

Highly variable surface-water conditions off southern Portugal during mid-Pleistocene Marine Isotope Stages 20 to 26 (790 – 970 ky)

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Introduction

The Mid Pleistocene Transition (MPT) was a global climatic event that occurred between 1250 and 700 thousand years (ky) ago. This period was characterized by a drastic change in the deep thermohaline circulation during the glacial periods that resulted in more intense and longer lasting glacial periods (changing from 40ky to 100ky cycles) and cooler sea-surface temperatures (SST). It is believed that the MPT may have been influenced by ocean-atmosphere system changes directly linked to an increased ice volume. A consensus point is that there was a pCO₂ reduction which in turn reduced the atmosphere's temperature, causing the expansion of continental ice sheets. In the North Atlantic, high-resolution records documenting the MPT's impact are still limited.

Objectives

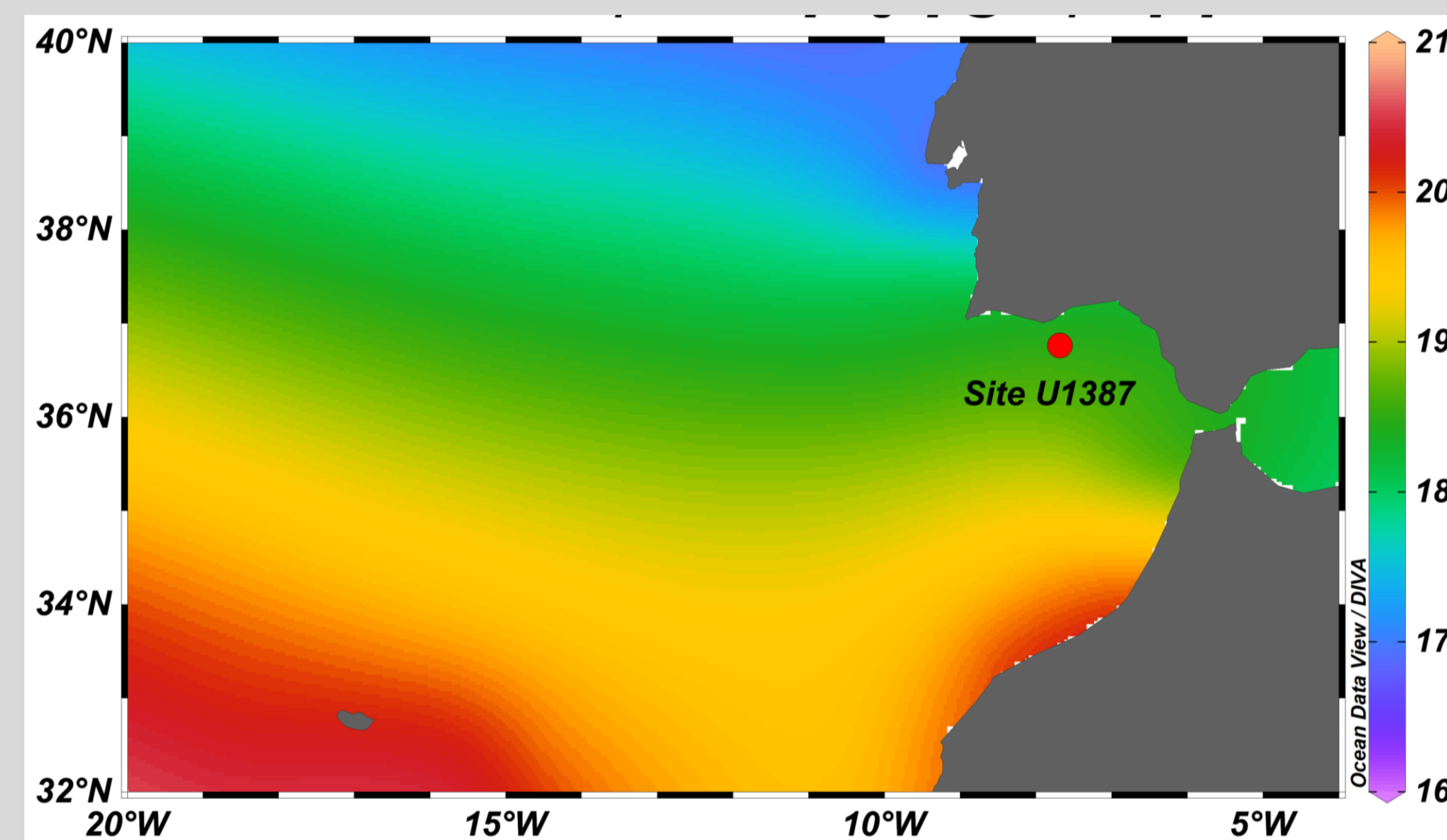


Figure 1: Mean summer SST (°C) from 1955 to 2012 (Data from World Ocean Atlas 2013) and location of IODP Site U1387.

The present study's objective is therefore to characterize surface-water variations at the mid-latitude southern Portuguese margin during the MPT. We are generating planktonic foraminifera faunal and related SST data for Integrated Ocean Drilling Program (IODP) Site U1387, retrieved from the Faro Drift in the Gulf of Cadiz, for the MPT interval from Marine Isotope Stage (MIS) 20 to MIS 25 at a temporal resolution of about 500 y. Nowadays, this site is dominantly influenced by subtropical surface waters. The SSTs are calculated with SIMMAX using the non-distance weighted output and the modern analog data base of Salgueiro et al (2010, 2014).

References

Salgueiro, E., Voelker, A.H.L., Abreu, L., Abrantes, F., Meggers, H., Wefer, G., 2010. Temperature and productivity changes off the western Iberian margin during the last 150 ky. *Quaternary Science Reviews* 29, 680-695.
Salgueiro, E., Naughton, F., Voelker, A.H.L., Abreu, L., Alberto, A., Rossignol, L., Duprat, J., Magalhães, V.H., Vaquero, S., Turon, J.L., Abrantes, F., 2014. Past circulation along the western Iberian margin: a time slice vision from the Last Glacial to the Holocene. *Quaternary Science Reviews* 106, 316-329.

