

Response to RC1, Mikhail Rogov

We are pleased that you find the MS by Vickers et al. an important contribution devoted to the enigmatic glendonite occurrences across the PETM climatic optimum, and that in general you find the manuscript well-written, with well-supported interpretations of the findings. In response to the specific line-by-line comments:

Line 83: “numerous glendonites in volcanic sediments” – rather, in “ash-bearing deposits”

- Indeed, ash-bearing deposits is a more accurate description, and we will make this replacement in the text.

Line 96: “glendonites in the stratigraphy of the Exp. 396 cores” – in my opinion, usage of the word ‘stratigraphy’ in such a meaning is doubtful; I propose to replace it by “glendonites recovered from Exp. 396 cores and their stratigraphic distribution”

- We agree, this way of phrasing is clearer and more accurate, and we will make this change.

Line 108: “The Modgunn locality is a transect of boreholes” – can the transect be considered as a ‘locality’?

- We can rephrase this to “*Boreholes from the Modgunn transect (Sites U1567-U1568) span the crater of a Paleogene hydrothermal vent complex*”. Likewise, when introducing the two transects, we can word this “Paleocene-Eocene sedimentary successions *were cored* along the Modgunn and Mimir *transects* (Fig. 1B and C).” to avoid any confusion.

Line 116: “and the biostratigraphic marker taxa *Apectodinium augustum* and *Hemiaulus proteus*” – rather, “FAD of the biostratigraphic marker taxa...”. Can you show key biostratigraphic events (FAD and LAD of dinocyst species) on the figures? It will be useful for readers

- We will add the first and last occurrence data for *Apectodinium augustum* and *Hemiaulus proteus* (from Berndt et al., 2023) to Fig. 2, along with both published and new carbon isotope data for chemostratigraphic interpretation. We will edit this line to read “The strata contain a negative $\delta^{13}\text{C}$ excursion and the *first and last occurrence of the* biostratigraphic marker taxa *Apectodinium augustum* and *Hemiaulus proteus* (Fig. 2).”

Line 228: “hydrothermal vent infilling sediments”- or “deposits” (here and above in the text)? the term 'sediments' more frequently used for modern unconsolidated ones

- We will replace “sediments” with “deposits” in both instances.

Line 242: at least a short review of biostratigraphic data, which are crucial for further discussion, is necessary prior the description of glendonites.

- We will add the published biostratigraphic from Berndt et al. (2023), along with carbon isotopic data (new and from Berndt et al., 2023) to Figure 2. We describe the biostratigraphic data briefly in the geological setting, but cannot describe it in the results as it is already published and discussed in Berndt et al., 2023, and not new data gathered for this study.

Lines 247-249: “Most show the characteristic shape of stellate or bladed ‘crystals’, although the individual blades are no longer a single crystal but rather a heterogeneous mix of smaller crystals” - as follow from photographs provided in the MS, nearly all recorded glendonite specimens can be

ascribed to a single rosette morphotype (following terminology proposed by Frank et al., 2008), except for specimens from figs. S4 and S8-S9, which morphology is unclear.

- We will add photos of all identified glendonites to Fig. 3 so that the readers do not have to refer to the supplementary material. We will change the sentence as recommended to *“Nearly all the recorded glendonite specimens can be ascribed to a single rosette morphotype (Fig. 3) (following terminology proposed by Frank et al., 2008), except for specimens from Fig. 3D, F, I and J, in which the morphology is unclear due to the fragmented nature or disturbance of the structure during drilling.”*, and will add Frank et al. (2008) to the reference list.

Lines 267, 300, 320: “Counts et al., in review” it is not necessary to cite such a paper, which still not accepted yet; in all the cases it cited along with other refs

- We will refer instead to the Geological Society of America Annual Meeting Abstracts with Programs, 55, 6, which presents this model.

Lines 301-302: “green Type 0 calcite identified in this study has not been observed in other glendonite thin section” - can this newly recorded generation be related with an influence of the nearby ash horizons?

- It may be, although note that this phase has not been reported in the Fur Formation glendonites of northern Denmark (e.g., Vickers et al., 2020 Fig. 3), or indeed observed by the lead author in prepared thin sections of these glendonites, which are also associated with thick ash horizons. More investigation needs to be undertaken on this before a conclusive driver of the formation of this calcite phase can be identified.

Line 311: “localisedincrease” – please split this word

- Yes, we will put in the missing space.

Unfortunately, an information about the precise coordinates of studied boreholes is missing in the MS; I propose to add a table with these data to the Supplementary.

- We will add latitude and longitude information to section 3.1. where we describe from which holes the glendonites were recovered: “The glendonites discovered by IODP Expedition 396 are found within two holes of the Modgunn *transect*, U1567C ($3^{\circ}3.219'E$ $65^{\circ}21.785'N$) and U1568A ($3^{\circ}3.109'E$ $65^{\circ}21.594'N$); and within two holes of the Mimir *transect*, U1569A ($2^{\circ}1.608'E$ $65^{\circ}49.878'N$) and U1570A ($1^{\circ}59.623'E$ $65^{\circ}49.890'N$) (Fig. 2 and Table 1)”. Full information for all holes for Exp. 396 (coordinates, water depth, penetration, drilled interval etc) can be viewed in Table T1 of Planke et al. (2023a).