Cold-water coral records of temperature and circulation in the Northeast Atlantic intermediate waters over the past 35 thousand years

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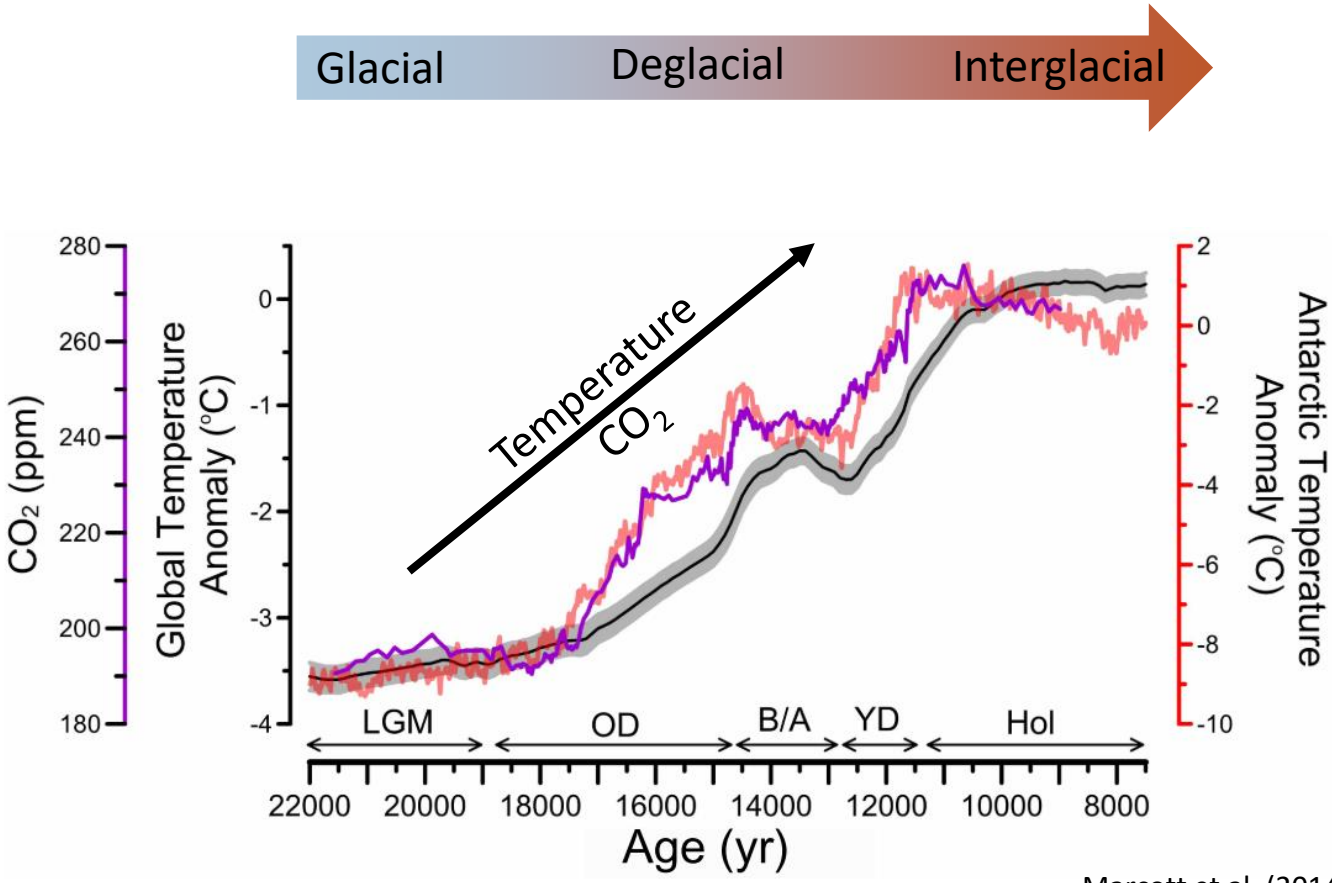
Motivation

- Better understand the link between ocean and climate

- Ocean regulates the climate:
  - Transport, absorption/release of heat and gases

- Paleorecords of climate system:
- Ice cores: correlated increase atmospheric temperatures and greenhouse gases (CO_2)



Marcott et al. (2014)

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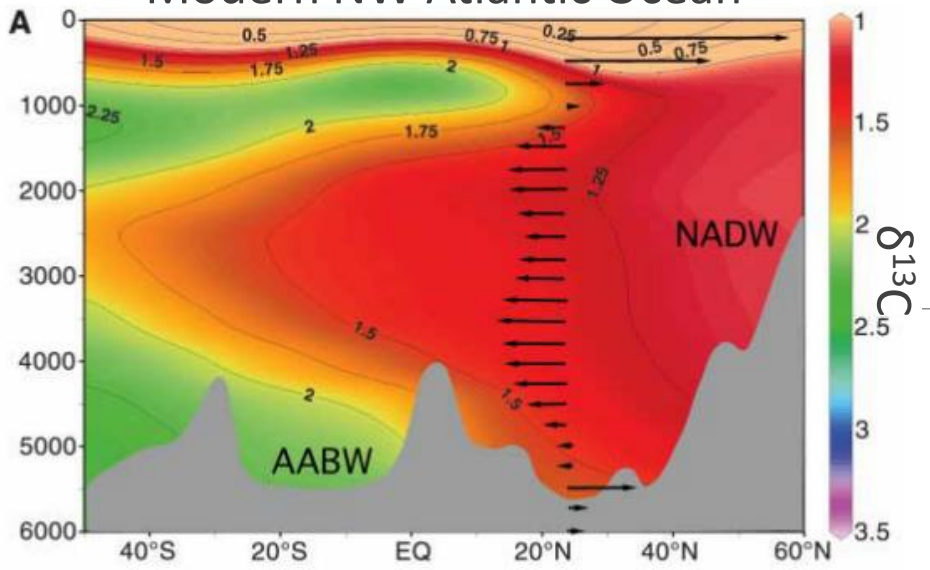
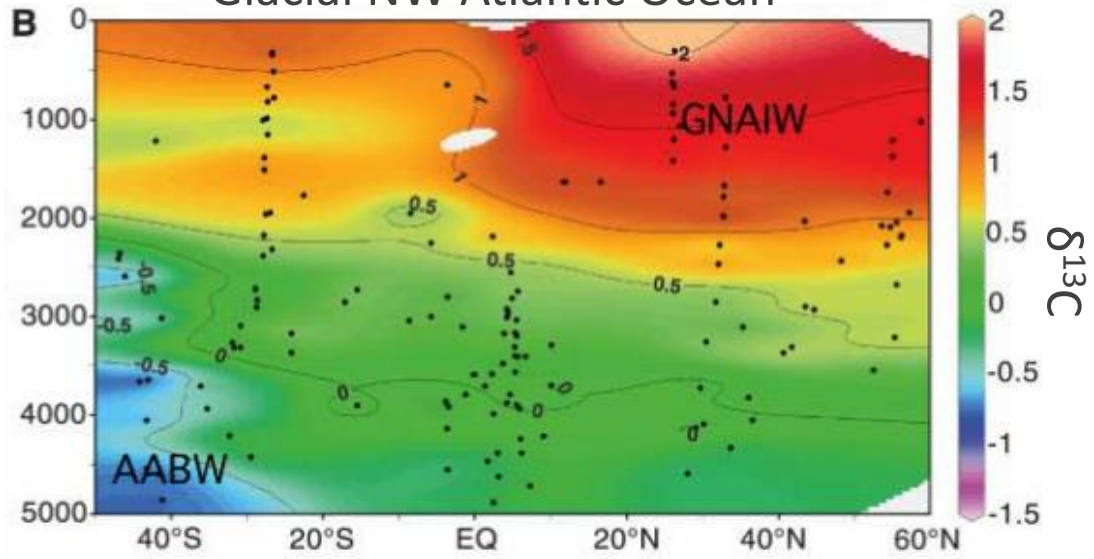
Motivation

- Past climate → oceanic changes
- Different ocean configuration

Modern NW Atlantic Ocean



Glacial NW Atlantic Ocean



Lynch-Stieglitz et al. (2007)

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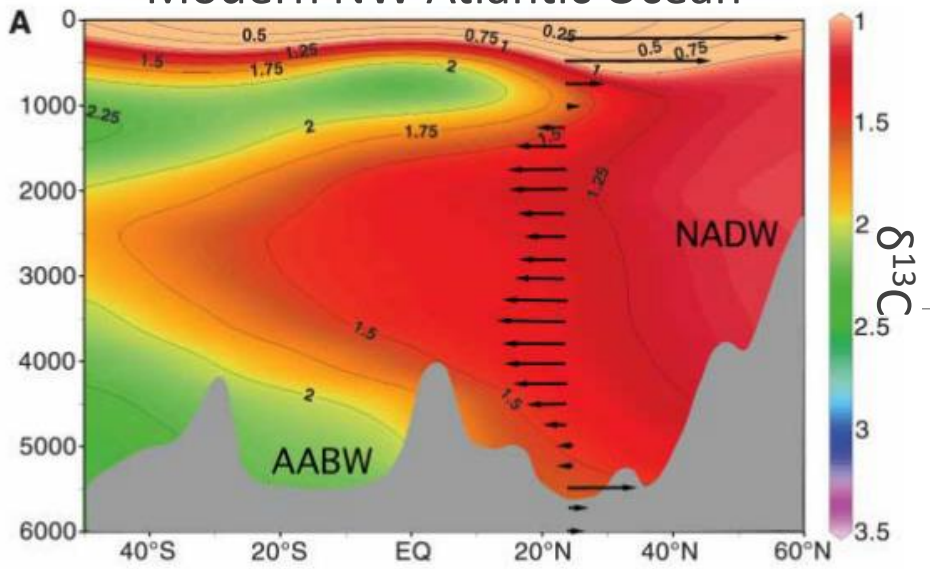
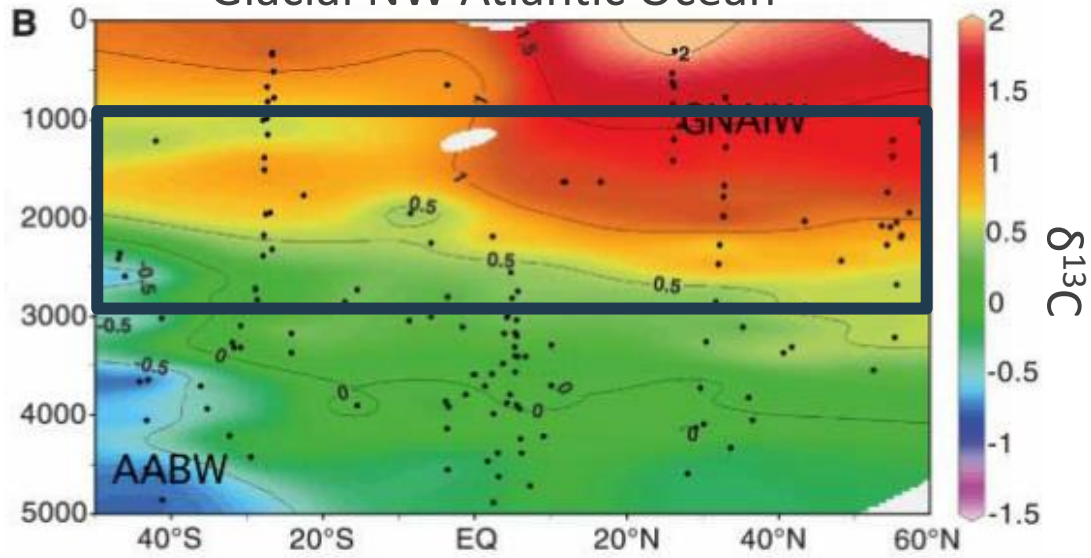
Motivation

