

# Sea surface temperature evolution of the Atlantic Ocean across the Eocene-Oligocene Transition

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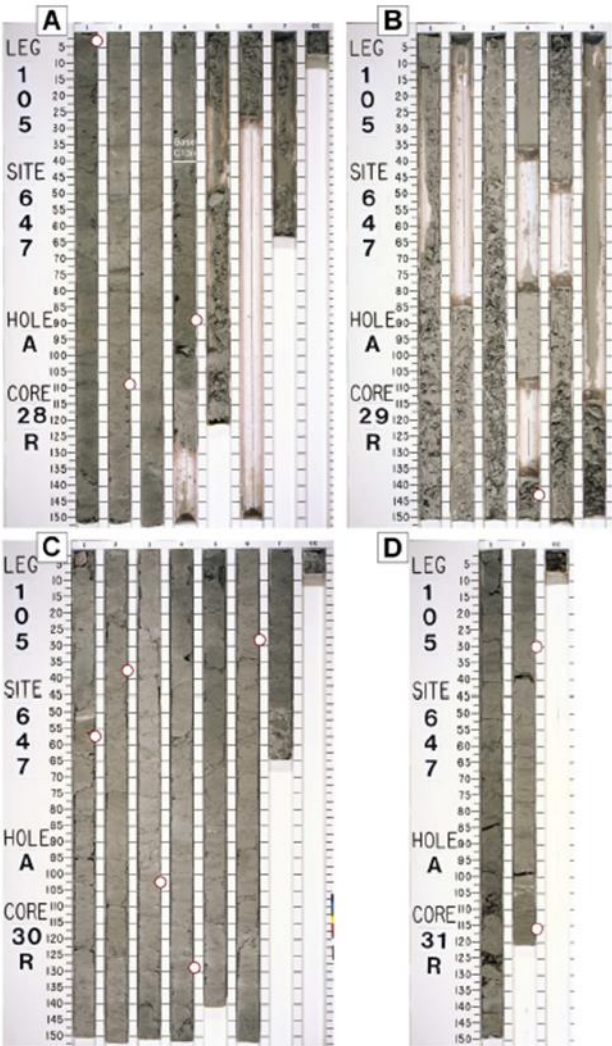
## 1. Terminology of the Eocene-Oligocene Transition.

In our paper we have applied terminology suggested in the recent review by Hutchinson et al. (Hutchinson et al., 2021). According to the revised definition, the EOT is understood as a phase of accelerated climatic and biotic change that began before and ended after the Eocene-Oligocene boundary (EOB). Stratigraphically the EOT is defined at its base by the extinction of the nannofossil *D. saipanensis* and at its top by the highest values of the benthic  $\delta^{18}\text{O}$  maximum referred to as EOIS, which postdates the base of magnetochron Chron C13n. On the most commonly used current timescale, 'Geological Timescale 2012' (GTS2012; Gradstein et al., 2012), the critical levels are calibrated as follows: extinction of *D. saipanensis* = 34.44 Ma; the EOB = 33.88 Ma (the extinction of *Hantkenina* spp.); the base of Chron C13n at 33.705, and the top of the EOIS = 33.65 Ma. Thus following the revised definition, the EOT has an estimated duration of 790 kyr. Furthermore, under this definition the 'Late Eocene Event' is in the base EOT.

