



*Paleoceanography and Paleoclimatology*

Supporting Information for

**Orbital (hydro)climate variability in the ice-free early Eocene Arctic**

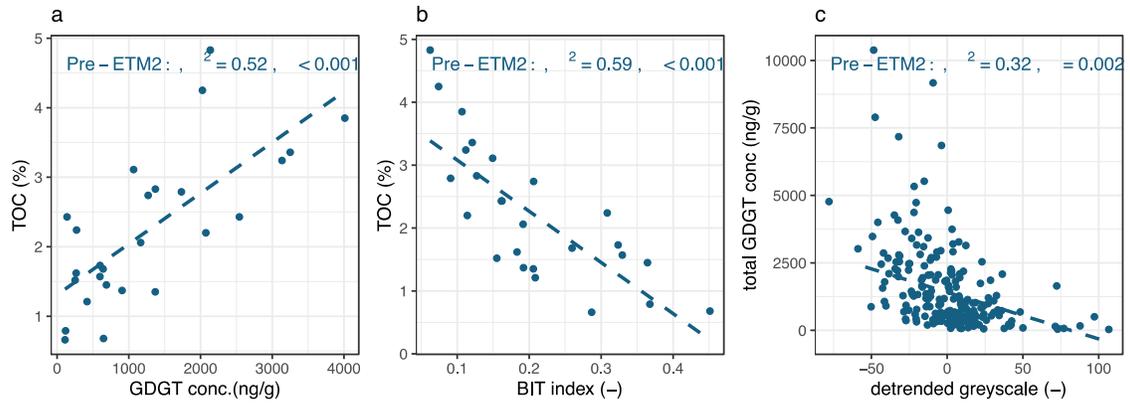
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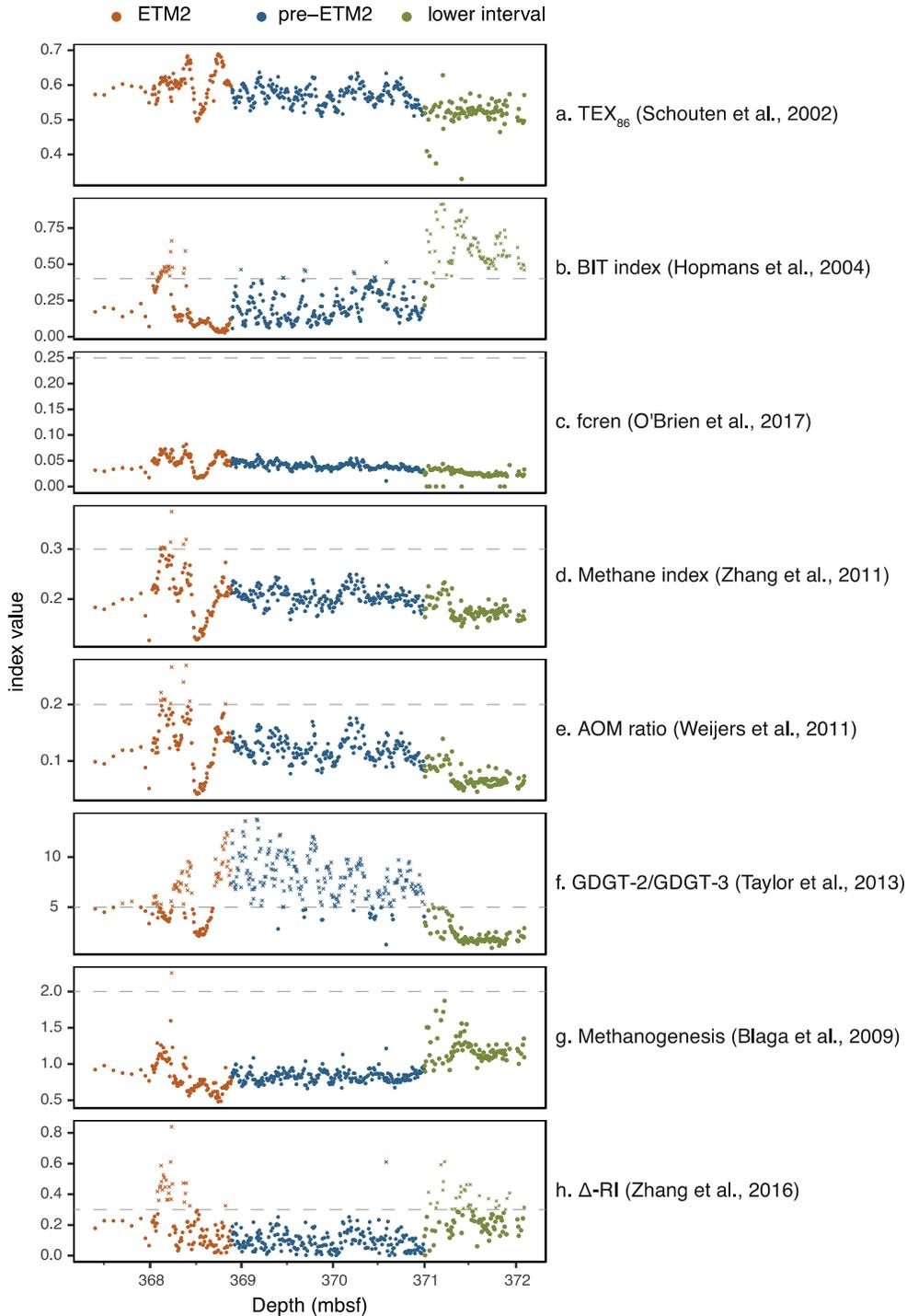
2: Royal Netherlands Institute for Sea Research (NIOZ), 1790 AB Den Burg, The Netherlands.