- Past climate → oceanic changes
- Different ocean configuration
- **Need** of intermediate depths records

Modern NW Atlantic Ocean



Glacial NW Atlantic Ocean



Lynch-Stieglitz et al. (2007)

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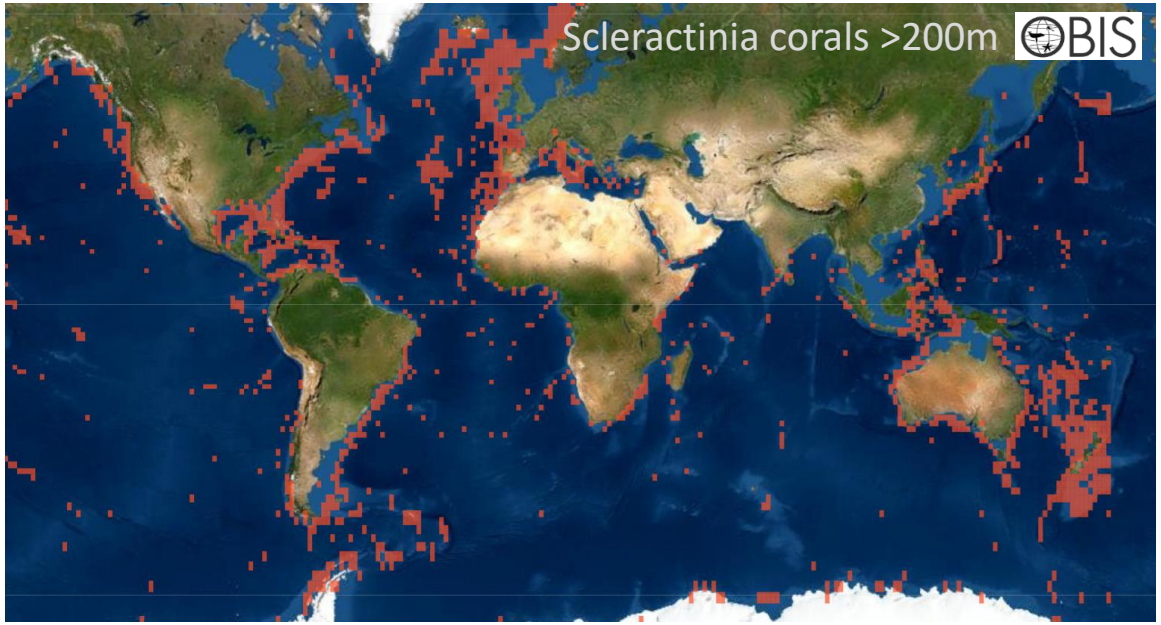
Cold-water corals: marine climatic archives

Live in **intermediate depths range** and **worldwide** distribution

Aragonitic skeleton → **Precisely and accurately dated**: U-Th dating

→ **Geochemical properties**: ^{14}C, elemental ratios

Javania sp.



Desmophyllum dianthus

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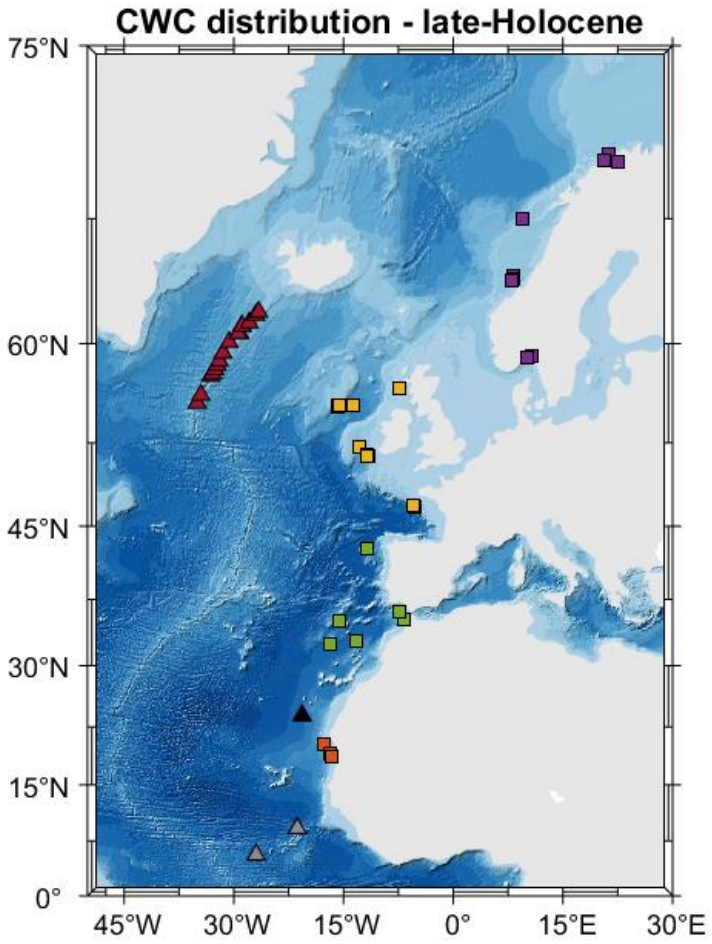
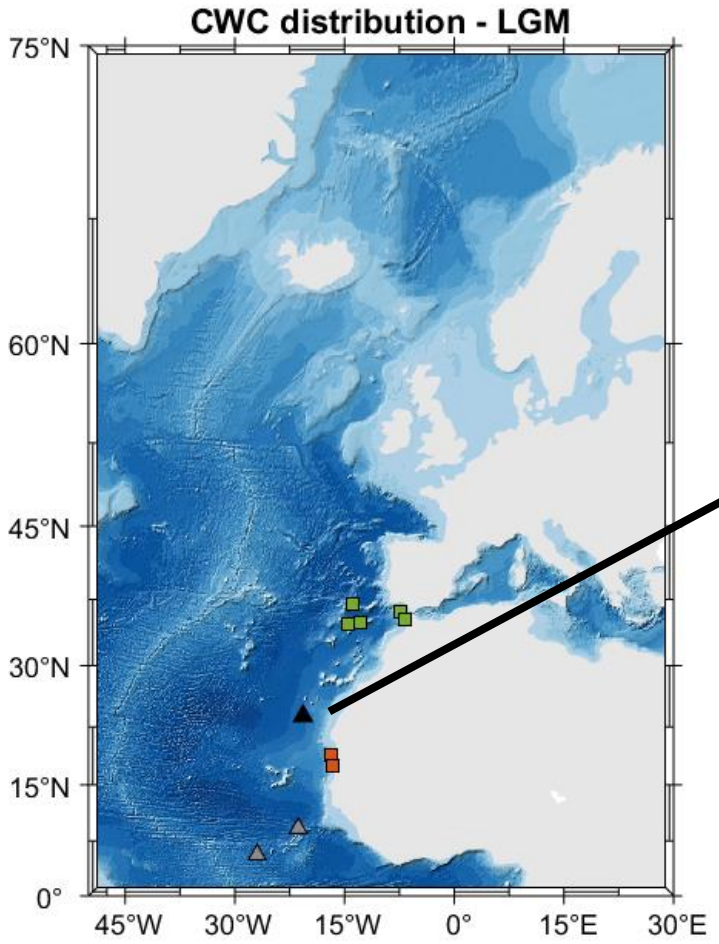
Past cold-water coral distribution – NE Atlantic

Interglacial



Glacial



Tropic Seamount (this study)

de Carvalho Ferreira et al. (in Review). *Deep Sea Research Part I*

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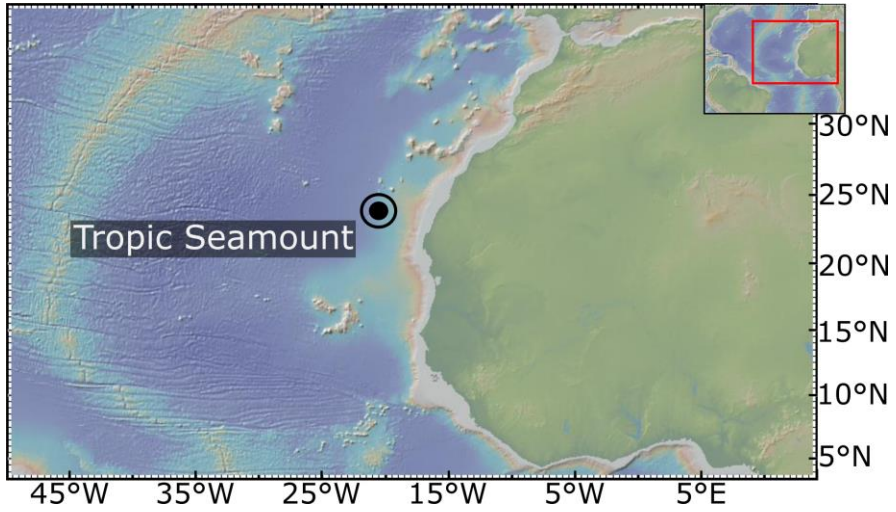
Tropic Seamount (23°N, 21°W)



