

Interactive comment on “Alluvial record of an early Eocene hyperthermal, Castissent Formation, Pyrenees, Spain” by Louis Honegger et al.

Anonymous Referee #2

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Interactive comment on the manuscript “Alluvial record of an early Eocene hyperthermal, Castissent Formation, Pyrenees, Spain” by Louis Honegger et al,

Louis Honegger et al claim to have located for the first time in a terrestrial succession the late Ypresian hyperthermal event coded “U”, specifically within the Castissent Formation, a well-known alluvial-fluviatile unit of the southern Pyrenees. Their claim is based on a stable carbon isotope profile obtained from pedogenic carbonate nodules of a single section (Chiriveta). Their study, if correct, is potentially important, because to fully understand the effects of hyperthermals events their impacts on different settings need to be investigated. However, although they might be correct in their claim, I am not entirely convinced that the fact presented in the manuscript incontrovertibly demonstrate that this is the case. Besides, some items of the manuscript are, in my

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view, somewhat confuse. Below I list the main points of my concern:

1. The title of the manuscript (Alluvial record of an early Eocene hyperthermal, Castissent Formation, Pyrenees, Spain) is misleading: When I first read it I thought the authors meant that the Castissent Fm had resulted from the effects of an hyperthermal – which would be impossible. I therefore suggest something like: Alluvial record of an early Eocene hyperthermal within the Castissent Formation, Pyrenees, Spain.

2. In lines 36–40 they state that “The results show that even relatively small-scale hyperthermals compared with their prominent counterparts, such as PETM, ETM2 and 3, have left a recognizable trace in the stratigraphic record...”. The environmental effects of the above-mentioned hyperthermals in terrestrial setting, especially those of the PETM, are very prominent (e.g., Foreman et al, 2012), a fact that made their record easily recognizable in the field. For the alleged U event (NCIE D) the information provided does not justify the above assertion. Thus, in Fig. 7 the event seems to be represented by a comparatively thin interval (<1 m), whereas the previous NCIE C, which is of smaller magnitude, is recorded by a ~ 3 m thick interval. A better documentation of the sedimentological features of the alleged U event is needed, as it is the focus of the study. It would also help if such (distinctive ?) features could be observed in other section(s).

3. Constraint on the age of the Castissent Fm is somewhat vague. It is not based on data from the Chiriveta section itself, but on bio- and magnetostratigraphic studies of previous authors (Kapellos and Schaub, 1973; Bentham and Burbank, 1996), carried out in the Campo section, 40 km westward. Based on them the authors indicate that the Castissent Fm occurs within the D. Iodoensis nannoplankton zone (= NP 13), with the base and top of the nannozone being respectively situated at ca 200 m below the base of the Castissent, and at ca 100 m above its top. My doubts about the reliability of the Kapellos and Schaub zonation (1973) partly stem from the fact that shallow marine facies such as those of the Campo section are not favorable for the preservation of nannofossils, and that therefore are not entirely reliable. The NP9/NP10 boundary

provides a proof of this, for K & Sch'73 did situate it ABOVE the so-called Alvelina limestone, while Orue-Etxebarria et al. (2001; *Marine Micropaleontology* 41, 45–71) proved that it occurred BELOW such unit, a finding that permitted to correctly place the PETM interval in the Campo section (see Fig. 1 of this Comment). More to the point, as shown also in Fig 1, the location of the top NP 13 zone is somewhat ambiguous: K & Sch'73 state in their text that the NP 13 zone spans from km 58.6 (base) to km 56 (top), whereas in their columnar section the top of the zone is placed at sample 32. Such uncertainty raises doubts about the magnetostratigraphic calibration of Bentham and Burbank (1996), likely based on the K & Sch'73. Indeed, in Fig. 3 of the manuscript the NP13/14 boundary is placed within the C22n magnetozone, whereas in Fig. 1 (from Westerhold et al, 2017) is located within C23r.

4. The completeness of the studied section is debatable In the first paragraphs of chapter 5.4 (“Preservation potential of hyperthermals in continental sections”), the authors acknowledge that alluvial-fluvial stratigraphic records are considered incomplete by many authors (e.g., Shanley and McCabe, 1994; Wright and Marriott, 1993; Turner et al., 2015; Barrell, 1917; Sadler, 1981). In the present case, Marzo et al. (1988) concluded that “The sedimentation of the Castissent Formation was structurally controlled by an interplay of vertical basement movement due to thrust stacking in the hinterland and surficial thrust displacement to the foreland resulting in alternating southward and northward shift of the fluvial system”. The Chiriveta section is close to the foreland thrust (Montsec thrust) and, in such dynamic scenario, it is doubtful that it would have accumulated a (near) continuous succession. But, even if that were the case, it seems rather improbable that the section would be complete enough to have recorded ALL the minor NCIES detected in the ODP 1263 site, as shown in Fig. 7.

