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Climate of the Past Discussions

Interactive comment on "Mercury anomalies across the Palaeocene-Eocene Thermal Maximum" *by* Morgan T. Jones et al.

Anonymous Referee #1

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Overall: This is a rich dataset aimed at investigating the link between NAIP volcanism (which ought to manifest as Hg/TOC anomalies in sediments) and the PETM. Purely based on the size of the dataset and the importance of the question being investigated, this is a worthwhile contribution. However, I do think that potential issues with the fidelity of individual records needs to be more fully acknowledged in the interpretation, which currently considers each Hg/TOC record to faithfully record volcanism. I find it entirely plausible that many of the anomalies at individual sites might be the result of secondary processes (changes in type of Corg, dissolution and diagenesis, even weathering of the outcrop sections) and not in fact related to volcanism at the time of deposition.

Abstract, Line 21: I assume the CIE you are referring to is the PETM, but that is not

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clearly stated.

Page 3, Line 4-5: A “strong positive correlation” is a bit imprecise, I would rather state that a close temporal coincidence between several LIPS and mass extinctions has been noted.

Section 3.4: I suggest that the description of the PETM in the ACEX hole be ammended to reflect that the onset of the PETM is clearly missing, with the underlying 50cm (separated by a core gap) “disturbed by drilling and various proxies suggests that the sediment from this interval represents a mixture of uppermost Palaeocene and PETM material” (Sluijs et al, 2006).

Page 8, Line 8: “and represents the most distal locality to the volcanic activity of the NAIP studied here.” Is it more distal than Dababiya?

Page 12 Line 232: “It is conceivable, but unlikely, that the Hg/TOC anomaly at Dababiya could purely be a product of diagenetic and weathering processes, given the amount of dissolution and acidification observed at this site (Figure 9; Keller et al., 2018; Khozyem et al., 2015). However, the effects of such processes on Hg/TOC ratios are poorly understood.” Well, this begs the question then, could not the Hg/TOC anomalies (or lack thereof) at all of the sites be influenced by the effects of dissolution and diagenesis? All of the sites here have large changes in lithology across the PETM, which of course suggests variable susceptibility to diagenetic alteration, with Svalbard apparently the lone exception. Perhaps the authors should allow that the records at all other sites may be dominantly controlled by the changes in lithology, which preserve mercury and TOC to various degrees, while Svalbard (which actually has quite a convincing Hg anomaly coincident with the PETM), due to being fairly homogenous clay throughout, might be the most reliable record.

Page 13, Line 22: “In Svalbard, palynological evidence indicates that there was a distinct transient shift towards marine-derived organic matter across the PETM (Harding et al., 2011). The organic matter before and after the CIE is dominated by terrestrially-

derived phytoclasts of cuticle and wood, while the body of the PETM is largely comprised of amorphous organic matter and marine dinocysts (Harding et al., 2011)." Well, that gives me second doubts about Svalbard being the most reliable record - if the nature of the organic matter (that hosts the Hg signal) is changing dramatically, then it's entirely possible that the trends preserved in the record are a result not of original Hg deposition, but how that Hg survives the ravages of time and diagenesis.

It seems to me that there's a potential problem here with the fidelity of the records. The effects of changes in the host organic material, subsequent dissolution, diagenesis and weathering on the preservation of Hg in sediments are all relatively unconstrained. It would be one thing if you had a set of sites of varying lithological changes, that all showed the same Hg/TOC trend. Then you could argue that the Hg/TOC trends are robust to diagenesis. But instead, I see a a number of sites with varying lithologic changes, that all show quite different trends in Hg/TOC. Now, I'm not suggesting that there's nothing to be learned, but perhaps the authors should stress that constraining the effects of all of those secondary processes is crucial to the interpretation of these Hg/TOC records. Before we have that information, it's difficult to make conclusions about NAIP volcanism and the PETM. These complications are discussed in sections 5.2, but not afterwards - in section 5.3 and in the conclusions the records are interpreted as is they are known to be robust. I find this to be an omission, and suggest adding statements to the effect of: Hg/TOC anomalies at individual sites (or the lack thereof) may reflect changes in the way Hg is preserved in sediments, not related to NAIP volcanism.

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