- 36 corals from 970 m to 1800 m
- **U-Th ages**

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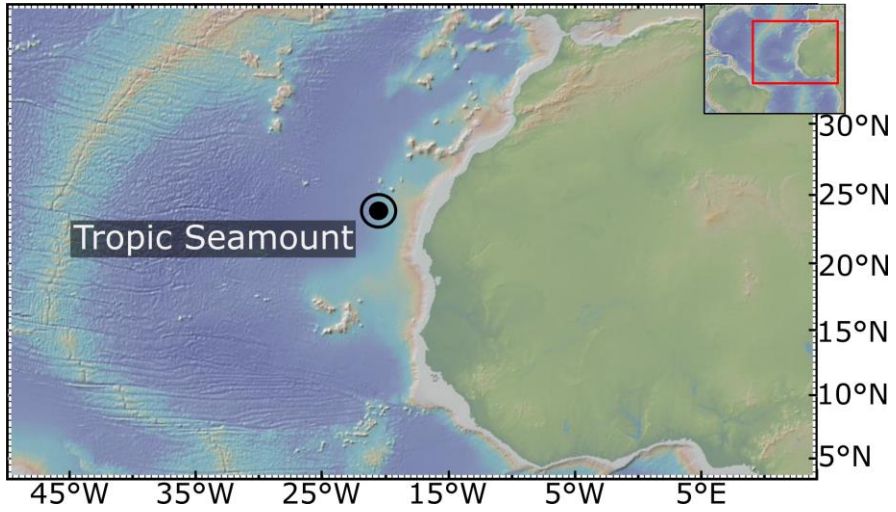
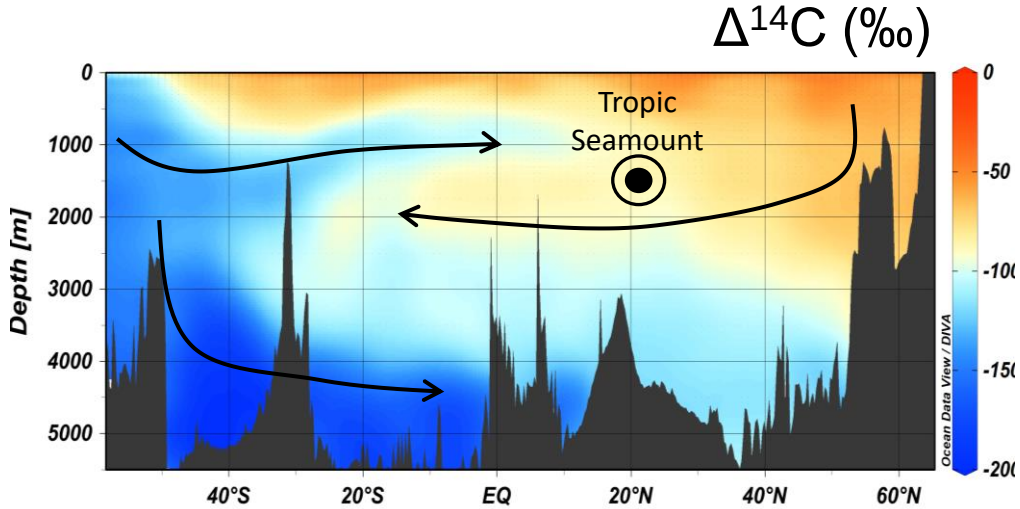
Tropic Seamount (23°N, 21°W)



- 36 corals from 970 m to 1800 m
- **U-Th ages**
- **Radiocarbon (oceanic circulation)**



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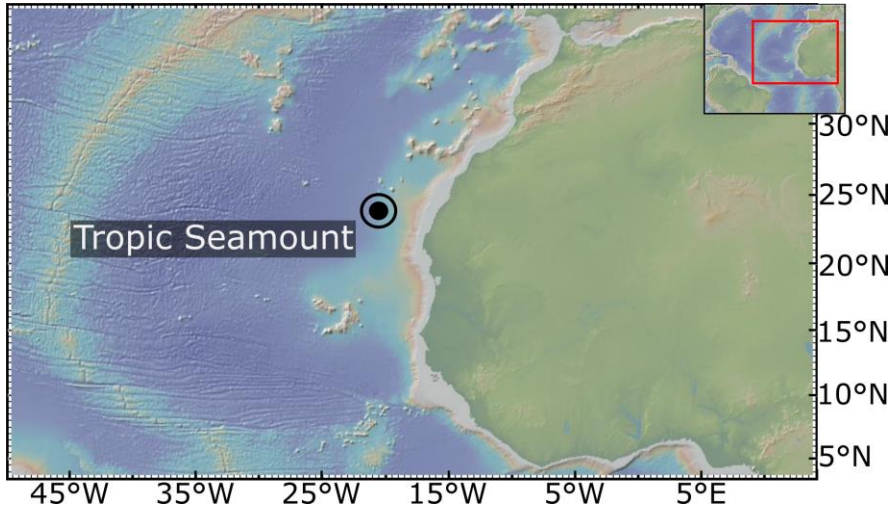
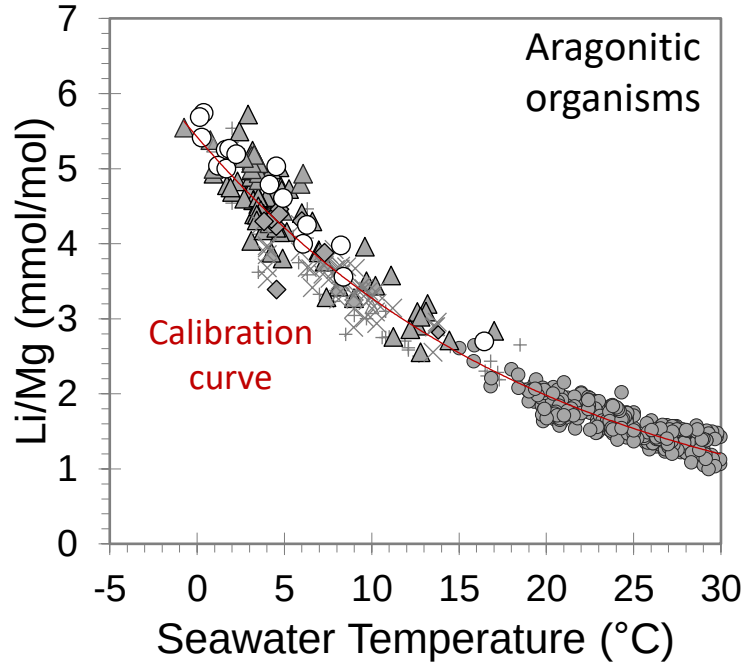


- 36 corals from 970 m to 1800 m
- **U-Th ages**
- **Radiocarbon**
- **Li/Mg (temperature)**



Li/Mg = 5.42 $e^{(-0.05\ \mathbf{T})}$

Stewart et al. (2020)

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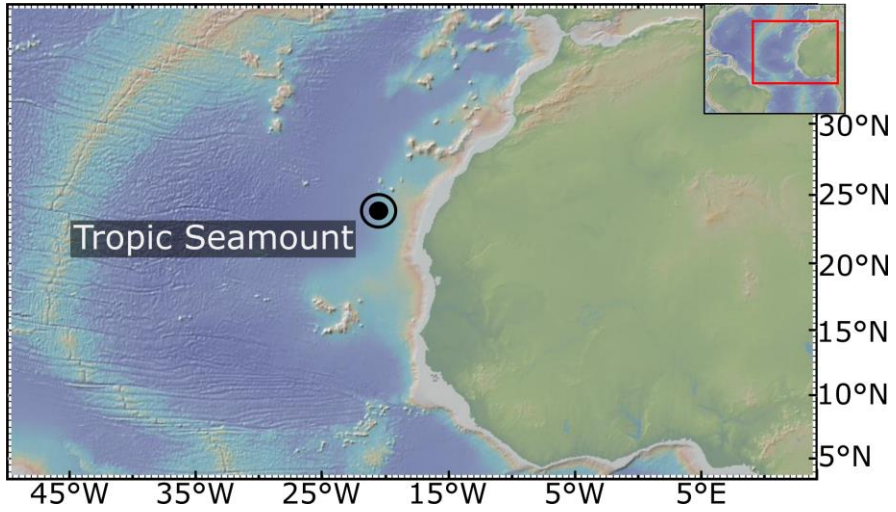
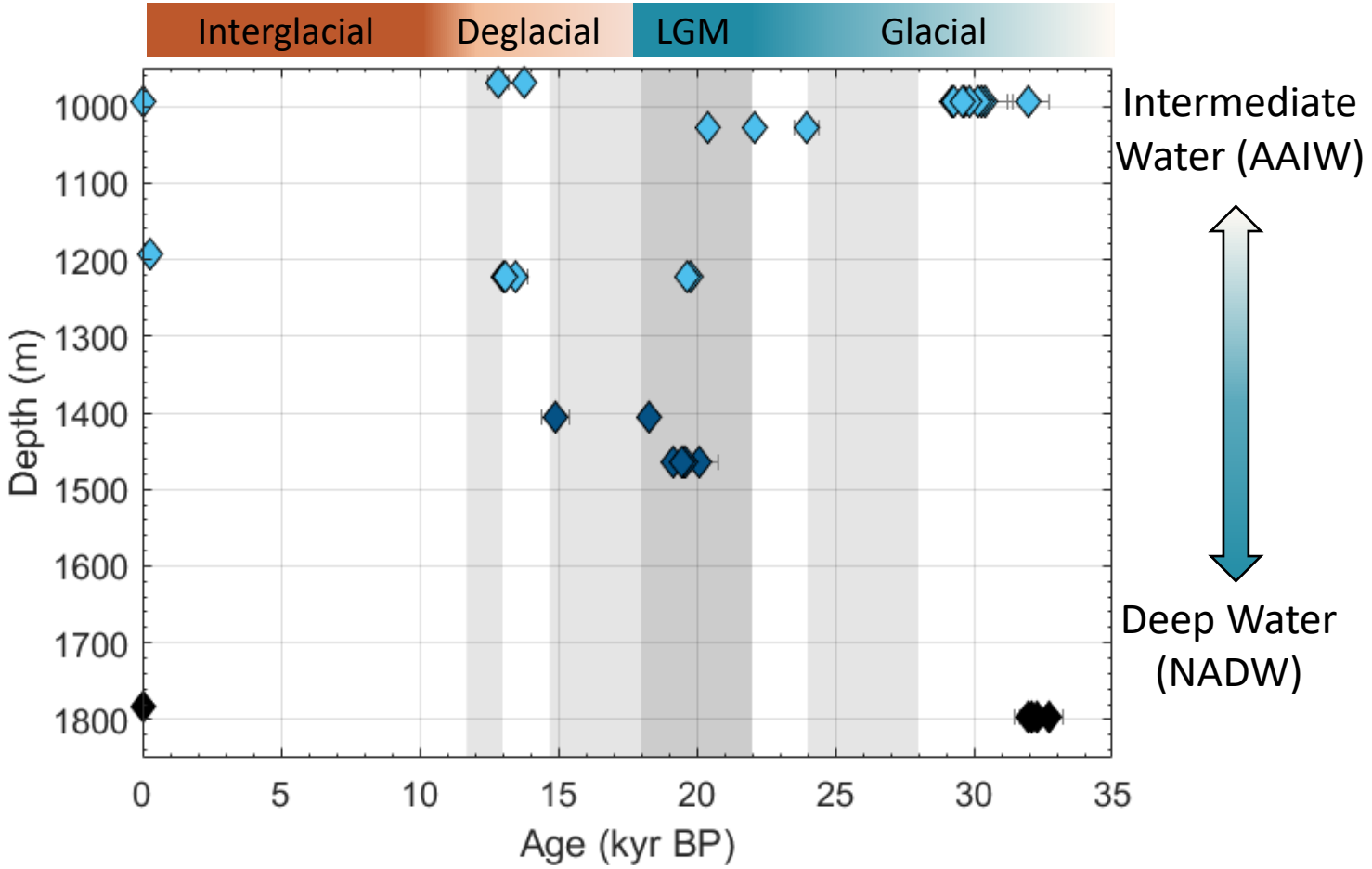
Tropic Seamount
U-Th ages





