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Glacial-interglacial shifts of the Subantarctic Front during MIS 11 near the Falkland Plateau

Preliminary thesis report with contradicting findings in the sea surface temperature reconstruction

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Introduction: The Subantarctic Front

The position of Subantarctic Front is largely expected to determine the connectivity between the Atlantic and the Pacific basins via the "cold water route"[1,2]. Glacial-interglacial variability of this connectivity due to Subantarctic Front migration may modify the throughflow of Pacific-sourced Antarctic Intermediate Waters (AAIW) into the South Atlantic and with that the heat and salinity budget of the Atlantic Meridional Circulation (AMOC)[2]. IODP site U1534 is ideally located in proximity of the Subantarctic Front north-east of the Drake Passage in the Atlantic section of the Southern Ocean (Fig.1) and is therefore most suitable to reconstruct shifts of the Subantarctic Front. This study focusses on the warm interglacial Marine Isotopic Stage 11 (474 – 424 ka, fig. 3b)[3,4], to give insight into Subantarctic Front migration and the evolution of the cold-water route during a previous warm climate interval that can serve as a analogy for near-future anthropogenic warming[4]. However, first results of sea surface temperature reconstructions are contradictory from what is expected as it follows a cooling pattern rather than a warming pattern during the warm interval.

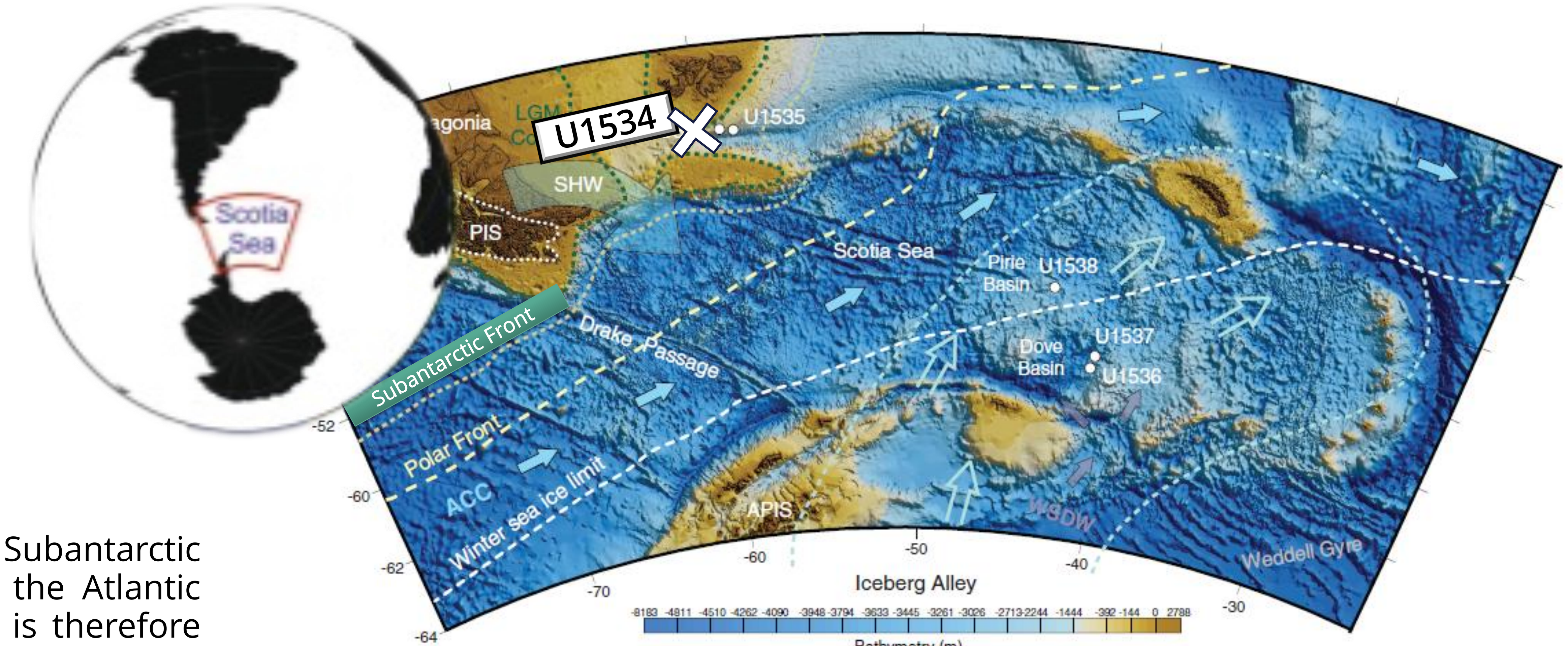

Figure 1
IODP Site U1534, located south of the Falkland Islands in proximity of the Subantarctic Front[1].

