Referee 2 (Anonymous) comments: R2C2

Synopsis

R2C-1. "section 5. 2. The major issue concerns the lack of interpretations for d18O fluctuations (and to a lesser extent this comment can be also applied to the d13Ccarb). Most of the time, this section only contains descriptions of isotopic trends without giving quantitative estimates about the MECO deduced from data presented in the section 4."

Response:

Thank you for this observation. In order to find the possible correspondence with global target curves and identify the MECO, in this paper we focused on describing the trends. It is true we lack quantitative estimates, but the small-scale fluctuations of $\delta^{18}O_{carb}$ could be linked to many factors that we have no control on. Contrary to the MECO isotopic excursion that is well characterized and for which, we also have magnetostratigraphic constraints.

However, in the interpretation part of the OMS, we come back on the link between the MECO $\delta^{18}O_{carb}$ fluctuations and the prominent deltaic progradation observed on both sections, hence addressing the relationship between the climatic perturbation, surface processes, and sediment supply to the basin.

Added/Changed: The section 5.1 and 5.2 were reorganized and several sentences reworded.

R2C-2. "lines 467-469 and 497-499. To my understanding, one of the main findings of the MS seems to be the significant increase of erosion and sediment transport during the MECO. However the figure 11 clearly shows a sedimentation rate held constant through time (pre/syn/post-MECO). This point deserves more attention."

Response:

We thank the reviewer for raising this point, which is important, and it wasn't sufficiently addressed in the OMS. First, the sedimentation rate (SR) indicated on figure 11 are "average" SR taken from Vinyoles et al. 2021. Indeed, these authors do not have sufficient time resolution to deconvolve high-resolution SR variations, and neither do we. In essence, there are no data here that would allow us to discuss variations in SR at the scale of the observed variations in $\delta^{18}O$.

On the other hand, in such a shallow marine environment, the SR is not necessarily a faithful indicator of increased erosion in sediment transport. Indeed, with limited space for accommodation, an increase in sediment supply is in fact more expressed by progradation and sediment bypass than by an increase in SR. We hence focus on sequence stratigraphic interpretation (A/S ratio) as a proxy of variations of sediment supply and accommodation. In theory, a test of our suggestion would be to assess sediment volumes, but this is currently impossible given the incompleteness of the outcrops in 3D at this scale.

Added/Changed: The section "5.4 MECO response in the South Pyrenean Foreland Basin" was

was checked and edited when necessary in the RMS (Lines 471–506).

R2C-3. "Lines 500-501. A such increase of the hydrological cycle during the MECO should, by its action on the weathering (and the alkalinity delivered), inhibit the ocean acidification process (or the authors assume that the acidification takes place in the early stage of the MECO before the enhancement of the hydrological cycle ?). Consequently, the authors should reword some of their points mentioned as potential implications (section 5.5) to be consistent with their results."

Response:

Thank you for this suggestion. The ocean acidification observed during the MECO is indeed controversial, as raised by Sluijs et al., (2013). They dubbed the MECO as "a middle Eocene carbon cycle conundrum", since the observations do not fit with the current carbon cycle theory.

Added/Changed:

To be more consistent with the results and not link ocean acidification and enhanced hydrological cycle, we have modified lines 527–529 of the RMS: **[This response in sediment delivery rate, OM burial in shallow and restricted basins, has been previously documented for other early Eocene hyperthermals (Chen *et al*., 2018; Foreman *et al*., 2012, 2014; Pujalte *et al*., 2015; Foreman and Straub, 2017; Honegger *et al*., 2020).]**

R2C-4. "Figure 3 (caption) Where are the grey lines mentioned in the caption?"

Response:

Thank you for this observation. The grey lines mentioned in the caption define the four depositional sequences defined by Millán et al., 1994 in the Belsué syncline.

Added/Changed:

Figure 3 was improved, we have emphasized the lines representing the depositional sequencies with a darker, more visible, grey.

R2C-5. "lines 366 and 368: please do not mix r and r^2 "

Response:

Corrected. Text and figures were checked and changed when necessary. In the RMS is used consistently the Pearson correlation coefficient, r.

Added/Changed: We modified in the RMS:

Lines 428–499: " Statistically, a non-significant correlation (**Pearson correlation coefficient; *r* < 0.6**) indicates that a diagenetic overprint of the primary isotopic signature can be excluded (e.g., Fio *et al*., 2010). In both sections, no statistical significant correlation (***r* < 0.3**) was found …"

Lines 460 to 463: " In addition, the terrestrial origin is also supported by the strong correlation **(r > 0.7)** observed between the siliciclastic elements (Al, Ti, Fe) and the TOC or all the OM-related trace elements (V, Mo, Ba, and Th; Tribovillard *et al*., 2006).