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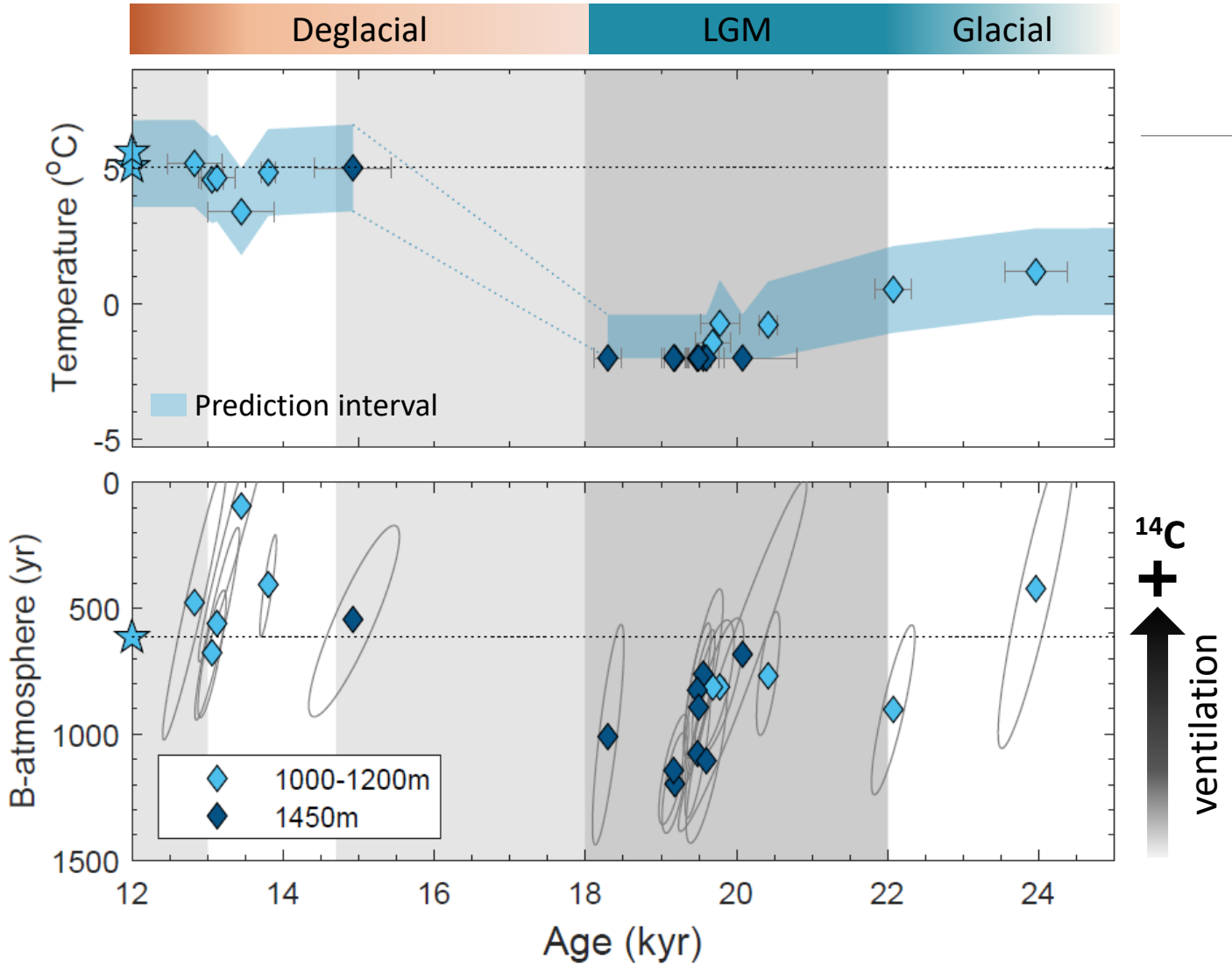
Tropic Seamount
Fossil record



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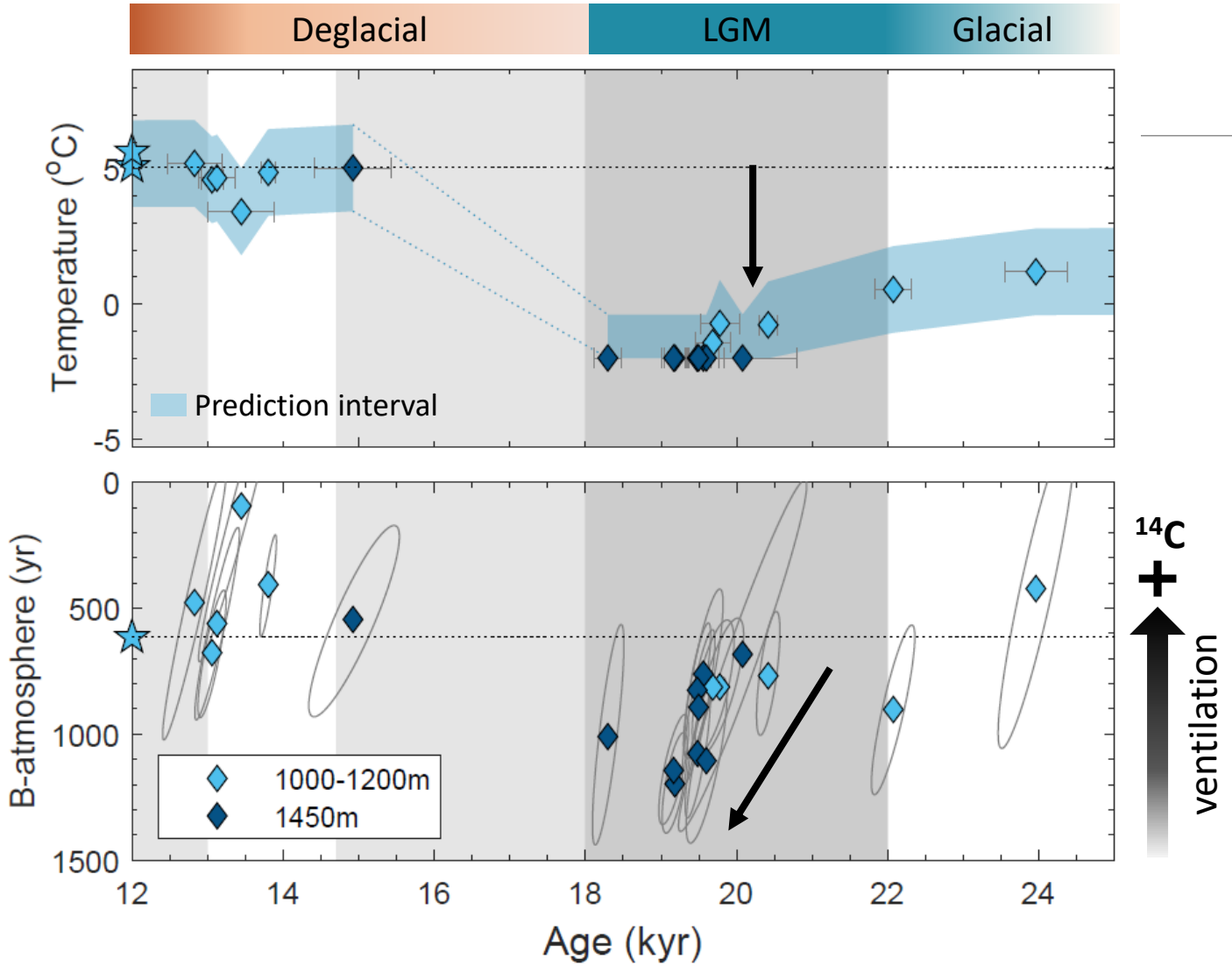

- **Last Glacial Maximum (LGM):**
  - Rapid ^{14}C decrease
  - Cold temperatures

