

# ***Interactive comment on “The composition of endolithic communities in gypsum is determined by the specific microhabitat architecture” by María Cristina Casero et al.***

## **Anonymous Referee #3**

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This work focuses on documenting the composition and distribution of microorganisms within endolithic habitats in gypsum in the Atacama Desert. It aims to test the hypothesis that specific microhabitat architecture influences microenvironmental conditions and therefore the relative abundance of different microorganisms within these habitats by using a combination of microscopy and molecular techniques.

The manuscript provides new and interesting information about microbial (relative) abundances within these habitats, and adequately explains how these habitats differ in terms of their physical architecture. For these reasons, I believe it is suitable for publication in Biogeosciences after considering the following comments:

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Abstract: suggesting that the lithic substrate “might” be an essential factor does not instill confidence in the results and conclusions, which contrasts with the term “confirms” in the Conclusions. In addition, the abstract should be more concise in describing the results of this work, not general observations of the results. For example, it currently points out that the hypoendolithic community was the least diverse and hosted unique taxa; explaining “why” here is important for the reader.

What is the significance of “Preandean Atacama Desert” within the context of this study?

Section 2.2: It is unclear how this climate data is directly relevant to the results of this manuscript. Other than thermal measurements, it does not appear to have been collected specifically for this work and so only needs to be mentioned in the Discussion.

Section 2.5: Title should include “DNA extraction procedures” to be consistent with Section 2.6.

Section 3: Results – Lines 139-141 are not necessary, nor is Section 3.1 with exception of gypcrete surface temperatures if they were measured for this study.

Section 3.3: Use present tense to describe observations, such as “. . . colonization zone is close. . .”

Section 4: What is the distance between the cryptoendolithic/chasmoendolithic habitats in the upper part of the substrate and the hypoendolithic habitat in the lower part of the substrate? Are they separated by millimetres? Centimetres?

Line 21 – “. . . a combination of microscopic investigations and. . .” Line 22 – “. . . the endolithic communities and their habitats at the microscale. . .” Line 23 – replace “lithic substrate” with “gypcrete” Line 39 – replace “noticeable” with “plausible” Line 39 – “. . . only by microorganisms that can survive and/or thrive under physical or geochemical extremes such as temperature. . .” Line 43 – replace “stress” with “limitations” Line 45 – “. . . able to survive under such conditions” Line 46 – “The Atacama Desert. . . on Earth,

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with scarce precipitation events...and extremely low mean annual relative humidity”  
Line 54 – replace “living inside the rock but close to the bottom” with “living on the underside of the rock”  
Line 56 – “...PAR radiation levels...”  
Line 67 – “...architecture on the diversity...”  
Line 71 – “...the microscale dimensions...”  
Line 71 – How do you define “peculiar”?  
Line 72 – Can you provide a definition for the term “microbiogeography”?  
Line 75 – “The area experiences...”  
Line 78 – “...we sampled gypcrete...”  
Line 80 – dry and dark environment – a lab drawer?  
Line 92 – “Light microscopy (LM) was used to examine cell aggregates...”  
Line 93 – “...on cyanobacterial isolates cultured from...”  
Line 97 – “...were run on pieces...”  
Line 101 – “...to reduce beam hardening.”  
Line 102 – “...performed using VG Studio Max Version 2.2 software.”  
Line 105 – “Biological material removed from gypcrete...”  
Line 105 – Was it BG11+N or BG11-N?  
Line 107 – Include a period after “Philips”  
Line 107 – “After incubation for 15 days, visible...”  
Line 116 – “Colonization zones were scrapped...” (not scrapped)  
Line 130 – “Sequences of 16S rRNA genes...”  
Line 151 – Replace “visualization” with “representation”  
Line 152 – Replace “following” with “exhibit”  
Line 155 – Can you better describe “undulated furrows”?  
Line 160 – How did you differentiate pigmentation in layers? Light microscopy?  
Line 161 – “...with high carotenoid content closest to...”  
Line 219 – “...included only one...”  
Line 220 – Which Chinese desert are you referring to?  
Line 221 – Please provide a reference for University Valley  
Line 222 – “...no sequences from isolates...”  
Line 230 – “...with our isolate sequences...”  
Line 234 – Can you think of another way to say “differentially abundant”?  
Line 235 – “Both OTU11...”  
Line 255 – The last sentence of this paragraph is not necessary.  
Line 259 – “Both substrates show...”  
Line 263 – “...based on the ratio of mean...”  
Lines 265-267 – I do not know if you can compare temperatures on terrestrial rock surfaces with those in hot springs as an approximation for the upper temperature limit for photosynthesis. Can you estimate the temperatures within the endolithic habitats?  
Line 273 – “...water to metabolise and grow.”  
Line 273 – “...gypcrete restricts water loss”  
Line 280 – I don’t think “consolidates” is the correct word in this sentence  
Line 282 – “following water gravity flow” is unclear  
Line 295 – end the sentence with a period  
Line 297 – “EPSs”

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should be “EPS” Line 300 – see line 297 Line 302 – “The aggregate-like structure. . .” Line 303 – “. . .and heterotrophic bacteria also helps. . .” Line 308 – “. . .in such an oligotrophic environment.” Line 330 – can you provide a reference that would support the statement that light intensity should be considered a crucial factor in understanding differences in community composition between top and bottom habitats? Line 342 – replace “unidentification” with “lack of positive identification” Line 353 – Replace “confirmed” with “hypothesized”; I would not say that this work confirms that liquid water availability is a driver of community composition, as no experimental evidence was provided in the manuscript to substantiate this claim. A more convincing argument for how microenvironmental conditions determines microbial distribution would strengthen the manuscript. Line 369 – “. . .draw conclusions. . .”

Figure 1 – Latitude and longitude markers should be included in the study are map Figure 3 – It would be helpful to point out what samples are polished blocks/thin sections vs whole mounts for SEM work.

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