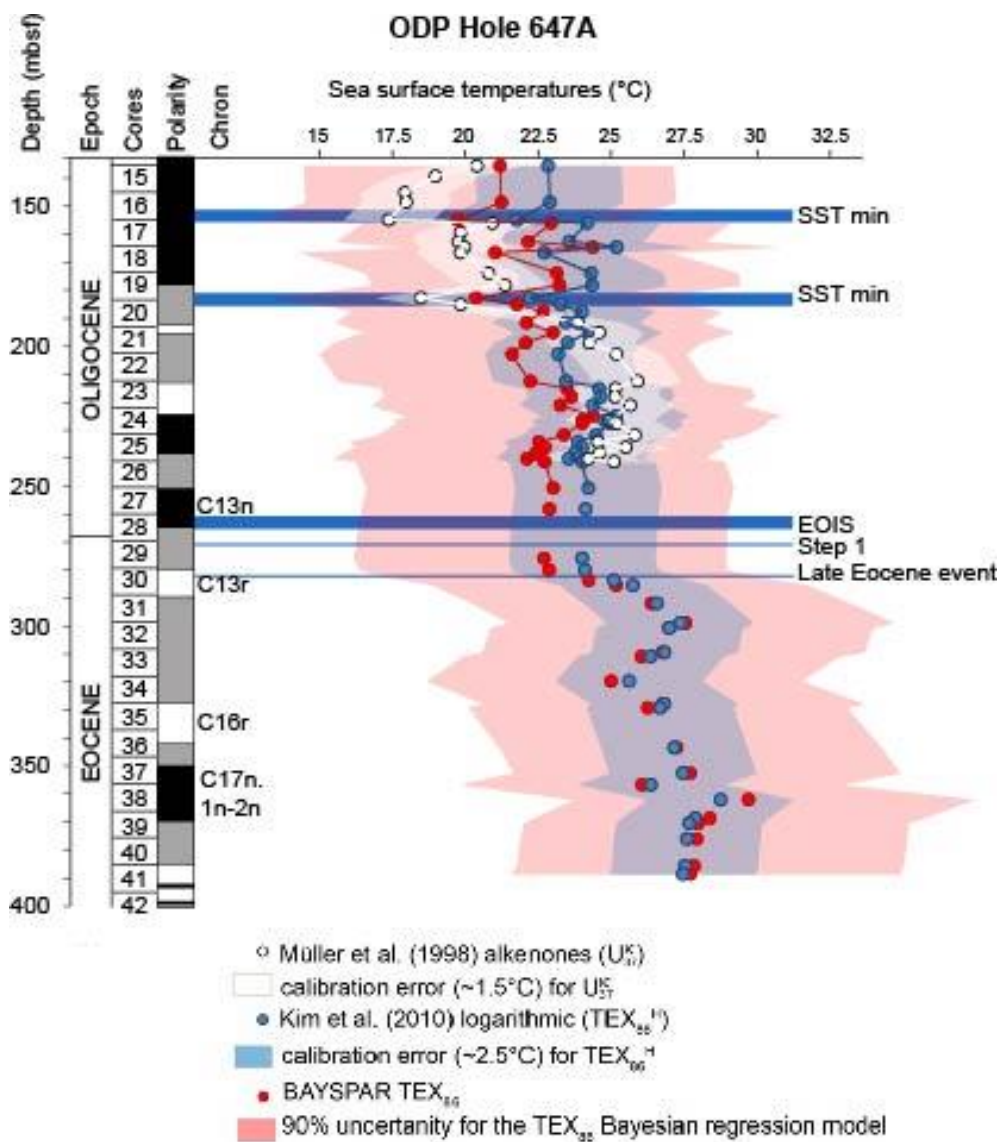
## 2. Lithostratigraphy of Site 647

30 The studied succession belongs to the Lithologic Unit III (Cores 105-647A-15R to 105-647A-55R; 135.4–530.3 mbsf) which is of the middle Eocene to early Oligocene age (Srivastava and Arthur, 1987) (Fig. S1). The Unit III is grayish-green, moderately to strongly bioturbated nannofossil claystone and nannofossil chalk (Srivastava and Arthur, 1987). The Subunit IIIA (Cores 105-647A-15R to 105-647A-22r; 135.4–212.3 mbsf) is rich in nannofossil and diatoms. The Subunit IIIB (Cores 105-647A-23R to 105-647A-25R; 212.3–241.1 mbsf) consists of biogenic claystone containing 25%-50% diatoms and sponge spicules. Calcareous nannofossil are present, but not significant. The Subunit IIIC (Cores 105-647A-26R to 105-647A-55R;

