

Interactive comment on “Rapid and sustained environmental responses to global warming: The Paleocene–Eocene Thermal Maximum in the eastern North Sea” by Ella W. Stokke et al.

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The authors provide an excellent new high-resolution study of a data set spanning the PETM in a sequence that deserves more attention than thus far received. I'd like to express some general concerns related to the referencing in this manuscript.

The introduction and discussion are largely up-to-date with respect to recent advances made on the PETM in general and on the regional expression of the PETM in particular. The last twenty years has seen enormous progress and new approaches to understand a wide array of aspects of the PETM, but many of the underlying observations and ideas emerged the decade before. After the cruise of ODP Leg 113 Maud Rise and

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publication of the Kennett and Stott (1991) paper, numerous sections and cores were investigated for the first time with a focus on the PETM. Only a handful of the hundreds of PETM studies published in the 1990s are cited in the present manuscript. Obviously, it is not possible or needed to cover all relevant literature in a research paper. Yet, besides referencing up-to-date research results, in my view it is a good practice to also refer to papers in which certain ideas were first developed and not only to secondary papers further evaluating the same ideas. That good practice is only sparsely applied here.

Referencing can also be inappropriate, for instance when a certain aspect of research results is not even evaluated in a cited paper, but just mentioned in support of other ideas. This applies to line 64: the paper Koch et al. (1992) is referred to with respect to the benthic foraminiferal extinction event. This was a seminal paper, revealing the PETM in continental deposits, but it added nothing to our knowledge of the extinction event. It just briefly mentioned this phenomenon as elaborated by Tjalsma and Lohmann (1982) and Thomas (1990).

With respect to a key topic in this paper, the oceanic anoxia, the following is written in lines 67-71: “Still, globally widespread ocean deoxygenation has been recognised (Pälike et al., 2014; Zhou et al., 2014; Yao et al., 2018), with particularly prevalent anoxic to euxinic conditions observed in semi-enclosed shelf areas such as in the Tethys Ocean (Egger et al., 2003; Khozyem et al., 2013), Peri Tethys Basin (Gavrilov et al., 2003; Dickson et al., 2014), the North Sea (Schoon et al., 2015), and the Arctic Ocean (Stein et al., 2006; Harding et al., 2011).” This seems to suggest that the importance of anoxia in marginal basins during the PETM was only recognized in 2003. Yet, this occurred much earlier, as can be judged from the following two papers: The late Paleocene anoxic event in epicontinental seas of peri-Tethys and formation of the sapropelite unit (Gavrilov et al. 1997- Lithology and Mineral Resources) and Benthic foraminiferal extinction and repopulation in response to latest Paleocene Tethyan anoxia (Speijer et al. 1997 - Geology). (at that time the PETM was still considered as a late Paleocene

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event, the LPTM)

Another example is provided by lines 126-128: “Both increased weathering of siliciclastic rocks and enhanced sequestration of organic carbon have been proposed as important negative feedback mechanisms, potentially driving the PETM recovery (Bowen and Zachos, 2010; Ma et al., 2014; Penman, 2016; Dunkley-Jones et al., 2018).” Also the organic carbon sequestration feedback during the PETM was addressed much earlier: Sea-level changes and black shales associated with the late Paleocene thermal maximum: Organic-geochemical and micropaleontologic evidence from the southern Tethyan margin (Egypt-Israel) (Speijer & Wagner 2002 - GSA SP356).

The same applies to lines 82-83: “The 4–5 °C PETM temperature increase (Dunkley Jones et al., 2013; Frieling et al., 2017) is comparable to that predicted in response to the current anthropogenic carbon emissions (e.g. Riahi et al., 2017).” For both statements there are earlier sources addressing them and there are more examples throughout the text for which primary sources are missing.

My general advice is to provide sufficient credit to papers that once brought new ideas and stimuli for further research, next to crediting more recent state-of-the-art papers on the same topic. This should especially apply to the introduction. In this way, the reader can immediately see where and when certain ideas originated and who was behind those ideas.

Further minor suggestions:

Figure 3: Is it correct that the two clay units are not part of a formal lithostratigraphic unit (formation or member)?

Oxicity should be oxygenation.

678: With respect to the discussion on Ba and P₂O₅ (export production), it might be worthwhile to consult the PETM records from Israel and Egypt (Schmitz et al. 1997 – Terra nova). This region provided many insights into the PETM, laying the founda-

tion for placing the GSSP for the Ypresian Stage at Dababiya (Dupuis et al. 2003 – Micropaleontology; Aubry et al. 2007 – Episodes).

750: Adatte, T. is correct

790-792: title of SP and editors are missing. Same for 817-818, 834-836, 845-847, 918-920, 921-923, etc.

830, 1039 and 1042: Damsté, J.S.S. should be Sinninghe-Damsté, J.S.

1092-1093: redundant capitals

Recent key papers to also consider: Hollis et al. 2019 (Geoscientific Model Development), Westerhold et al. 2020 (Science)

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