Clim. Past Discuss.,
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Climate of the Past Discussions
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Interactive comment on "Orbital forcing of terrestrial hydrology, weathering and carbon sequestration during the Palaeocene-Eocene Thermal Maximum" *by* Tom Dunkley Jones et al.

V. Pujalte (Referee)

victoriano.pujalte@ehu.eus

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Tom Dunkley Jones, in his replay to my second Comment, correctly indicates that some of the hemipelagic marls at Zumaia may contain up to 50% clays, probably detrital, and he asks: "What drives the precession cyclicity in carbonate content through the Paleocene?"

This is an interesting question that, to my knowledge, is still unresolved. But I do think that this issue is beyond the point of the ongoing discussion.

I illustrate this third (and hopefully final) Comment with 4 images, for it is said that a

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picture is worth a thousand words.

Fig. 1: Overturned upper Danian deposits in an outcrop near Zumaia. The succession is formed by hemipelagic marls and limestones, with low clays and no turbidites. Precession and eccentricity cyclicities clearly recognizable to the naked eye.

Fig. 2: Above: A part of the Selandian succession at Zumaia. Lots of clays (I do not remember exactly how much). However, the marl/marly limestone precession couplets are easily discernible.

Below: uppermost Thanetian at Zumaia, just below the green limestone. Precession couplets still visible, despite the "noise" introduced by thin bedded turbidites and lot of clays . Interestingly, the number and thickness of turbidites varied between the different couplets, and indication of random deposition.

Fig. 3. Above: A part of the Thanetian carbonate breccias and thick-bedded turbidites at Aixola. Below: A part of the PETM amalgamated sandstones and pebbly sandstones at Orio (scale within the red oval = 1 m). No cyclicity can be discerned in any of the cases.

Fig. 4. Above: A part of the PETM at the Barinatxe section: a random stacks of fining-upward 1–3.5 cm thick packages composed of fine grained quartz sands grading up to dark-grey clays.

Below: The lower part of the PETM fine-grained siliciclastic unit at Zumaia (the base of the 1 m scale is placed at the top of the greenish marls). No cycles can be discerned. Note red and greenish colours of the clays, very different than at Barinatxe.

In conclussion: The Milankovitch cyclicity is quite evident when detrital clays and thin-bedded turbidites are scarce or absent (Fig. 1). Detrital clays and thin-bedded turbidites, when in low or moderate amount, introduced some "noise" but do not obliterate the inherent cyclicity (Fig. 2). In successions almost exclusively formed by thick- or thin-bedded calciclastic or siliciclastic turbidites (Orio, Aixola, Barinatxe) no cyclicity can be discerned (Figs. 3 and 4).

Key points in this discussion: No regular cyclicity can be observed within the fine-grained PETM deposits at Barinatxe (Fig. 4, above). If similar events controlled the deposition at Zumaia why should there be a cyclic arrangement? No cycles can be visually recognized at Zumaia within the SU, and the origin of supposed Si/Fe cycles is still unaccounted for, as pointed out by the anonymous referee. Also requires an explanation the change of colours of the SU clays upon weathering (compare the two images in Fig. 4), suggestive of remobilization of Fe in exposed outcrops such as Zumaia, a remobilization which may have biased the analytical results of the samples.

In my opinion, these key point must satisfactorily explained for the paper to be accepted.

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Fig. 1.

Fig. 2.

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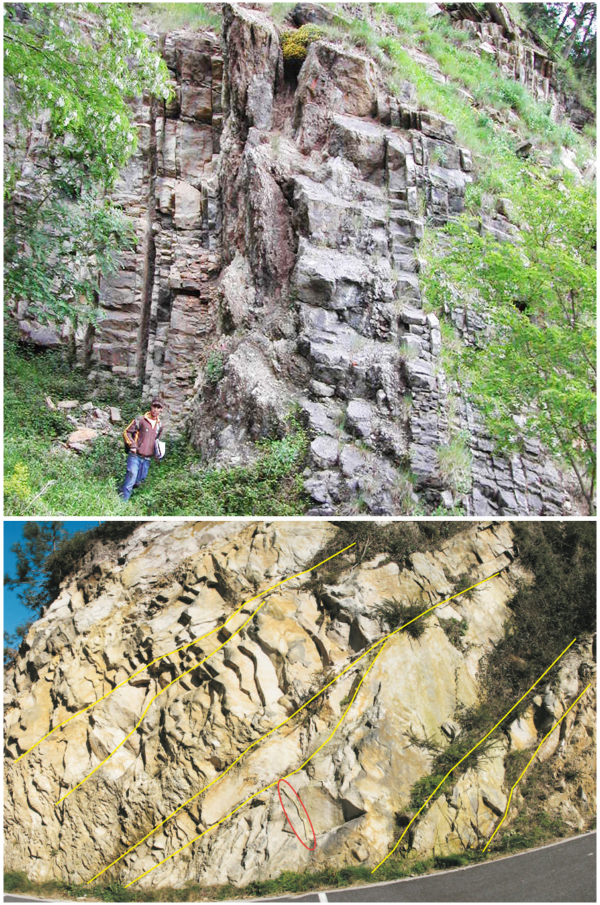

Fig. 3.

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Fig. 4.

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