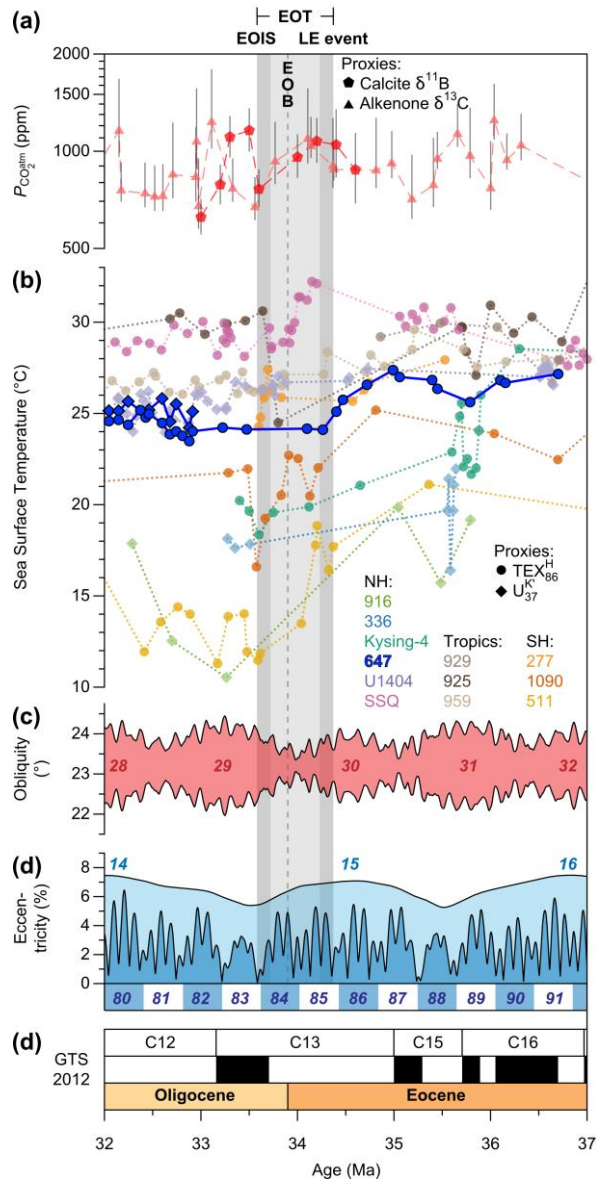
35 241.1–530.3 mbsf) is rich in calcareous nannofossils, on some levels in foraminifers, and yields relatively little biogenic silica. The EOT at Site 647A spans the Subunit IIIC.



40 **Figure S1:** Photographs of Cores 28 to 31 which span the Eocene-Oligocene Transition (EOT) in the ODP Site 647A. Positioning of samples for organic paleo-thermometry from these three cores are marked with white dots.



45 **Figure S2:** ODP Site 647: chronostratigraphy (Firth et al., 2013) and temperature data (this study) including calibration errors ( $U_{37}^K$  and  $TEX_{86}^H$ ) and 90% uncertainty bar for the Bayspar  $TEX_{86}$  calibration. Raw data can be found in the Supplementary Information file.