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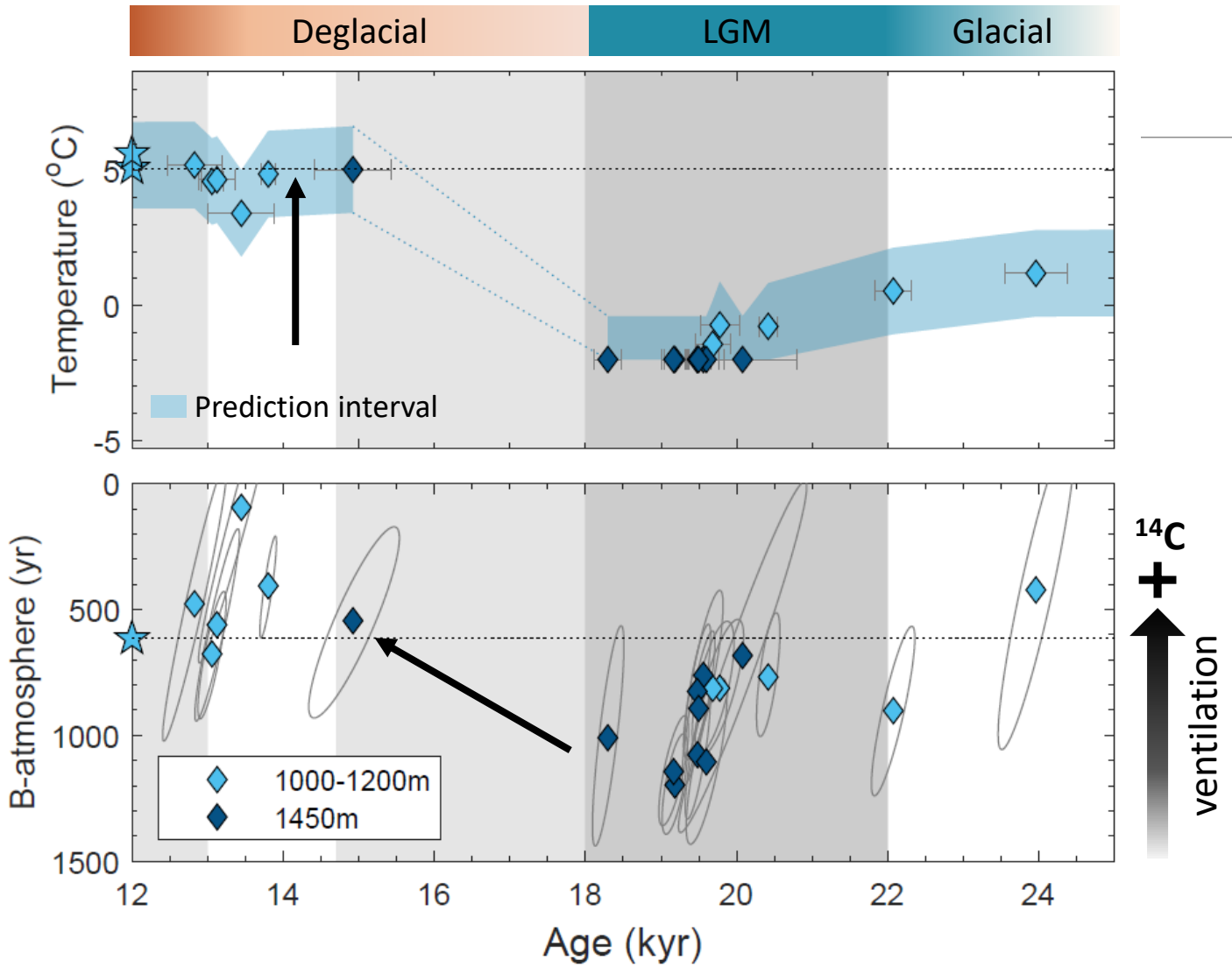
Tropic Seamount
Fossil record



- **Last Glacial Maximum (LGM):**
  - Rapid ^{14}C decrease
  - Cold temperatures

- **Deglaciation:**
  - Modern-like ^{14}C
  - Modern-like temperatures (~5°C)

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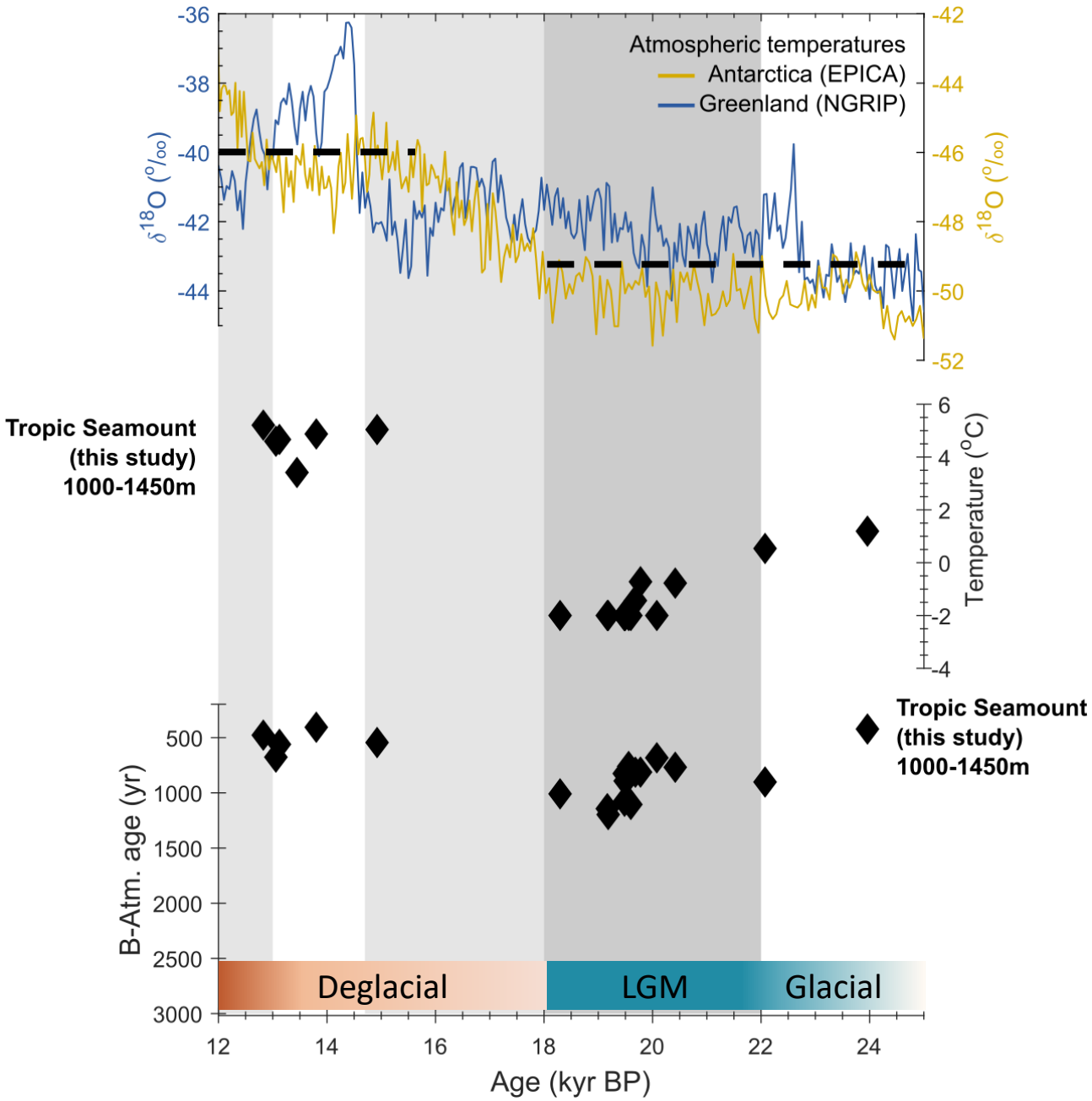

Discussion

- **Glacial vs deglacial:**
  - Agreement with atmospheric records

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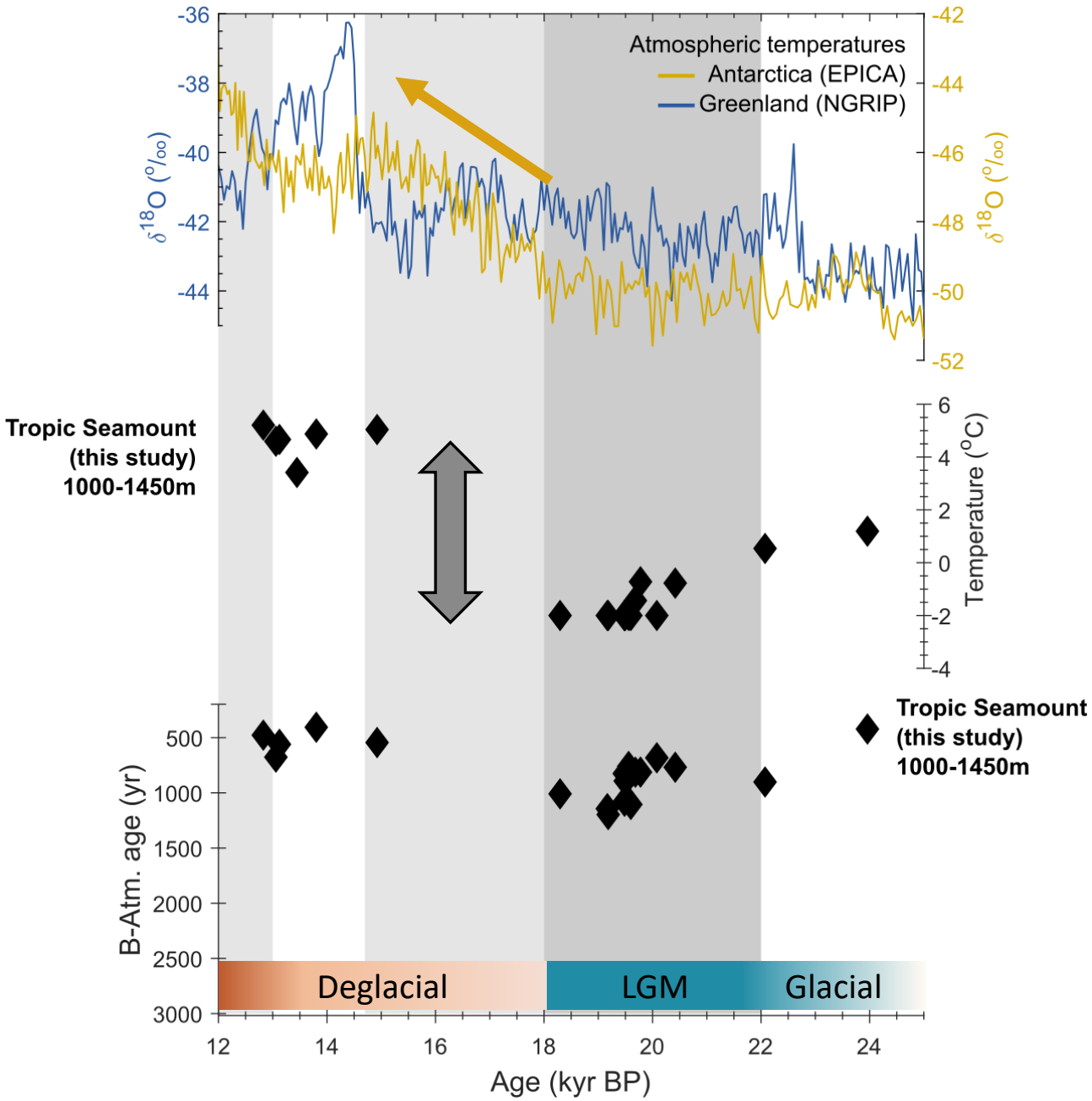