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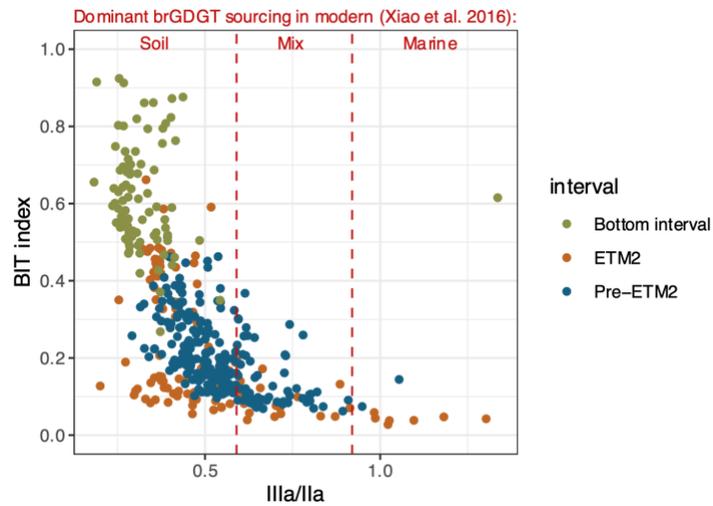
Figures S1 to S6



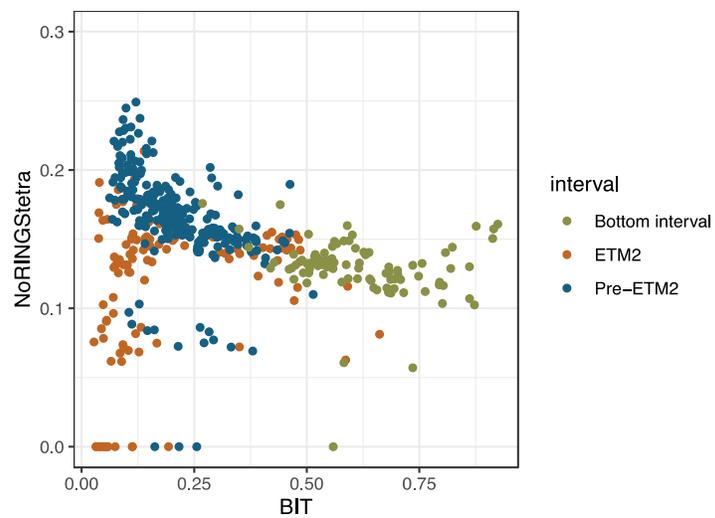
**Figure S1.** Cross plots between TOC% (Sluijs et al. 2009), total GDGT concentrations, BIT index, and (detrended) greyscale in the pre-ETM2 interval.



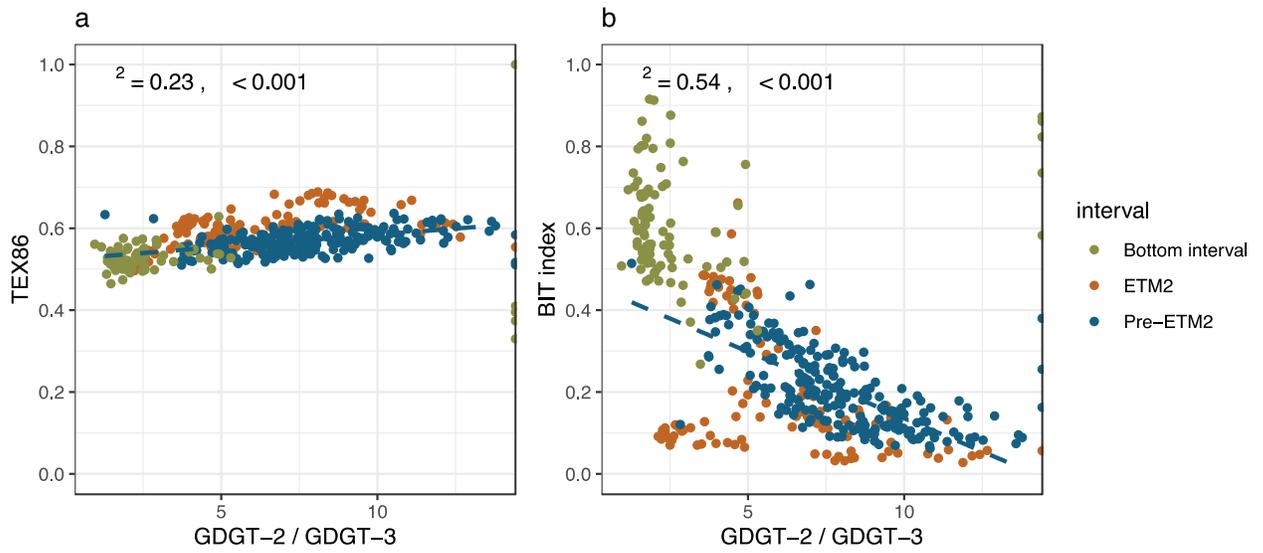
**Figure S2.** GDGT indices for detecting non-thermal overprint on the  $TEX_{86}$ . Dashed line indicates cut-off value for non-thermal influence maintained in literature. Colors correspond with the different intervals of Core 27X (defined in the main text). Figure generated with the R script from (Bijl et al., 2021).



