks that were collected directly in the field and were not subsampled in the lab. This now added to the field sampling section.

17. L. 280: correct spelling to indices

A: Correction has been made

18. L. 282: do you mean package?

A: Correction has been made

19. L. 284: I can't find any mention of an "non-parametric igned Rank Transformation ANOVA" – is this a typo?

A: This should be "non-parametric Aligned Rank Transformation ANOVA" (now corrected) and refers to Figure 4 D.

20. Figure A1: since this is a supplemental figure please make it bigger to take up as much of the page as possible. This way the detail is really easy to see

A: The figure was enlarged.