##Response to Reviewer 1##

General Reviewer comment –response
We thank the reviewer for this constructive and insightful assessment of our manuscript. We appreciate the recognition of the novelty and potential of the dataset, as well as the detailed comments regarding conceptual framing, scaling of interpretations, and treatment of uncertainty.

In response, we have substantially revised the manuscript to address the main concerns raised. First, we have reworked key sections of the Introduction to more clearly frame rhodolith and maërl beds in relation to classical blue carbon ecosystems. In particular, we now explicitly emphasize their role as particle-trapping systems that facilitate the accumulation of sedimentary organic carbon, rather than presenting them as direct analogues to vegetated blue carbon habitats. The unresolved balance between organic carbon storage and calcification-related CO_2 release is now clearly introduced early in the manuscript.

Second, we have revised the interpretation of our results to better align with the scale and limitations of the data. Statements regarding long-term carbon storage and reservoir function have been moderated, and we now more explicitly distinguish between measured sedimentary organic carbon stocks (upper 50 cm) and broader spatial and temporal. We have also incorporated additional discussion of uncertainty and representativeness, particularly highlighting that stock estimates are based on cores collected from thicker sediment deposits and therefore may not capture the full spatial variability of the system.

Third, we have strengthened the discussion of spatial heterogeneity and sampling limitations, and included explicit recommendations for future work to better constrain variability in sediment thickness, carbon content, and deeper sediment layers (>50 cm), as well as across different rhodolith densities and morphologies.

Regarding the use of the term “millennial-scale,” we have revised the wording throughout the manuscript to adopt a more cautious tone. However, we note that the upper 50 cm of sediment analysed in this study spans several thousand years of accumulation (up to ~6,000 years based on radiocarbon constraints), and therefore still reflects processes operating over millennial timescales. We believe that data, despite the limitation of measuring the first 50 cm along cores, reveal millennial ages (see table 2). However, to be more precise we propose an alternative title: Carbon Accumulation in Mediterranean Rhodolith Beds during the Holocene.

We believe these revisions have significantly improved the clarity, balance, and robustness of the manuscript, and we thank the reviewer again for their valuable input.

Reviewer comment: Claims exceed direct evidence
We fully agree on the need to more clearly distinguish between direct observations, inferred processes, and broader interpretations. In the revised manuscript, we have carefully reframed the main findings to align more closely with the scale and scope of the data and to more clearly acknowledge remaining uncertainties, particularly regarding long-term carbon preservation and spatial variability (e.g., lines 598-607; 613-15; 673-74).

Reviewer comment: Blue-carbon framing is conceptually incomplete
We agree that the distinction between organic carbon storage and net ecosystem carbon balance is fundamental, particularly in calcifying systems such as rhodolith and maërl beds, and that this needed to be made clearer from the outset. In response, we have substantially restructured and rewritten the Introduction to address this issue explicitly and early in the manuscript. The revised version now clearly distinguishes between (i) coastal blue carbon ecosystems dominated by organic carbon burial, and (ii) calcifying carbonate-producing habitats, where organic carbon sequestration co-occurs with calcium carbonate precipitation and associated CO_2 release.
Importantly, we now state explicitly in the Introduction that the study focuses on sedimentary organic carbon stocks and their depositional history, and that it does not aim to resolve net ecosystem carbon balance.
Please, see document with track changes (e.g., lines 68-79).

Reviewer comment: Representativeness and extrapolation need stronger caution

We agree that the sampling design and its implications for representativeness and extrapolation required clearer and more explicit discussion. We would also like to highlight the effort and cost involved in extracting core samples at a depth of 60 metres in a harsh environment, a task that requires the use of virbocorers and the prior acquisition of a geophysical map. At present, this is not an activity that can be easily repeated, as it requires a significant investment of research funds. For this reason, we consider that the data obtained, although limited within an ideal theoretical framework, are valuable in practical terms, concerning a system about which we had no prior information.
In any case, we have strengthened the manuscript by explicitly acknowledging the sampling strategy and its potential bias toward thicker sediment deposits (e.g., lines 395-96; 55-56).

Reviewer comment: Chronostratigraphic interpretation is plausible but needs more restraint
Thank you for the suggestion. We rephrased the text in different sections (abstract, lines 613-15) to be more conservative and stressing the limitation (in terms of spatial extent and amount of dated material) of our dataset, which however we believe to be valuable.

Reviewer comment: The manuscript needs major language revision
The text has been proofread by the two co-authors, who are native English speakers; we hope the reviewer will find it easier to read.

SPECIFIC COMMENTS
Abstract / lines 24–27
The abstract currently presents the results as showing that Mediterranean rhodolith beds “act as long-term organic carbon stores.” This should be toned - Addressed (lines 27)
Introduction / line 52
References included as suggested (line 63)
Introduction / lines 60–67
The introduction has undergone substantial changes to address this issue (please, see document with track changes)
Introduction / lines 93–98
Text modified as suggested (line 297)
Methods / lines 136–139
Uncertainty on resolution added as suggested (line 385)
Methods / lines 141–146
An explanation has been included (line 395)
Methods / lines 165–169
There is no reversal, as the dating results, although limited, do not reverse; they are sequential with respect to depth. There are no older data at shallower depths
Methods / lines 178–196
More detail has been included in this section (lines 443-47)
Results / lines 222–230
This has been addressed in different sections of the manuscript (e.g., line 555, 700)
Results / lines 253–254
This figure has been improved
Results / lines 259–277
This has been addressed in the text and in the table 2
Results / lines 288–293
This section includes a more detailed explanation (lines 553-60)
Results / lines 306–315
This has been addressed and model results are interpreted more cautiously (lines 677)
Discussion / lines 337–338
The sentence has been rewritten
Discussion / lines 362–369
We have emphasised that this is an interpretation (lines 679-80)
Discussion / lines 377–384
These differences are now stated clearly (lines 611-13)
Discussion / lines 398–401
This has now been addressed earlier in the document.

Conclusions / lines 403–413
The suggestion has been included and the inferences about a millennial deposit treated more carefully

##Response to Reviewer 2##

We thank the reviewer for the positive assessment of the robustness of our results and conclusions. We agree that the Discussion section could benefit from a broader integration of previous literature, particularly in relation to carbon storage in rhodolith beds and carbonate sediments. Following the reviewer's suggestion, we have revised the Discussion to reduce repetition of the Results section and to incorporate additional comparisons and context from the relevant studies suggested. We also included comparisons with studies addressing thick buried rhodolith deposits and carbonate platform dynamics (e.g. Bosence and Wilson, 2003; Ehrhold et al., 2021).

We appreciate the reviewer's recommendation to expand the comparative framework beyond Mao et al. (2020), as this helped us better contextualize the Menorca rhodolith deposit within the broader literature on carbon storage and long-term preservation in carbonate systems. Minor comments and corrections raised by the reviewer have also been carefully addressed throughout the revised manuscript.

We now have a revised version of the manuscript that incorporates the constructive comments from both reviewers. Should the Editor consider it appropriate, we would be pleased to submit the revised manuscript for further consideration