Reconstructing late Pleistocene surface ocean conditions offshore Tasmania, based on dinoflagellate cyst assemblages

Hanyu Li, Francesca Sangiorgi, Peter Bijl
Depth Earth Sciences, Utrecht University, Princetonlaan 8a, 3584CB Utrecht, The Netherlands
h.li11@students.uu.nl

Introduction: Pleistocene frontal shifts

The subtropical front (STF) represents the boundary between the subtropical gyre and sub-polar waters, and its latitudinal position is subject to potential alterations in response to climate change. The Pleistocene is characterized by rhythmic oscillations between glacial and interglacial states, but questions remain on how the ocean frontal position exactly responded to such oscillations. We aim to generate dinocyst assemblage data from ODP Site 1168 offshore western Tasmania, to reconstruct changes in the latitudinal position of the subtropical front between glacial and interglacial periods during the late Pleistocene (the work presented is in progress and shows preliminary results).

ODP Site 1168

The sediment samples from ODP Site 1168, situated on the western periphery of Tasmania, at middle bathyal depths approximately 70 kilometers away from the coastline[1]. The site is currently close to the subtropical front.

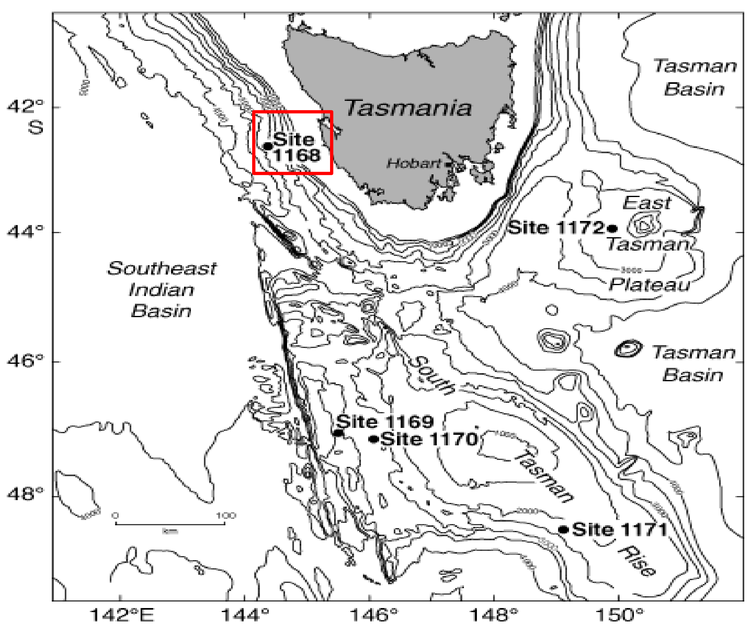

Figure 1: Location of site 1168[1].

Methods

We will build a dataset of dinoflagellate cyst species composition and relative abundances throughout the Late Pleistocene (1.25 Ma to Holocene). The dinocyst assemblages are then interpreted with a model that links modern dinocyst assemblages to local ocean conditions (sea surface temperature, salinity, nutrients, sea ice proximity)[2]. The results will be compared with other datasets from the same record to come to an integrated reconstruction of local ocean conditions and front movement[3]. Finally, we will compare our results to other regional reconstructions of STF migration for the same time interval.