Results and Discussion

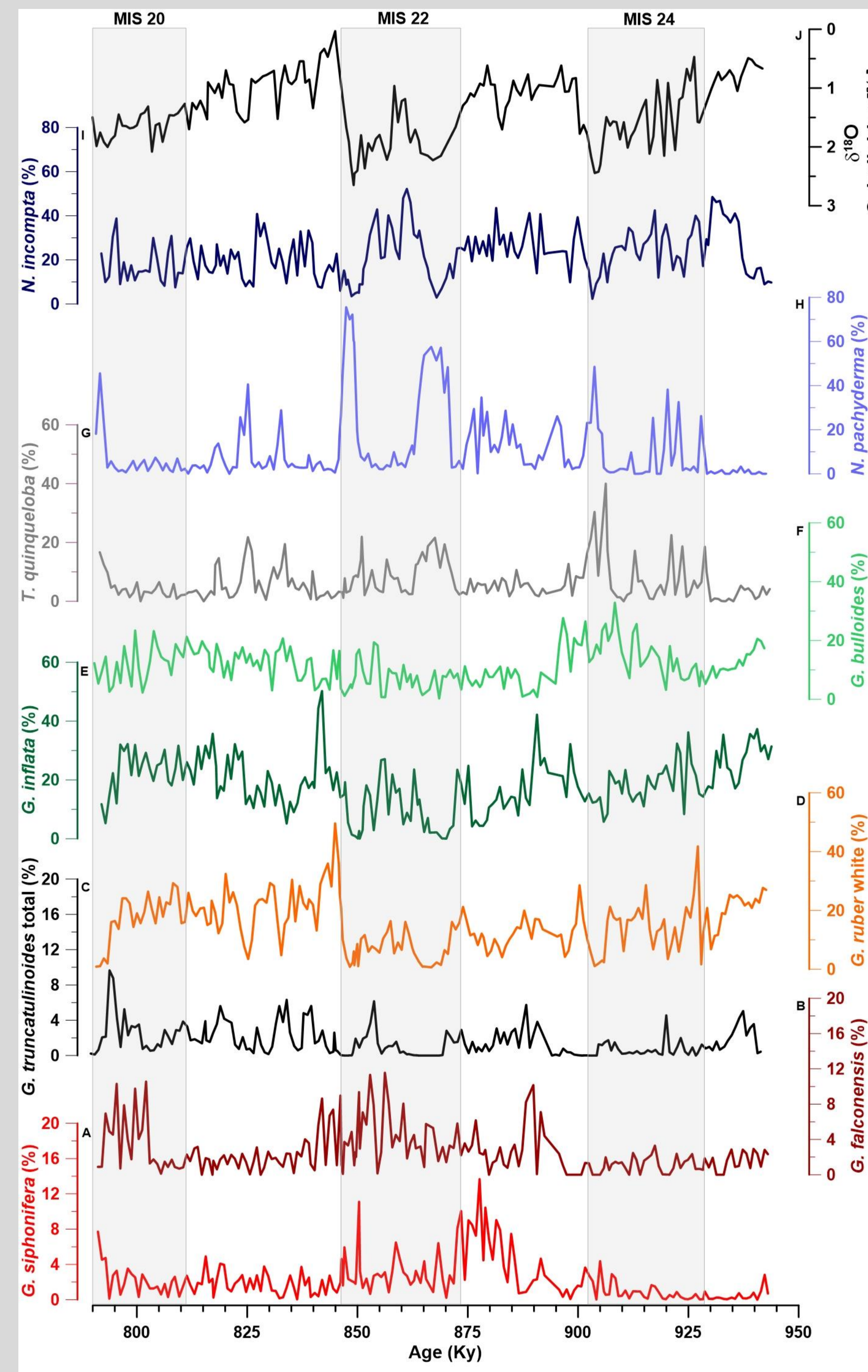


Figure 2: Abundance of planktonic foraminifera species at Site U1387. From bottom to top A: *Globigerinella siphonifera*; B: *Globigerina falconensis*; C: *Globorotalia truncatulinoides*; D: *Globigerinoides ruber* (white); E: *Globorotalia inflata*; F: *Globigerina bulloides*; G: *Turborotalita quinqueloba*; H: *Neogloboquadrina pachyderma*; I: *Neogloboquadrina incompta*; J: $\delta^{18}\text{O}$ of *Globigerina bulloides*.