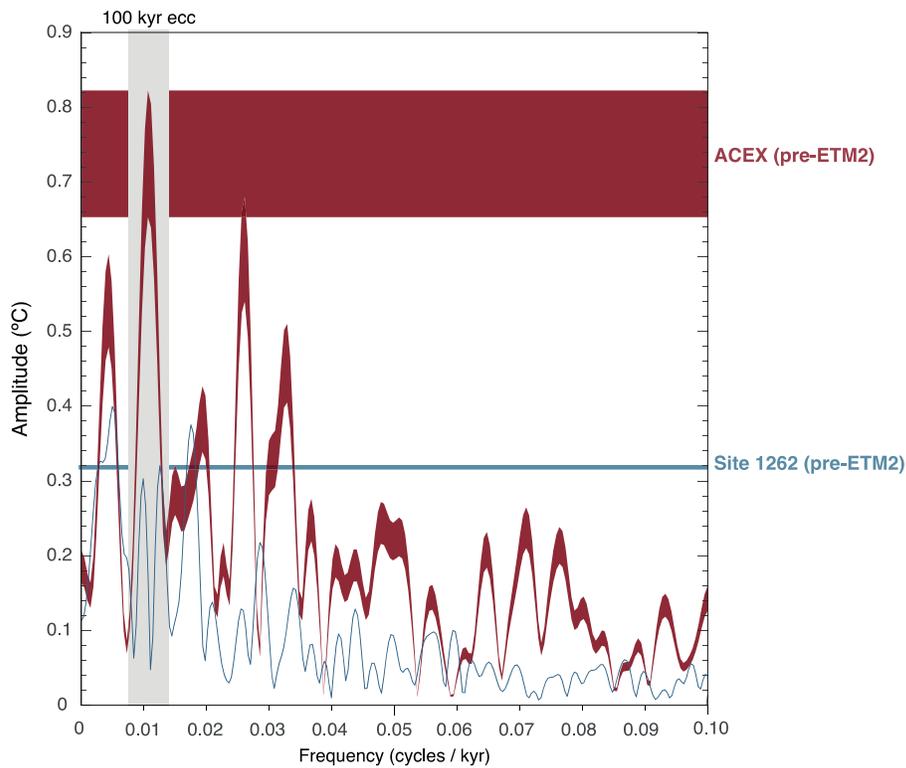
**Figure S3.**  $IIIa/IIa$  versus BIT index. Colors mark intervals, as distinguished in Main Text Section 3.1. Dominant brGDGT sources associated with  $IIIa/IIa$  values, as observed in the modern system by Xiao et al. (2016), are marked in red.



**Figure S4.**  $\#rings_{tetra}$  versus BIT index. Colors mark intervals, as distinguished in Main Text Section 3.1. Values with  $\#rings_{tetra} = 0$  ( $n = 16$ ) relate to samples where none of the cyclic brGDGT peaks exceeded the maintained detection limit.



**Figure S5.** GDGT-2/GDGT-3 versus TEX<sub>86</sub> (a) and BIT index (b). Colors mark intervals, as distinguished in Main Text Section 3.1. Linear regression (blue dashed line), with its R-squared and P-values are displayed exclusively for the PreETM2 interval.



**Figure S6.** Amplitude comparison of ~100 kyr eccentricity-forced temperature variability between the ACEX and Site 1262 during the pre-ETM2 interval (54.1–54.5 Ma). Uncertainty range in the ACEX estimate represents the difference between SST ( $TEX_{86}^H$ , highest amplitude) and SubT ( $SubT_{100-250m}$ , lowest amplitude)  $TEX_{86}$  calibrations.