Discussion

- **Glacial vs deglacial:**
  - Agreement with atmospheric records
- **Deglaciation:**
  - Warmer temperatures **contemporaneous** with warming atmosphere at Southern Hemisphere

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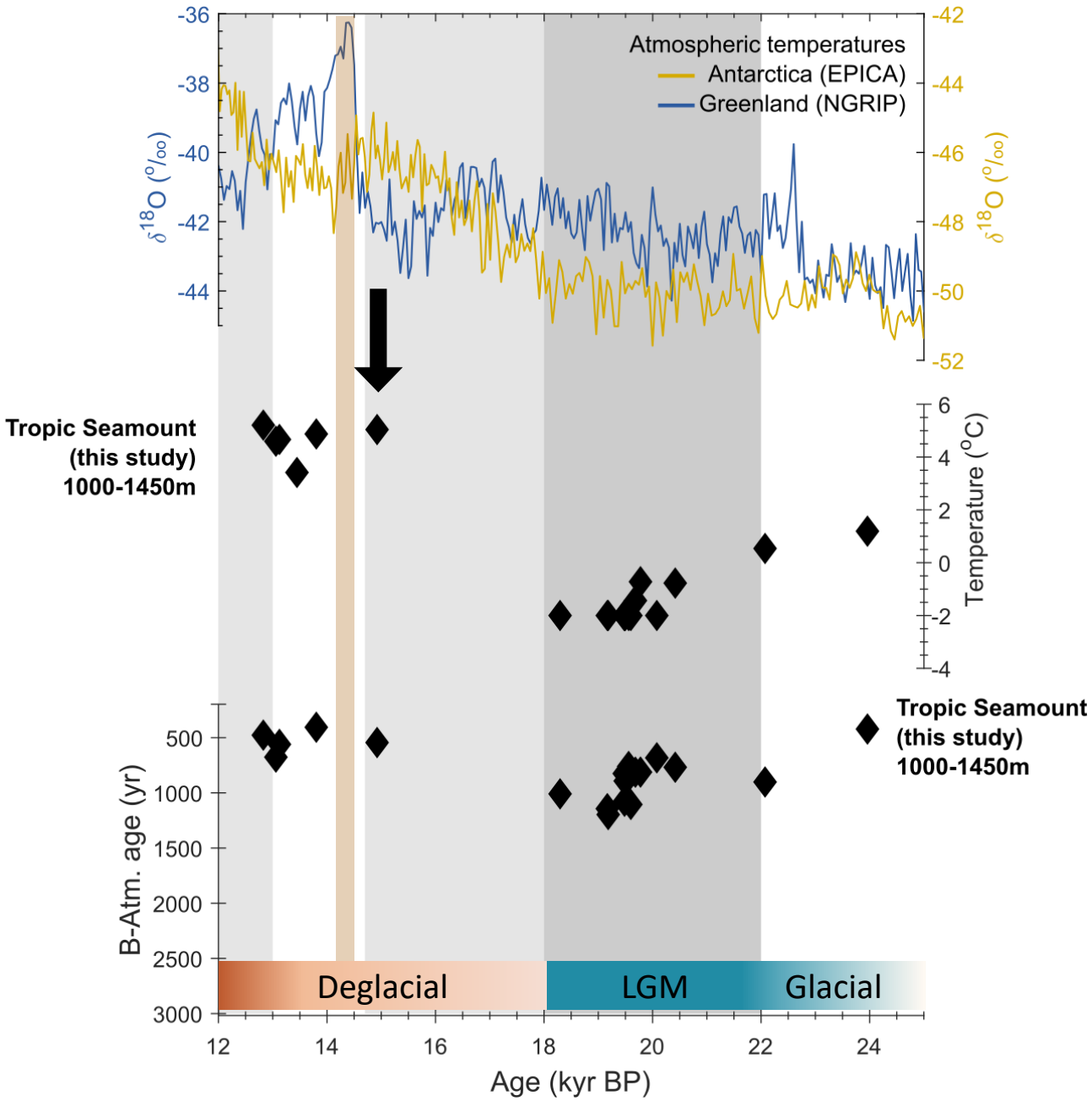

Discussion

- **Glacial vs deglacial:**
  - Agreement with atmospheric records
- **Deglaciation:**
  - Warmer temperatures **contemporaneous** with warming atmosphere at Southern Hemisphere
  - Intermediate ocean warmer **before** warming peak at Northern Hemisphere

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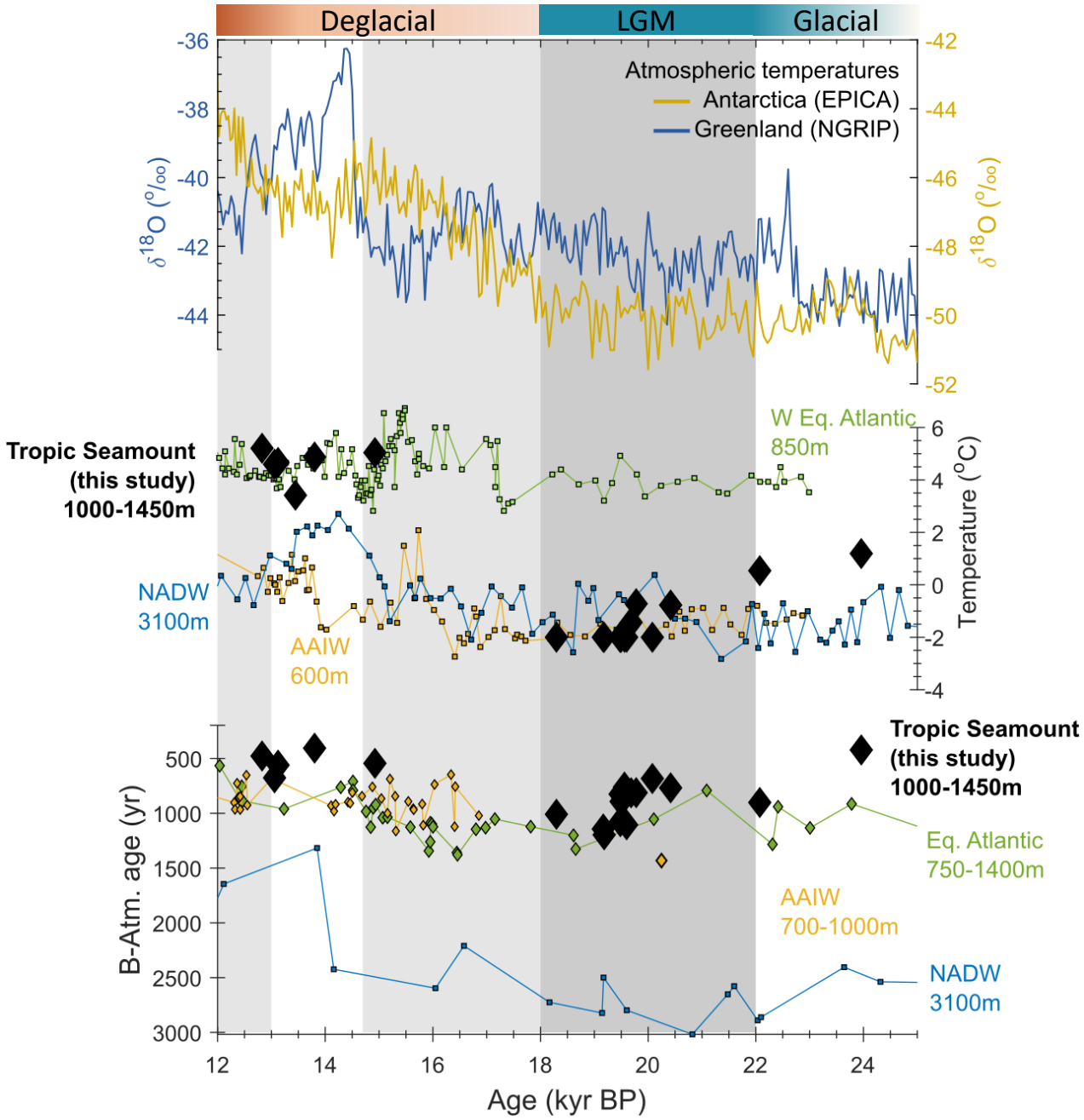

