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Interactive comment on “Methane release from gas hydrate systems during the Paleocene-Eocene thermal maximum and other past hyperthermal events: setting appropriate parameters for discussion” by G. R. Dickens

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Dear Jerry

I have read your paper and the subsequent comments and responses with much enthusiasm. This type of interaction clearly highlights the transparency of the discussion process and shows how one can greatly improve a manuscript. Such improvements would clearly make a manuscript very useful for any incoming academic to the PETM topic and any deep-time negative carbon-isotope excursions. Although I am clearly not

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an expert on the PETM and the papers that are currently being referred to in the comments, I am curious about one aspect of the methane hydrate release. Understanding whether the methane is oxidised in the water column or atmosphere is critically important, but where it occurs the oxidation process produces water ($\text{CH}_4 + 2\text{O}_2 = \text{CO}_2 + 2\text{H}_2\text{O}$). This may be a very simplistic manner in which to consider the oxidation process, but why has no one really discussed this other byproduct (or have I missed some key literature!): it seems that everyone has focused only on the CO_2 product. If a certain amount of methane was oxidised in the atmosphere clearly this would increase water vapour and thus the greenhouse effect. Bowen and others have clearly suggested an increase in humidity during the PETM. Although the evidence is not direct, could one assume that the increase in humidity is the result of methane oxidation in the atmosphere? Additionally, if the methane is oxidised in the water column this would draw down the oxygen inventory of the oceans but what happens to the water byproduct in the ocean?

Another minor comment (similar to your one on my paper in Solid Earth). Would it not be useful to refer to other CIE events in the deeper geologic record that have been inferred to be the result of methane hydrate destabilisation earlier in your manuscript that at the end with only one reference. Other events such as the Devonian Kacak Event (van Hengstum & Gröcke 2008), Permian/Triassic boundary (Krull & Retallack 2000), Toarcian oceanic anoxic event (Hesselbo et al. 2000), early Aptian oceanic anoxic event (Beerling et al. 2002) and the Cretaceous/Tertiary boundary (Day & Maslin 2004). Your paper is very helpful for these other groups and that kind of acknowledgement should be highlighted at the start of the manuscript. Your discussion paper is not just for the Cenozoic community - in fact it should be one that all the Mesozoic and Palaeozoic communities should read.

Thanks again for producing an excellent discussion paper and I look forward to seeing it published so that I can share it with my students (graduate and undergraduate). Cheers, Darren

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