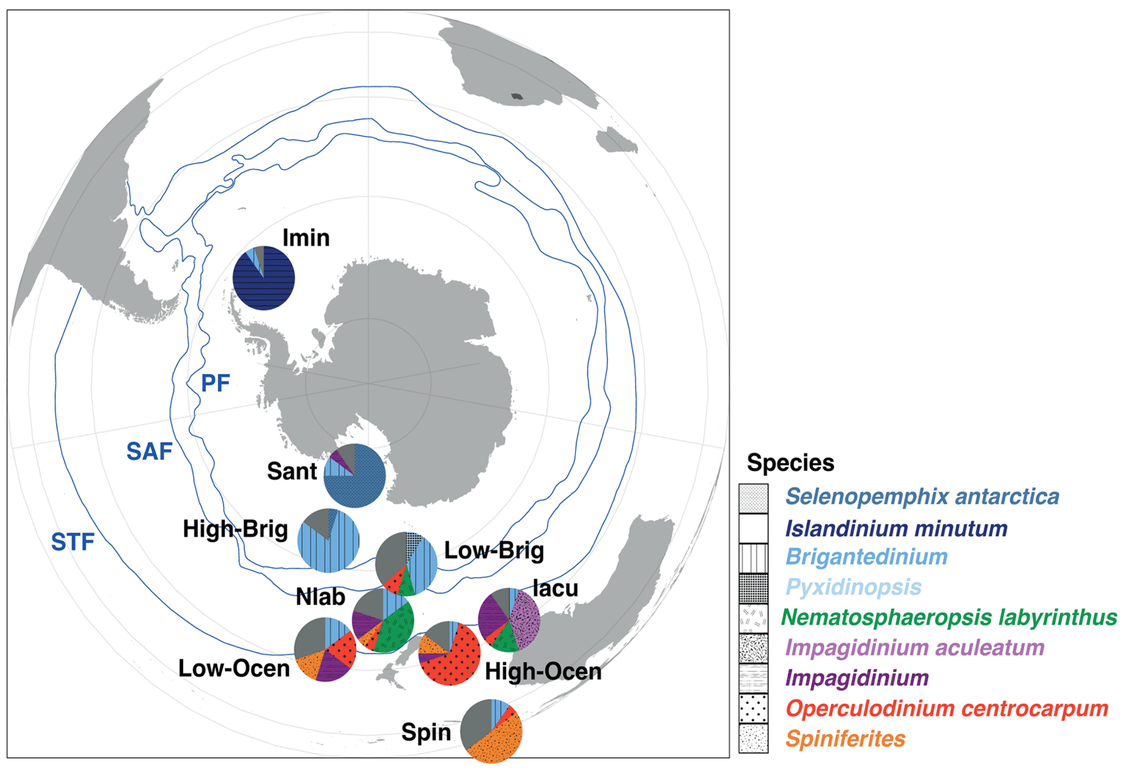

Figure 2: Schematic representation of the generalized biogeographic distribution of dinocysts in Southern Ocean surface sediments[2].