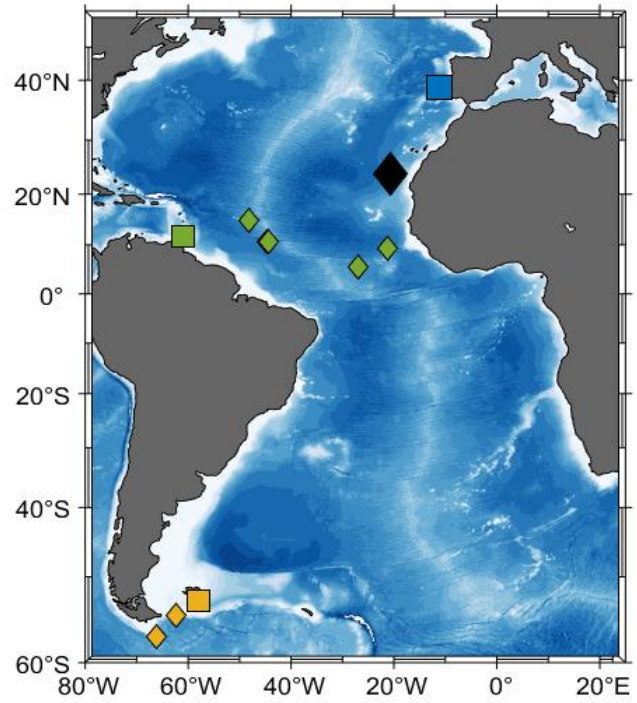

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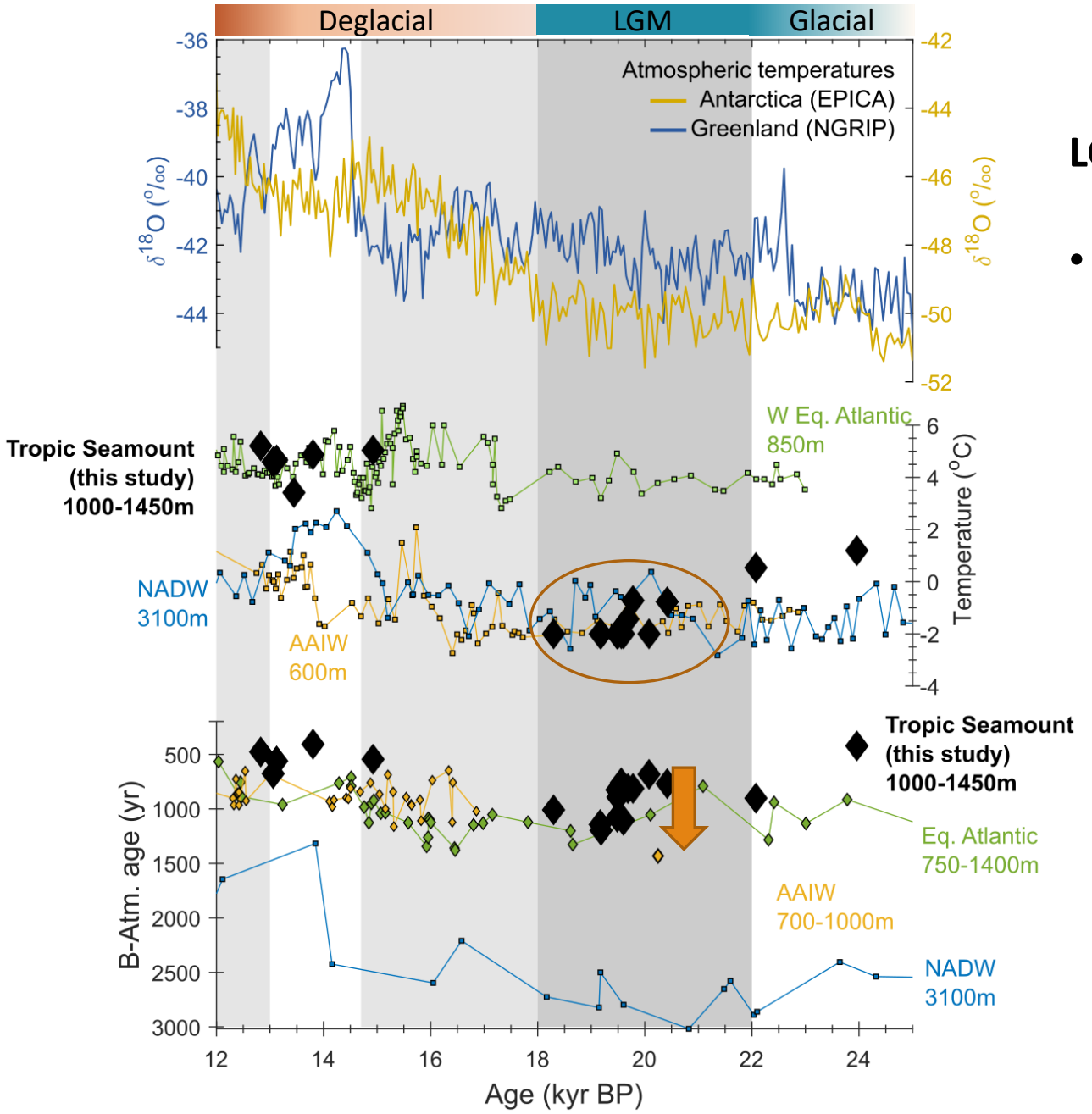
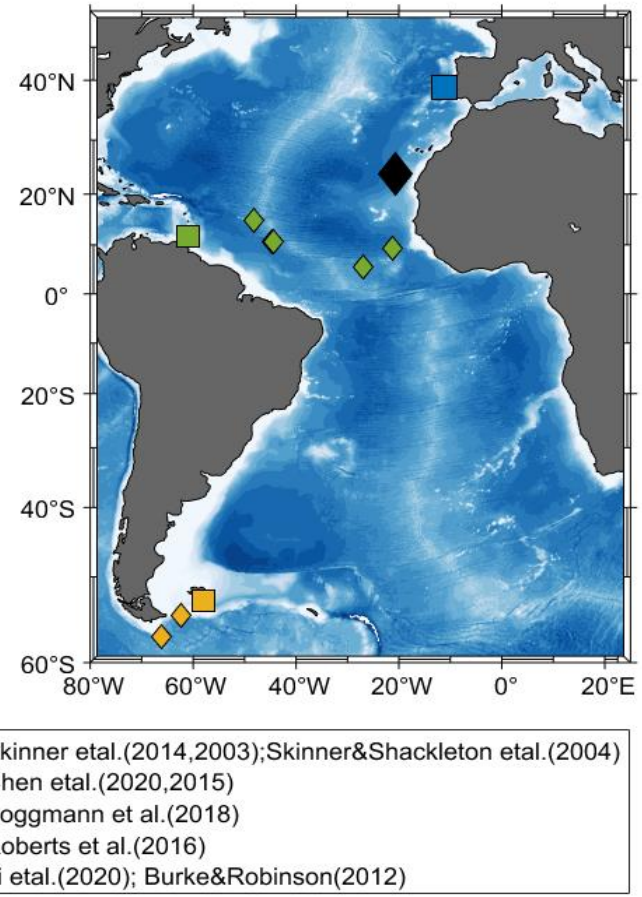


LGM:

- AAIW signatures



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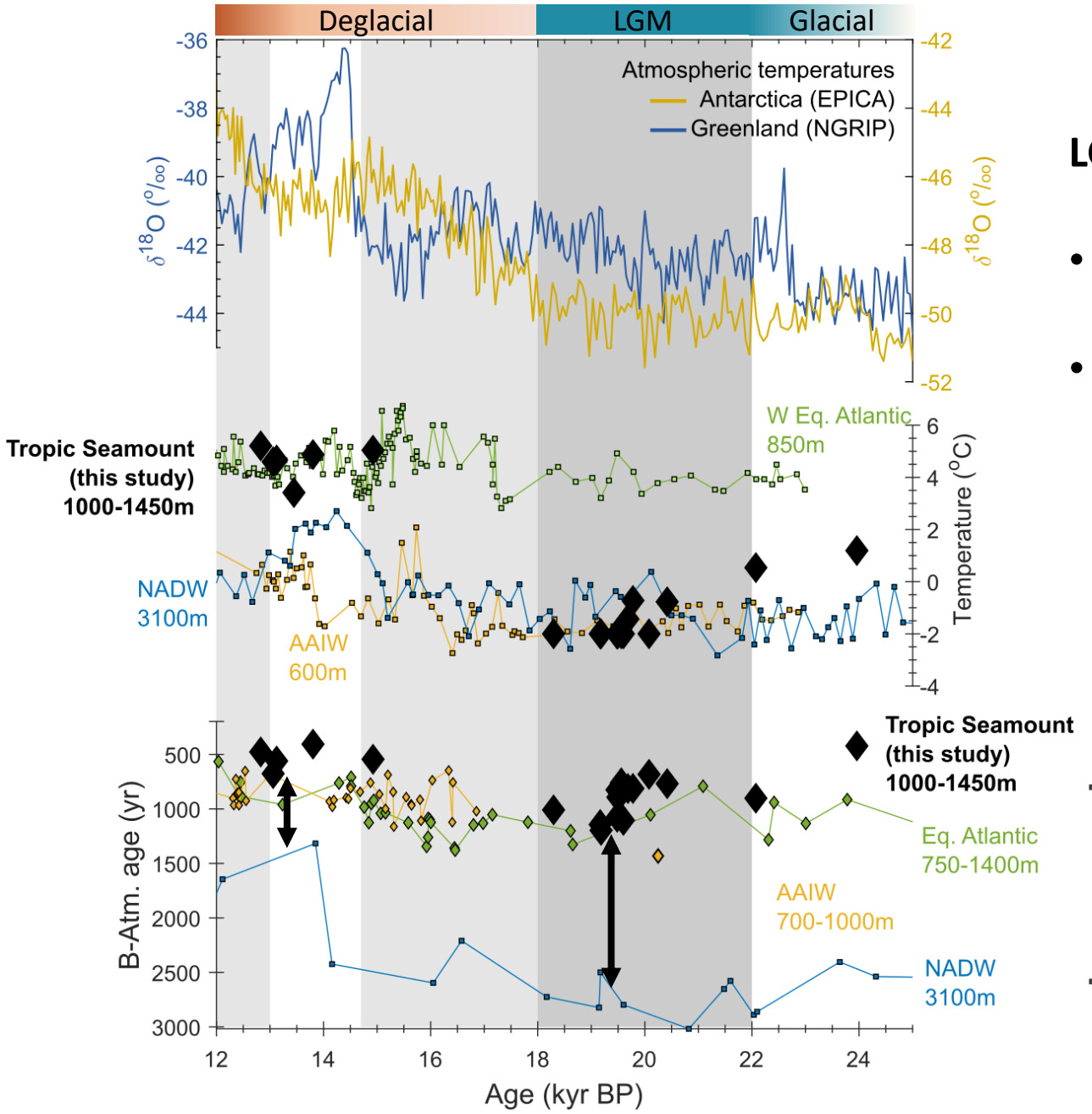
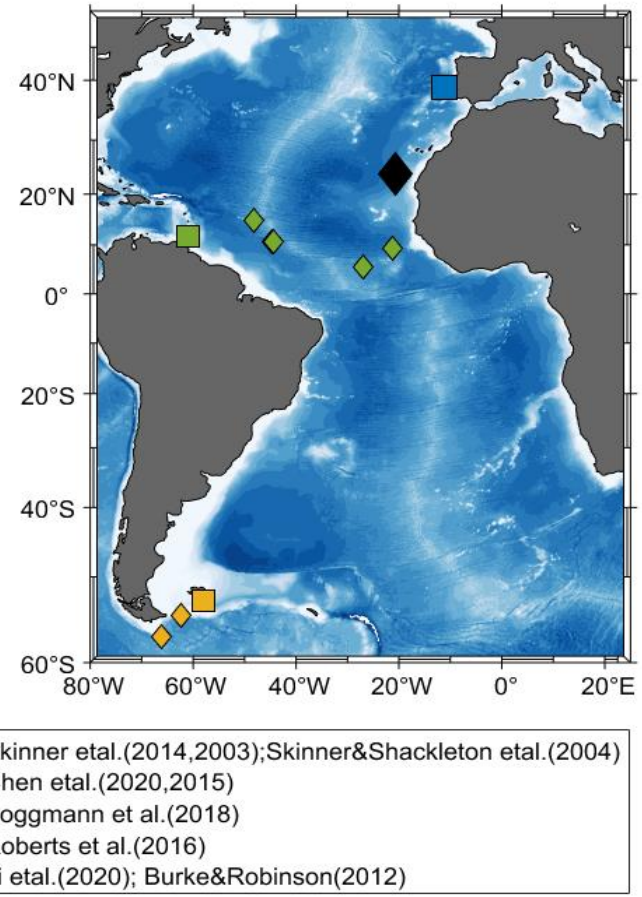