Methods: Dinocysts assemblages & TEX$_{86}$

For IODP Site U1534, dinoflagellate cyst paleo-assemblages are obtained (fig. 1). and will be compared to present-day biogeographic distributions of dinocysts, which are strongly bound to oceanic frontal systems[5,6]. Relative abundances of glycerol dialkyl glycerol tetraethers (GDGTs) are analysed for the TEX$_{86}$ proxy to obtain a sea surface temperature (SST) reconstruction[7,8].

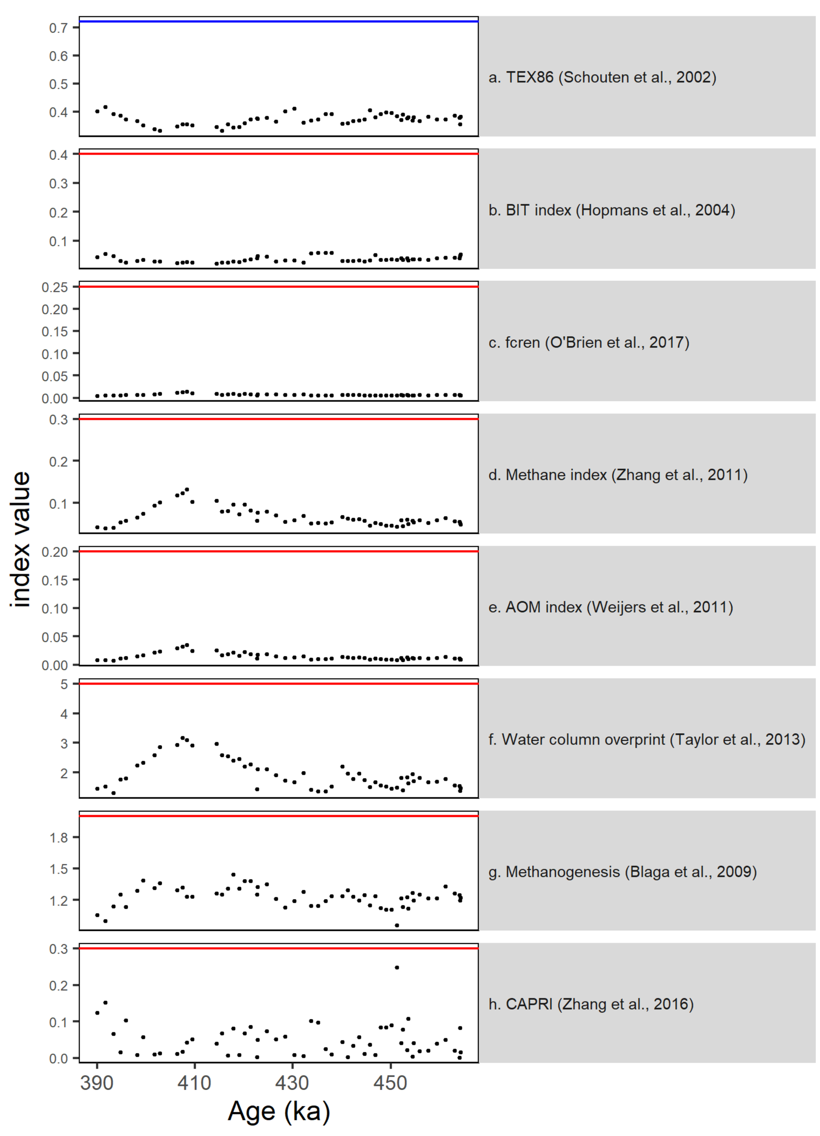

Figure 2
GDGT overprints.

