Dear Editor,

Please find attached a reply to the reviewer comments. We thank you and the anonymous reviewer 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.

Sincerely,

Nimrod Wieler

Comments by Reviewer

Manuscript: „Estimating the growth rate in desert biological rock crust by integrating archaeological and geological records by Weiler et al. is valuable study of biocrust concerning its origin, taxonomy, isotopic composition, and growth rate. Bellow there are some comment.

A: Thank you, please see our reply to specific comments below.

Major comments

R: Manuscript title focuses solely on „growth rate". Large portion of manuscript is nevertheless focused on bacterial communities based on RNA sequencing and also on isotopic composition of rock and crust. These two topics should be also mentioned in paper title. Paper title should be changed, for instance: „Desert biological rock crust: Bacterial diversity, isotopic composition and growth rate". This might better express manuscript content.

A: Thank you for the comment. We believe that the focus of the manuscript is estimating the biological rock crust growth rate. Especially, due to the limited amount of studies dealing with this issue in arid environments. We agree that there is also a lot of focus on the isotopic composition and microbial community and have therefore changed the title to:

"Microbial and geo-archaeological records reveal growth rate, origin and composition of desert rock surface communities"

R: Also abstract should better correspond to manuscript content. There is not a single sentence on isotopes for instance.

A: Thank you. The abstract was revised so that it also refers to the isotopic analysis.

R: Conclusion is very short and not much reflecting findings of the manuscript. It should be rewritten to cover all important findings of the paper.

A: Thank you. The conclusion section has been rewritten so that it includes our major findings.

R: As one of the most important results of the paper is the growth rate of biological rock crust, it is important to describe on how many samples the thickness 0.1 -0.6 mm was measured.

A: Thank you. To estimate biological rock crust growth rate we used total of 24 rock samples. Twelve rock samples were collected from the limey Nezer Formation including six samples from the archaeological site and six from the nearby natural slope. The same sampling procedure was applied for the chalky Menuha Formation (lines 217-222). This is now clarified in lines 72-73: "Microscopic examinations of thin sections (30 μm thick) that were prepared from 24 limestone and chalk blocks showed that, as expected, the BRCs were restricted to the atmospherically-exposed parts of the rocks (Wieler et al., 2019)".

R: Line 149: Authors state that: „Our analyses invalidate the lithology role in shaping the BRC composition". In fact not really, as limestone and chalk are both calcite rich, so from many respect very similar lithologies. Statement is too strong, not supported by data. Statement should be changed or more evidence is needed.

A: We appreciate the comment and agree with the reviewer that chalk and limestone are very similar lithologies as can be seen through the XRD analysis (Table 1). Following the reviewer comment the statement was modified (line 163) - "Our analyses suggests that both rocks experience the same regional-scale environmental factors (Fig. 4B) in shaping the BRC composition."

Minor comments

R: Fig. 1 Colors in figure are so dull that individual lithologies can only hardly be recognized. Colors should be brighter. Also, what means the red color, which lithology?

A: The figure was modified following the comments above. It further includes a definition of the other lithologies projected on the map.

R: Lines 80-90: Concerning O a C isotopic values, the name of standard should follow after values (like -3‰ VPDB)

A: Correction of the O and C isotopic standard was added along the subjected lines.

R: Fig. 3 The description of horizontal axis "d13C/a18O" may confuse that ratio of C/O isotopes is used. Better would be: "d13C and d18O". It would be nice to separate in graphs which part of the data are in crust and which are measured below the crust (for instance using black dashed line as base of rock crust or highlight the rock crust by grey color)

A: The figure was modified following the suggestions raised by the reviewer.

R: Fig. 4 Figures A-D have small fonts, especially the B which is way too small.

Better alignment of individual parts of figure will be

A C

B

D

So that B a D would have whole width of page.

A: The figure was modified following the suggestion raised by the reviewer.

R: Line 130 "Overall, the results point to a very deterministic successional course of BRCs development." Meaning of sentence is not clear, please rewrite.

A: The line was rewritten (line 143): "Therefore, our findings indicate that the rock surfaces at the archaeological site act as a succession planes for BRC development."

Line 223-225. It seems that O isotopes are in fact referenced with respect to VPDB rather than VSMOW. Otherwise, O isotopic value of marine limestone would not be close to 0. Anyway, this should be clear from manuscript.

A:The lines (240-242) were rewritten: "d13C and d18O values were also referenced relative to Vienna PeeDee Belemenite (VPDB) standard as previously described (Uemura et al., 2016) with SD of 0.1‰. All values are reported in per-mil (‰)."