Results: Dinoflagellate cysts

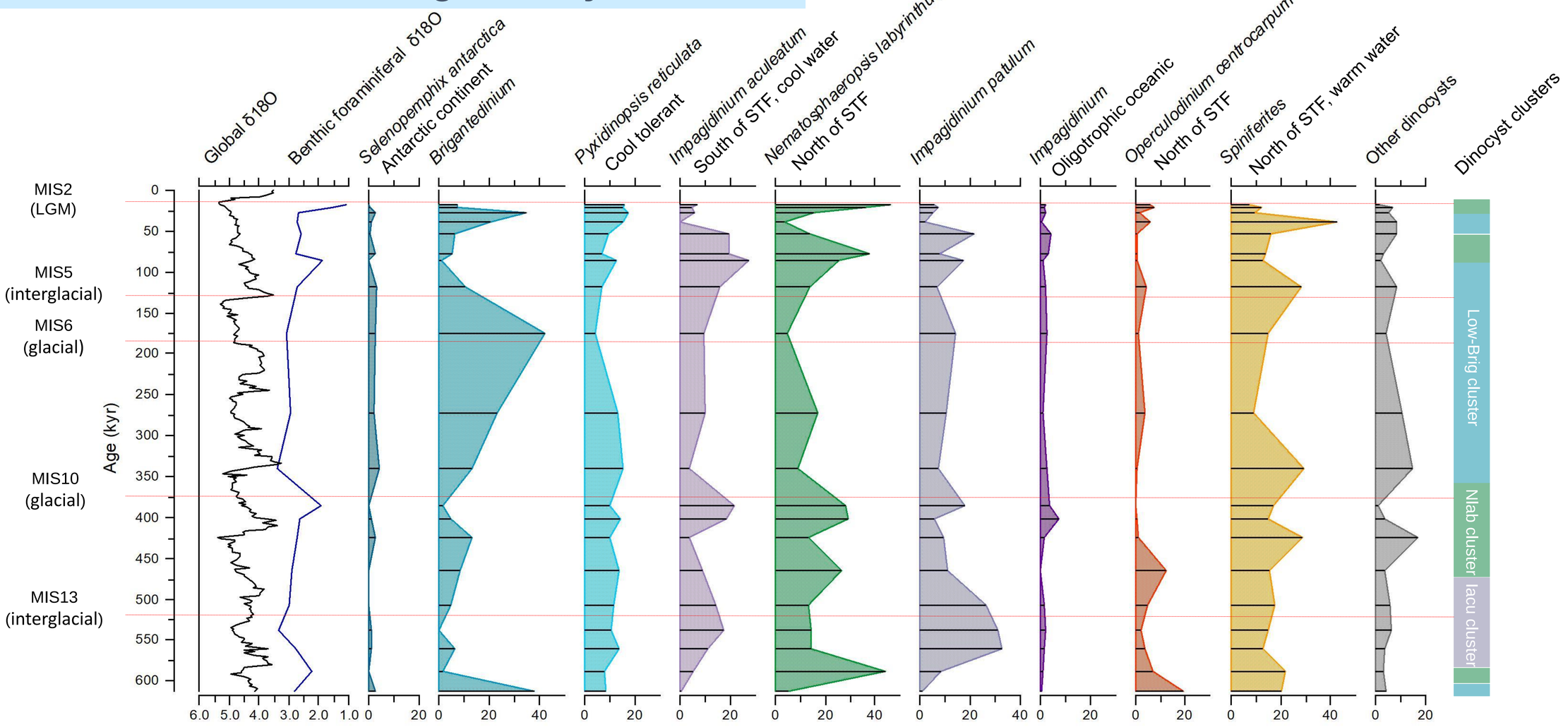

Figure 3: Relative abundances of dinocysts as a percentage of total dinocyst assemblage and benthic $\delta^{18}O$ records[4]; Dinocyst clusters based on figure 2.

In summary

- We observe ‘colder’ dinoflagellate cyst assemblages during glacials, and ‘warmer’ assemblages during interglacials.
- Based on this, we infer that the latitudinal change of the subtropical front responded to the glacial and interglacial cycles during the upper Pleistocene.
- The next step in this study is to extend this record further down, and then further interpret our data in more detail, e.g., also on species level.

References:

1. Shipboard Scientific Party, 2001. http://www-odp.tamu.edu/publications/189_IR/chap_03/chap_03.htm

2. Thöle, L. M., Nooteboom, P. D., Hou, S., Wang, R., Nie, S., Michel, E., Sauermilch, I., Marret, F., Sangiorgi, F., & Bijl, P. K. (2023). An expanded database of Southern Hemisphere surface sediment dinoflagellate cyst assemblages and their oceanographic affinities. *Journal of Micropalaeontology*, **42**(1), 35-56. 10.5194/jm-42-35-2023

3. Hou, S., Lamprou, F., Hoem, F. S., Hadju, M. R. N., Sangiorgi, F., Peterse, F., & Bijl, P. K. (2023). Lipid-biomarker-based sea surface temperature record offshore Tasmania over the last 23 million years. *Climate of the Past*, **19**(4), 787-802. 10.5194/cp-19-787-2023

4. Thomas Westerhold et al. ,An astronomically dated record of Earth’s climate and its predictability over the last 66 million years.*Science* **369**,1383-1387(2020).DOI:10.1126/science.aba6853

Universiteit Utrecht