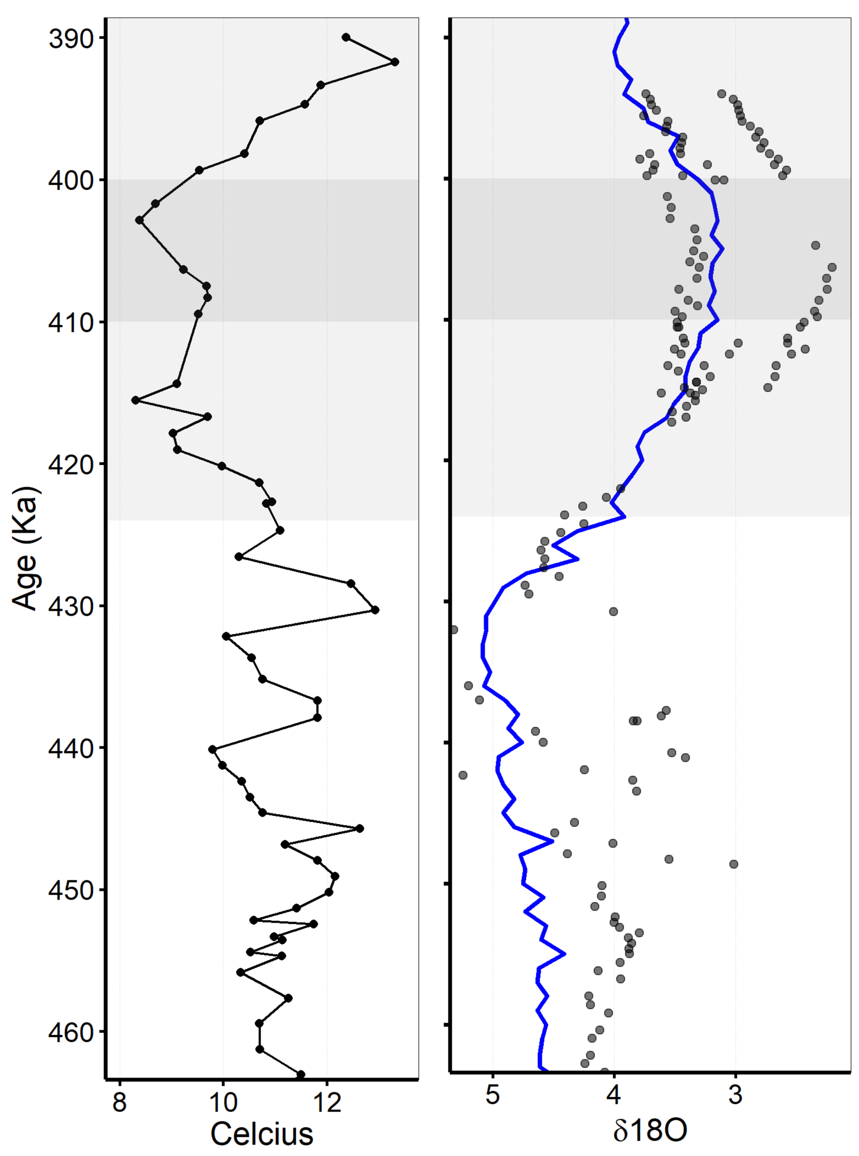

Figure 3 a
TEX$_{86}$ - sea surface temperature (low calibration)[8].

Figure 3 b
blue line indicates the LR04 stack[3], the grey dots are d^{18}O data from benthic foraminifers U1534.