5. Section 4.1 of the manuscript (“Overview Of the Castissent Fm at the Chiriveta section) seems to be misplaced. I suggest to remove it from the Results section and place it after the Chapter 2, Geological setting.

6. I have not had the time to check out all the references, but in a quick glance I

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can point out that some of them are incomplete: Hunger, T.: Climatic signals in the Paleocene fluvial formation of the Tremp-Graus Basin, Pyrenees, Spain. University of Geneva., 2018. Is that a Thesis? How many pages? It is published or unpublished?

Poyatos-Moré, M.: Physical Stratigraphy and Facies Analysis of the Castissent Tecto-Sedimentary Unit., 2014. Is that a Thesis? If so, from which University? How many pages? It is published or unpublished?

The list of authors of the reference “Payros, A. and Tosquella, J.: Filling the North European Early/Middle Eocene (Ypresian/Lutetian) boundary gap: insights from the Pyrenean continental to deep-marine record, *Palaeogeogr. Palaeoclimatol. Palaeoecol.*, 280, 313–332, doi:10.1016/j.palaeo.2009.06.018, 2009” is incomplete. Either include all the authors (Payros, A., Tosquella, J., Bernaola, G., Dinarès-Turell, J., Orue-Etxebarria, X., and Pujalte, V.), or quote it as Payros, A., Tosquella, J, et al.

7. Some previous papers should be referenced. In lines 60–63 the manuscript states that “In coastal marine sections, Early Eocene hyperthermal events are generally associated with an enhanced flux of terrigenous material, interpreted as linked to accelerated hydrological cycle and higher seasonality (Bowen et al., 2004; Dunkley Jones et al., 2018; Nicolo et al., 2007; Payros et al., 2015; Slotnick et al., 2012). . .” To my knowledge, one of the first paper pointing out this fact was: Schmitz, B., Pujalte, V., Núñez-Betelu, K., 2001. Climate and sea-level perturbations during the Initial Eocene Thermal Maximum: evidence from siliciclastic units in the Basque Basin (Ermua, Zumaia and Trabakua Pass), northern Spain. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 165, 299–320

In lines 63–65 the manuscript states that “Several studies document a spatially heterogeneous hydrological climatic response during the PETM (Bolle and Adatte, 2001; Carmichael et al. 2017; Kraus and Riggins, 2007)”. The paper by Giusberti, L., Boscolo Galazzo, F., Thomas, E., 2016. Variability in climate and productivity during the Paleocene–Eocene Thermal Maximum in the western Tethys (Forada section). *Clim.*

Past 12, 213–240, should be acknowledged, as their compilation made evident such climatic variability.

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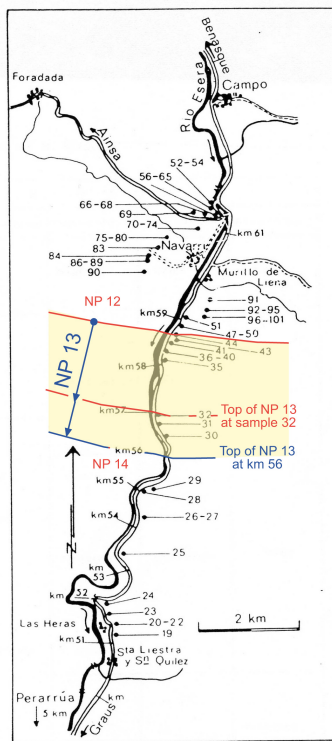


FIG. 7. — Esquisse topographique de la coupe paléogé de Campo.

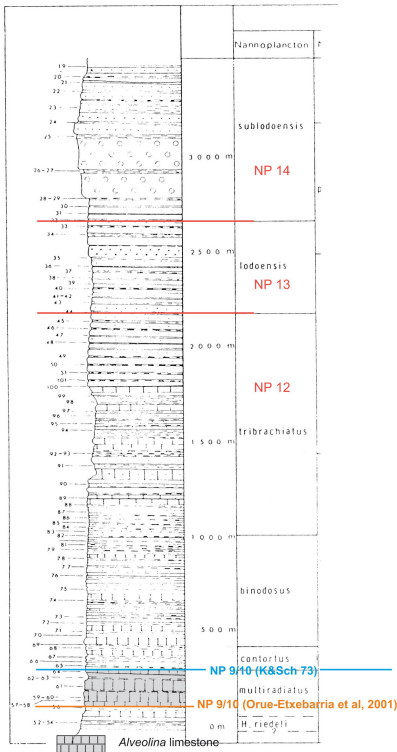


FIG. 8. — Profil schématisé et biozones du Paléogène au S. de Campo.

Figure 1, tentative location of the NP 13 on the road map of the Campo section (left), and in the columnar section (right), superimposed on figures 7 and 8 of Kapellos and Schaub. Alternative locations of the NP9/NP10 are also indicated in the columnar section