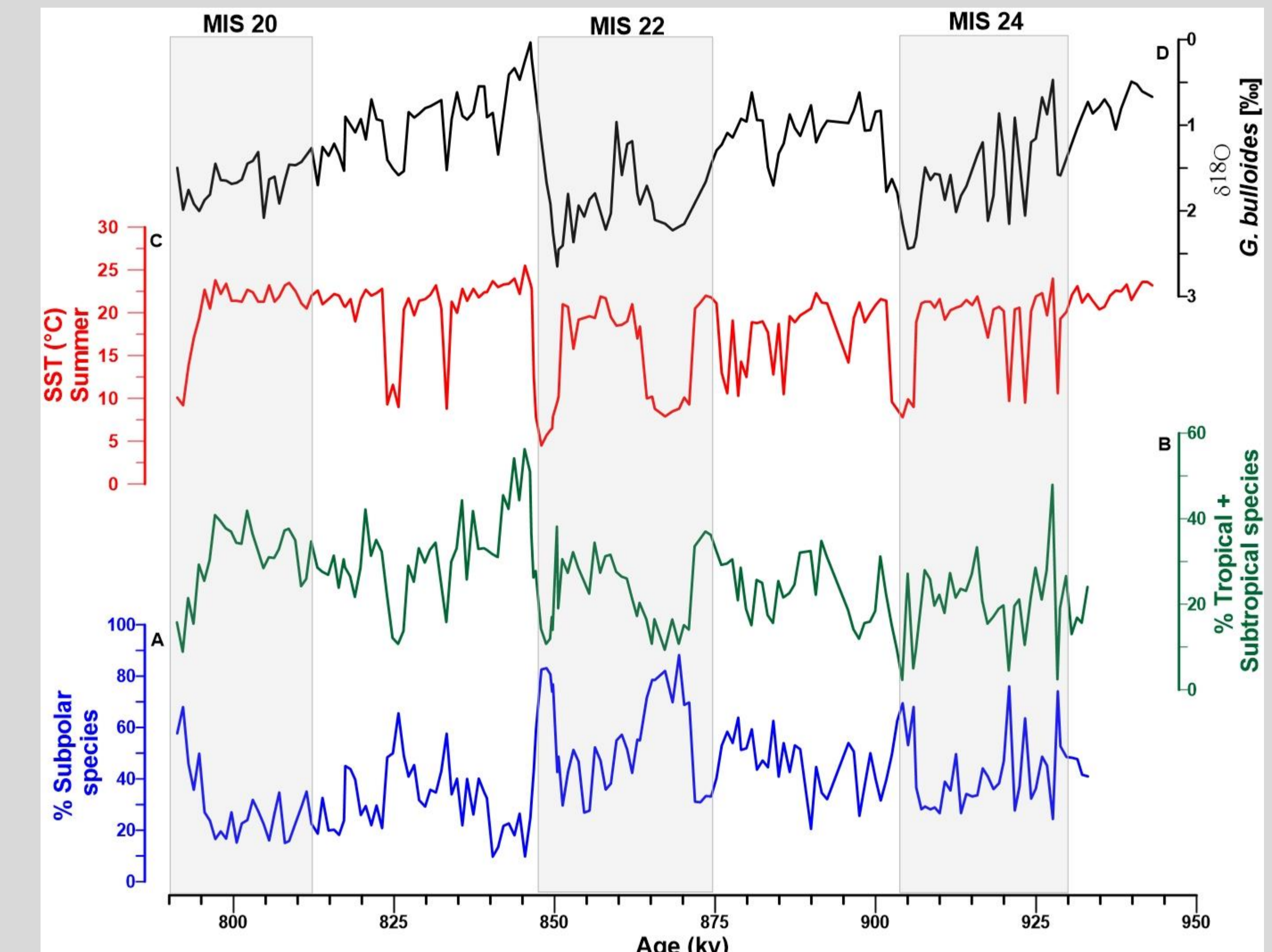


Figure 3: From bottom to top A : Percentage of subpolar species (*Neogloboquadrina incompta*, *Turborotalita quinqueloba* and *Neogloboquadrina pachyderma*) from Site U1387; B: Percentage of tropical and subtropical species (*Globorotalia crassaformis*, *Globigerinella siphonifera*, *Globigerinoides ruber* (white), *Globigerinella calida*, *Globorotalia truncatulinoides*, *Globigerina falconensis* and *Orbulina universa*) from Site U1387. C: SST (°C) from Site U1387 calculated with SIMMAX software D: $\delta^{18}\text{O}$ of *Globigerina bulloides*.

- Warmest summer SST between 23-25°C are recorded during interglacial MIS 21 when the fauna is dominated by tropical-subtropical species.
- During interglacial MIS 23, SST reached only 21°C with warm periods being interrupted by abrupt cooling events with minimum SST of 10°C in the later phase.
- Glacial MIS 22 has three phases starting and ending with extreme cold events separated by an interstadial period, during which SST increased up to 21°C.
- The impact of the second cold event was more extreme with SST dropping below 5°C for 4ky, related to the dominance of subpolar species. The transition from this cold event to MIS 21 interglacial conditions occurred within 1ky.
- Contrary to MIS 22, MIS 20 was a relative warm glacial period with SST dropping down to 9°C only during the terminal event at the MIS 20/19 transition.
- The glacial MIS 24 presents SST evolution similar to MIS 20 with the coldest period (near to 10°C) during the terminal event, but also shows some short-term coolings during the early phase.

The Site U1387 SST record reveals dominantly subtropical gyre influence interrupted by incursions of subpolar waters when the North Atlantic's subarctic front moved to its southernmost position during abrupt cold events.

Acknowledgements

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