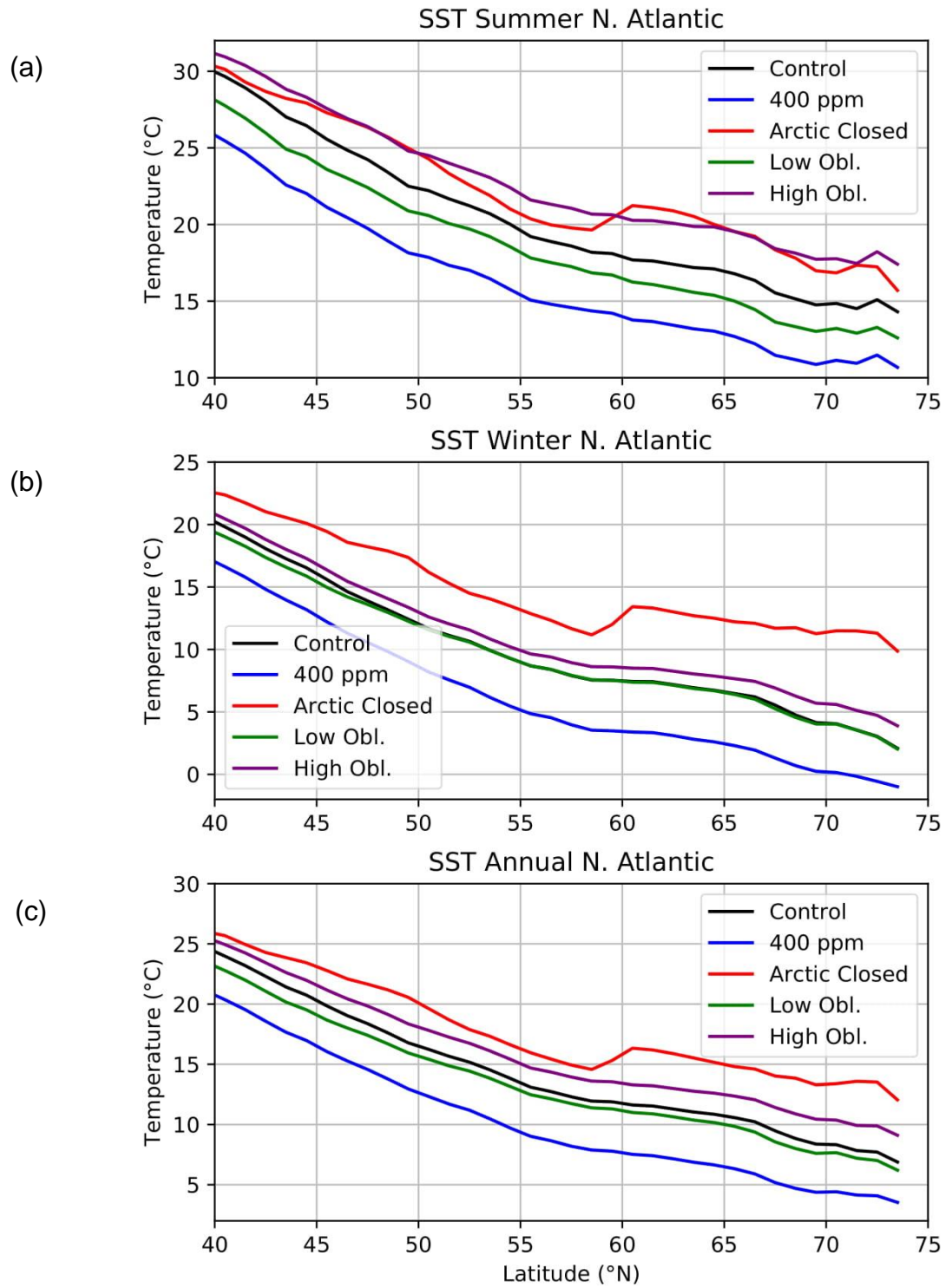


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49 **Figure S3:** Global SST evolution across the EOT. (a) Reconstructed  $P_{\text{CO}_2^{\text{atm}}}$  based on planktonic foraminiferal  $\delta^{11}\text{B}$   
50 (pentagons) (Pearson et al., 2009) and phytoplankton alkenone  $\delta^{13}\text{C}$  (triangles) (Pagani et al., 2011; Zhang et al., 2013).  
51 The effect of  $P_{\text{CO}_2^{\text{atm}}}$  on radiative forcing scales logarithmically. (b) Newly generated and published (Liu et al., 2009,  
52 2018; Wade et al., 2012; Inglis et al., 2015; Śliwińska et al., 2019; Houben et al., 2019) reconstructed SSTs based on  
53  $U_{37}^{k'}$  (diamonds) and  $\text{TEX}_{86}^{\text{H}}$  (circles) including Pacific Ocean Site 277 (cf. Fig. 3 in the main document). (c) ~1.2 Myr  
54 obliquity based astrochronozones. (d) ~2.4 Myr and 405 kyr eccentricity based astrochronozones. (e) Magneto- and  
55 chronostratigraphy based on the GTS2012 (Vandenbergh et al., 2012).

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**Figure S4:** Zonal mean SST averages for (a) summer, (b) winter and (c) annual mean.

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