

Dear editor and author,

This paper is a solid work on the climate control on a Lower Jurassic hemipelagic succession in the Basque-Cantabrian Basin that contain interesting approaches to understand factors controlling its accumulation. Data, interpretations and discussion are very well organized (although some parts are not balanced: see comment 20; and the discussion is quite long and complex). Without a doubt, the paper deserves to be published. However, concerning descriptions (and related interpretations and discussions) four main aspects require to be deeply explained:

- hemipelagic character of the successions (see mainly comments 1, 6);
- significance of color (see comments 10, 16, 18) and MS data (see comments 17, 18);
- criteria for definition of couplets (precession cycles) and bundles (eccentricity cycle) (see comment 15);
- characterization of the black shale package as a whole (see comments 7, 13, 26).

Other changes are suggested in order to state clear some concepts and descriptions.

Introduction

1. Pelagic rhythmites are presented as one of the key sedimentary successions recording orbital controlled climate changes (first paragraph). However, the studied succession is hemipelagic. It would be interesting to include: 1st) a brief definition of the term hemipelagic in the context of the studied BCB; 2nd) a brief explanation (and references) on the role of orbital-induced climate variations on this particular kind of sediments, compared to the pelagic ones.

Geological setting

2. Lines 83-84: “which connected the Boreal Sea with the southern Tethyan Ocean”. Better: “which connected the Boreal Sea with the northwestern Tethyan Ocean”.

3. Line 87: “source area was located in the semiarid belt”. What do you mean thin “source area”, emerged land?, shallow platform carbonate source area? Please, explain better.

4. Specify if the distribution of the humid and semi-arid zones was stable for the entire Early Jurassic.

5. Use in Fig. 1, Early/Lower Jurassic instead of Lias.

6. Line 104: “Pliensbachian (192.9–184.2 Ma) hemipelagic successions of the BCB..”. I suggest deleting the time duration: I suppose the studied succession has not been time-calibrated so accurately. The sedimentary environment of the successions requires a deep explanation. Notice the term “outer ramp” appears for the first time in the discussion (line 778). See also lines 677-679 “restricted paleogeographic setting”). Revise also lines 841-843 (“basins depleted in oxygen”: be careful, it sounds like a circular reasoning).

7. Line 106: use “packages of alternating black shales and limestones/marly limestones” instead of “black shale intervals”. It is important to state clearly these black shales do not include only shales but also intercalated limestone/marly limestones. I think the word Interval has a time connotation.

8. Lines 130-132: “and 1 km north-west of a coeval section studied by others at the train station in the same locality...with which a bed by-bed correlation can be readily carried out.”. This sentence is more appropriate for the discussion (see also comment 26). In any case, it requires a deep explanation of how this correlation was made, without (I suppose) lateral continuity of outcrops.

9. Lines 132-137: Please state clearer the location and thickness of the studied succession. As far I understand the studied succession is 22.5 m thick and includes: the uppermost 2.5 m of the Puerto Pozazal Formation and the lowermost 20 m of the Camino Formation (including the first x-thick black shale package of this unit). However, in line 140 “30.40 m thick” is mentioned.

Materials and methods

10. The average color of samples is used for cyclostratigraphic (spectral) analysis. However, there is not any analysis to elucidate the sedimentary vs. diagenetic significance of this feature.

11. Thin sections are mentioned in results, but not included here.

12. Please, explain the lithology of the studied bundle and samples: line 167: fifty-seven samples, include also here the values of x samples/bed; line 177: central part of each bed, include here also the total number of samples.

Results

13. Lines 209-210: Concerning lithological terms, “limestones or marly limestones” and “marls or shales”. Do you have calcimetric analysis of the entire succession to differentiate these lithologies?. Concerning the term “shale”, please see previous comment 7. The black shale package has to be presented.

14. Description of lithologies and texture. In Fig. 2 (log), marly limestones or limestones with different texture are not drawn. I suggest to draw them. Also state clearly the description of each lithology separately (also limestones and marly limestones; do they have bioturbation?) and then compare their main differences.

15. Lines 236-244 on couplets and bundles. This paragraph has to be separated in a subsection. The criteria for differentiating couplets are unclear: why the couplets marl/shale to limestone/marly limestone (and not at the contrary)?; the “lithological contrast” for bundles is also very unclear (see also comment 13 on carbonate content

of the entire succession). Do you see significant features at the boundaries of couplets or bundles or any trends within couplets or bundles?

16. Color trends: lines 244-258 “The variations in colour values are more significant in the central couplets of bundles than at bundle boundaries. This suggests that, as shown in previous studies... colour values are representative of the carbonate content of the samples.”. See previous comment 15 on “lithological contrast” for bundles (not well explained” and also comment 10 (significance of color). To use the similar trend in color and carbonate content in C35 to C44 as supporting criterion, it is necessary to discuss there was not a diagenetic imprint in both color and carbonate content.

17. Did you perform analysis of susceptibility-temperature (k-t) curves to know the type and abundance of magnetic minerals? The following sentence is not clear (as far I understand you interpret the presence of ferromagnetic minerals indirectly): Lines 264 “The MS of hemipelagic deposits is commonly determined by their paramagnetic components (mostly detrital clays; Kodama and Hinnov, 2015). However, in Santiurde this parameter does not show a great correlation with colour (r: 0.48, $p < 0.001$, all section; Fig. S1) or calcium carbonate (r: 0.36, $p < 0.001$, between C35 and C44; Fig. S1). Therefore, the Santiurde relationship suggests that the MS signal is more likely controlled by ferromagnetic minerals, such as magnetite (Fig. S2).” Revise also lines 750-755.

18. Spectral analysis of MS data (lines 283-285). MS data do not correlate with color and carbonate content; however, their spectral analysis corroborate the results of the spectra analysis of color. Please, explain this apparent contradiction.

19. Lines 310-311. “In general, %CaCO₃ fluctuates in line with lithology, limestones and marly limestones (average: 66.36%) being richer than marls and shales (average: 34.86%).”. What do you mean? In fact, carbonate content is the criterion to differentiate these lithologies.

20. In 4.2. Detailed analysis of Bundle 9 (C35-C44 interval), pure descriptions are included in 4.2.1 to 4.2.4; however, 4.2.5 and 4.2.6 contain interpretation/discussion of the results, including the interpretation of oxic/anoxic conditions of the different lithologies (without any reference to the other results). This imbalance should be corrected.

Discussion

21. Line 459. “Origin of inorganic sedimentary fluctuations”. I suggest deleting “inorganic”. This term is obscure.

22. Lines 470-472 (secondary cements..), line 474 (bed geometry): these descriptions should be explained also in Results.

23. Lines 476-478. "Quite the opposite, the characteristics of the beds are continuous for more than 1 km between the Santiurde motorway and railway sections". See comment 8.

24. Lines 485-487: "In general, the diagenetic characteristics observed in the Santiurde rhythmites are typical of processes related to organic matter decay during burial (Rosales et al., 2001). This sentence is not informative. Please explain in which way.

25. Lines 488-493 about periodicities. Do you have data on the time span of the studied succession to compare with your results? I would be interesting to know how many cycles are then represented in the entire succession and BS package.

26. The discussion lacks a proper explanation of the BS package as a whole (how many precession or eccentricity cycles includes, what short- and long-term factors controlled its accumulation.

Regards,
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