Response to reviewer #2

We thank the reviewer for their helpful comments and indications which have contributed to improve the clarity and quality of our manuscript. All comments were addressed, and detailed responses are provided below.

The manuscript by Vergotti et al. details boron isotope and trace element analyses of *Cladocora caespitosa* samples from two locations in the Mediterranean Sea. Results are used to investigate seasonal and inter-annual scale impacts of seawater temperature and ocean acidification on the carbonate chemistry of the calcifying fluid within this coral – an important species as the only zooxanthellate reef builder in the Mediterranean. Both laser ablation and bulk solution ICP-MS approaches are employed, and these two techniques show good agreement. The authors demonstrate that the carbonate chemistry of the analysed specimens had a low sensitivity to seasonal environmental change, and that temperature was the main driver of seasonal variability in the calcifying fluid composition with seawater pH acting on longer timescales.

The paper is very well written, with clear and concise language throughout, detailed methods, and an interesting and well-considered discussion. Results will be of interest to the scientific community interested in coral biomineralisation strategies and their resilience to changing ocean conditions. In particular, little is known about *Cladocora caespitosa*, making this paper a welcome addition considering the species importance in the Mediterranean. The manuscript is absolutely within the scope of Biogeosciences and will be an excellent addition to the wider literature on this topic. I have no major concerns and recommend publication. I can only offer the minor points/queries below.

- Section 2.1: what size are the corallites studied? Perhaps including a sample photo would be beneficial.

The corallites are approximately 4 to 5 mm in diameter. An X-ray of each corallite used in this study is shown in Figure B1, which includes a scale bar. A panel was added to Figure B1 including a photo of a sample cut longitudinally by way of an example, indicating the main skeletal features. For additional clarity, the approximate dimensions (width and length) of each sample are now indicated in Table B1.

- Section 2.3.1: an impressive list of reference materials is listed for the matrix interference correction. Please make it clear which are micropellets and which are nano. E.g. are the JCp and JCt mentioned micropellets, as later on a JCp-np is referred to as a secondary standard? Presumably the same pellet wasn't being used as both a primary and secondary reference material.

We used only in-house pressed micro-pellets (in the case of JCp-1 and JCt-1) for the matrix interference correction. Specifically, the JCp-1 and JCp-1 mentioned for the use of the matrix interference are in-house pressed micro-pellets of the standard powders. The nano-pellet JCp-1-NP was used as secondary standard, and not included in the matrix interference correction curve.

- Line 170: states “in Section 2.2.3 below”. I think this section number is incorrect. Should it be 2.3.3?

We thank the reviewer for pointing this out. The statement does refer to section 2.3.3 and has been corrected accordingly.

- Line 192: please state the assumed Ca contents used for the internal normalisation.

The assumed Ca contents used for internal normalization was 39 wt% (Mertz-Kraus et al., 2009) which has been stated explicitly in the manuscript at line 192.

- As noted, table B5 shows the E/Ca of JCp-np sometimes being considerably different to that the reported Hathorne values. Can you comment further on this discrepancy? Much like in the section on d11B, it can probably be explained by alteration during the pellet making process to a degree, and a recent paper by Flöter et al. 2026 (https://doi.org/10.1038/s41597-026-07812-0) may help support this.

We thank the reviewer for highlighting this topic. We agree that the differences in the E/Ca ratios obtained with the different instruments used in our study, and their offsets with the values reported by Hathorne et al., (2013) for the bulk powder JCp-1, likely stem from the alteration originating from the nano-pellet production process. The likely contaminant phase in the NPs originates from the agate ball mill, and may not affect all elements equally, with some elements possibly preferentially leached from the carbonate, resulting in variable levels of offsets between each elemental ratios. Additionally, the alteration occurring during nano-pellets production process may not be homogeneous, and we used different pellets of JCp-1-NP for each instrumental setup used in our study, explaining some of the differences between our sessions. A note was added on this topic to method section 2.3.2: “we note that offsets between laser sessions and bulk values measured by Hathorne et al. (2013) likely reflect preparation artifacts related to agate-milling alteration inherent to the nano-pellet production (Flöter et al., 2026)”.