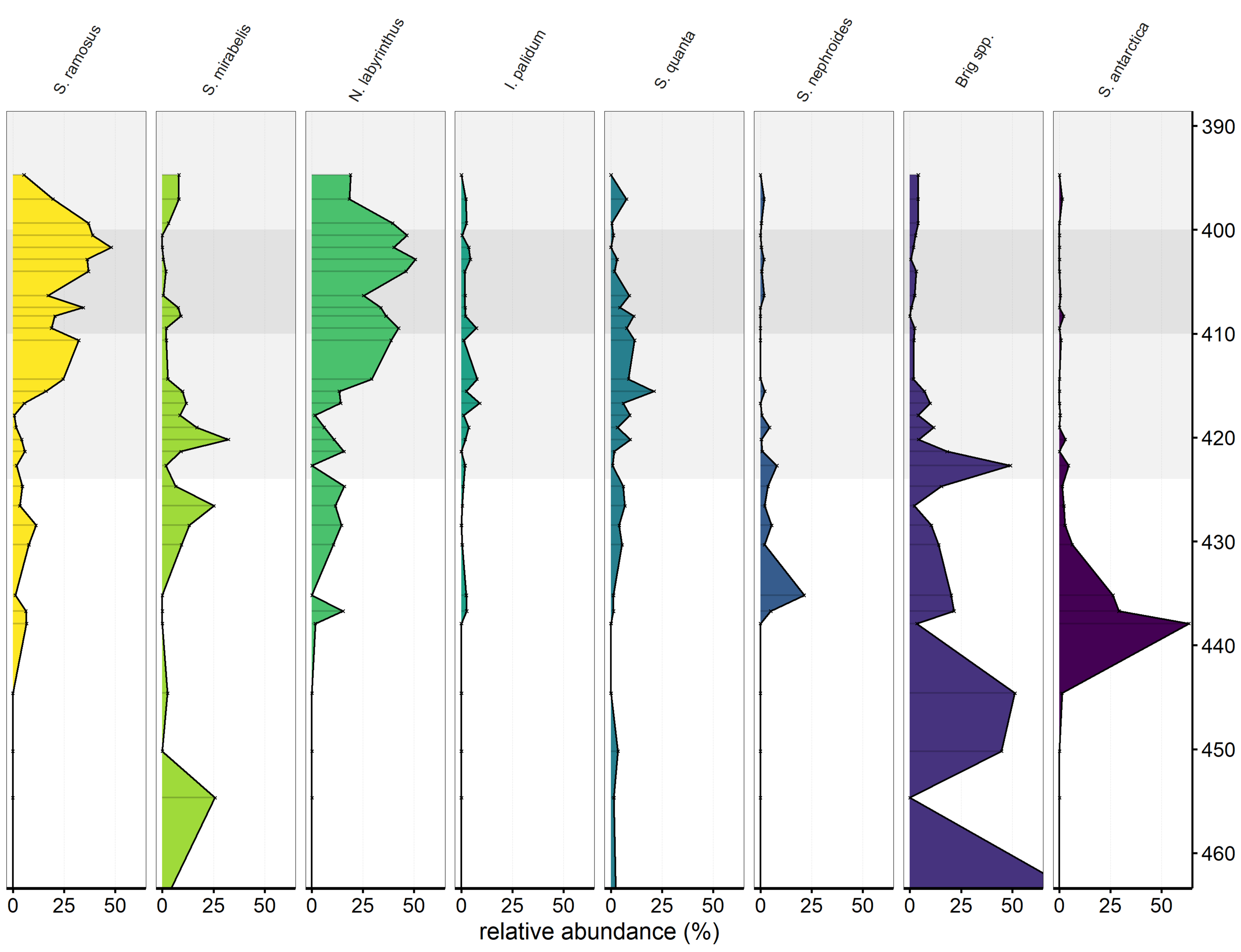

Figure 3 c
Summary of the main dinoflagellate cyst abundances from IODP site U1534. Grey area indicates Marine Isotopic Stage 11 (473-424 ka), dark grey area indicates warmer peak interglacial MIS11c (400-410 ka)[3].

Main findings TEX86

- All GDGT overprint indices are well below the threshold values, indicating that the TEX$_{86}$ proxy can indeed be used for SST reconstructions.
- However, SST results show a contradicting pattern from the d^{18}O record, which is not expected!
  - SST cooling during glacial-interglacial transition MIS 12 - 11.
  - SST warming at the end of MIS 11, when cooling is expected.

Main findings dinocysts

- *S. ramosus* and *N. labyrinthus* are abundant during warmer interglacial MIS11, in accordance to their modern biogeographic distribution.
- The peak in *S. antarctica* indicates the glacial MIS 12.
- Not yet included in the data visualisation: large amounts of reworked non-Pleistocene dinocysts, especially high relative abundances outside MIS 11.

References
1. Weber et al., 2019
2. Lamy et al., 2015
3. Lisiecki and Raymo, 2005
4. Candy et al., 2013
5. Zonneveld et al., 2003
6. Prebble et al., 2013
7. Huguet, 2007
8. Schouten et al., 2002

What's next?

Find out what the relative abundance of the reworked non-Pleistocene dinocysts to infer their influence. Do they skew the SST results and mirror the cooling-warming trends?