- Line 219 to 221: I don’t follow this normalisation approach. Can you explain it in a more succinct way? If the bias is instrumental, why not just apply a secondary normalisation based on the JCp-np measurements with each set-up?

A secondary normalization using JCp-1-NP could not be applied to correct for instrument bias, as different JCp-1-NP pellets were used across instruments, so that using JCp-1-NP to correct for instrument bias in this case may introduce additional artificial offsets between samples (detailed above). For this reason, we opted for a site-specific mean-centering approach which we applied to each elemental ratio, by adjusting the baseline of each sample to the overall site baseline: $E/Ca_{normalized} = E/Ca - mean(E/Ca_{corallite}) + mean(E/Ca_{site})$. This approach removes the instrumental bias, while fully preserving the relative seasonal and inter-annual variations. The statement has been rephrased accordingly for more clarity (“Because different JCp-1-NP pellets were analyzed on each instrument setup, each carrying inherent preparation-related artifacts, JCp-1-NP could not serve as a reliable secondary standard across setups to correct

for instrumental bias. To compare elemental ratios obtained from different instruments, a site-level normalization was applied to eliminate correct potential instrumental bias, by subtracting the mean elemental ratio of each individual corallite and adding the overall site mean, as JCp-1-NP presented different elemental ratios between instruments").

- Line 215: "ratios record" rather than "ratios records"?

We thank the review for pointing this out. The statement has been corrected to "elemental ratio records".

- Line 278: deleted the two "of" from before the temperatures. And both temperatures need units.

We thank the reviewer for their indications and will correct the statement accordingly.

- Line 281: please detail somewhere how linear extension and calcification rates were calculated.

We thank the reviewer for their question. Linear extension, skeletal density, and calcification rates were calculated using the Coral XDS software, following the method detailed in Vergotti et al. 2025. Briefly, the linear extension and skeletal density of each growth band were measured on the X-rays using the Half-Range method of the Coral XDS software. The calcification rate was then calculated as the product of linear extension and skeletal density. Section 2.1 of the methods has been modified to reflect these points (line 118: "Coral growth for each annual growth band, defined as couplets of low density and high density bands, was measured in terms of linear extension (mm·year^{-1}) and skeletal density (g CaCO3·cm^{-3}·year^{-1}), using the Half-Range method of the Coral XDS software (https://hcas.nova.edu/tools-and-resources/coralxds/index.html). Coral calcification (g CaCO3·cm^{-2}·year^{-1}) was then determined as the product of linear extension and skeletal density".

- Line 295 to 296: are the stated d11B values based on LA only, or both LA and solution analyses?

These $\delta^{11}B$ values are based on LA measurements only, which has been specified in the manuscript for clarity.

- Line 379/380: were you able to totally avoid combining skeleton from different structural components with your LA analyses, or could challenges with sample also be an issue in this work? It is my understanding that corallites of *Cladocora caespitosa* are not so small, perhaps ~5mm diameter, so centres of calcification may not be insignificant in size. How large are COCs in of *Cladocora caespitosa*, and would they impact an analyses based on your sampling resolution? Perhaps they would be visible in the Mg/Ca trace. A more detailed comment on this is required.

We thank the reviewer for raising this important consideration. According to Montagna et al., (2007), the centers of calcification (COCs, referred to as EMZs therein) in *C. caespitosa* are approximately 10 to 20 μm wide, and distributed in chains in the central part of the setpa, along the growth axis. While we did not monitor for the occurrence of COCs, we believe our fsLA analytical protocol mitigates this. Rasters were executed with a laser beam diameter of 20 μm, moving across an area 50 μm wide, and 600 μm long, set parallel to the growth axis, on the inner-side of the theca wall. While individual laser passes likely integrate across COCs and aragonite fibers, we believe this sampling method combined with our site level multi-corallite analytical design allows to smooth out microstructural noise, while also guaranteeing enough material is collected for effective δ11B evaluation. A statement was added to the first paragraph of section 4.1 of the discussion, acknowledging the potential effect of microstructural heterogeneity (line 384: "Nevertheless, it must be noted that the microstructural heterogeneity of the *C. caespitosa* theca wall, including secondary aragonite fibres and centres of calcification (Montagna et al., 2007), may have contributed to the higher variability observed in the records obtained through fsLA").

References

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