LGM:

- AAIW signatures
- Larger ^{14}C difference between intermediate and deep waters



→ **Intermediate layer**

→ **Deep layer**

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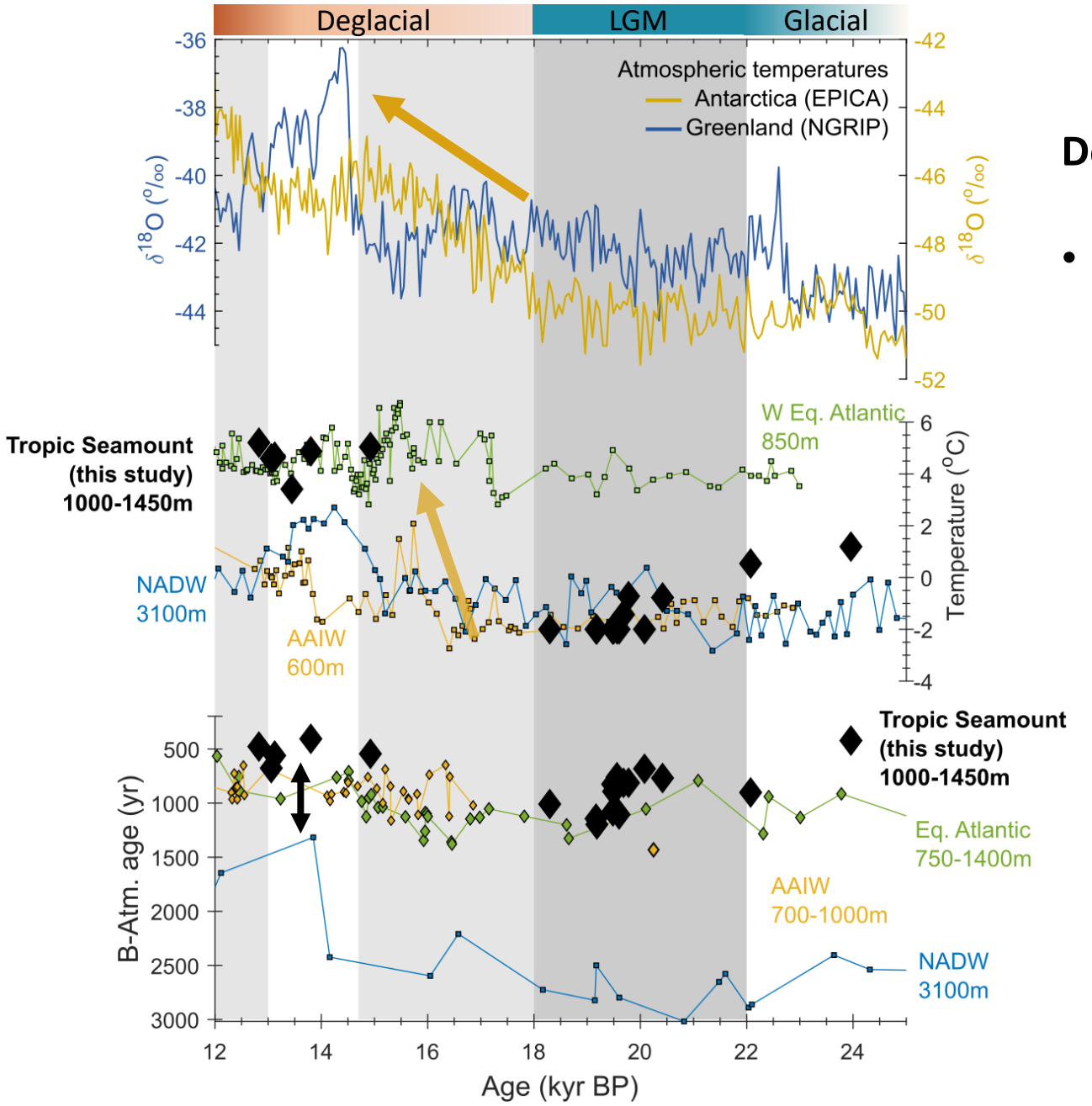
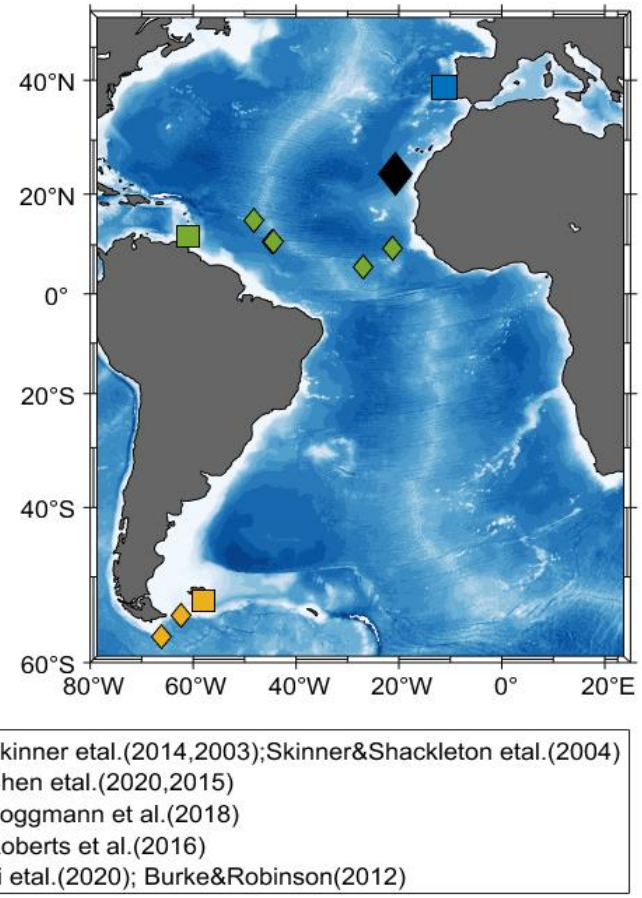


Deglaciation:

- Intermediate waters warming correlates with Antarctica and AAIW



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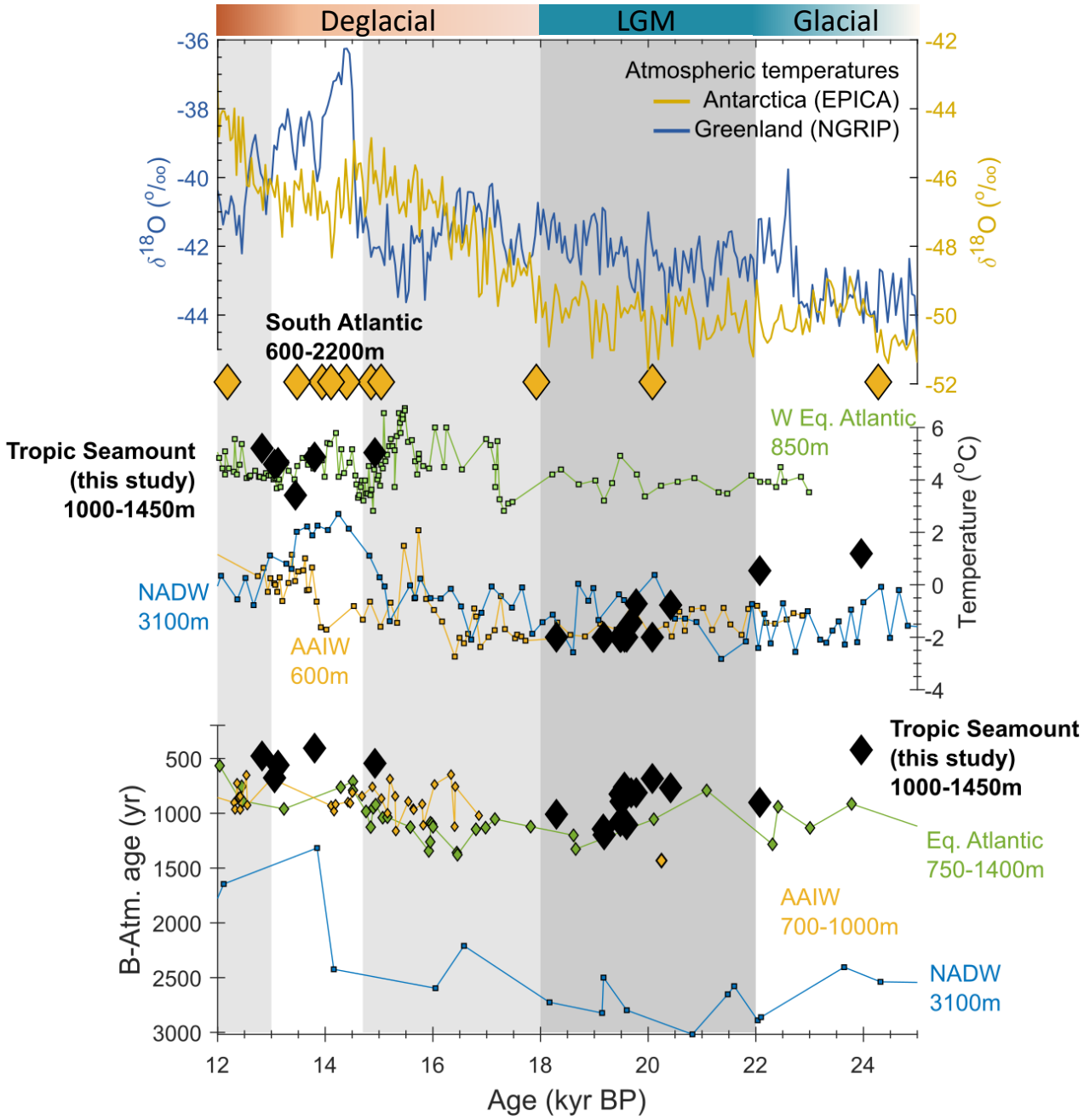

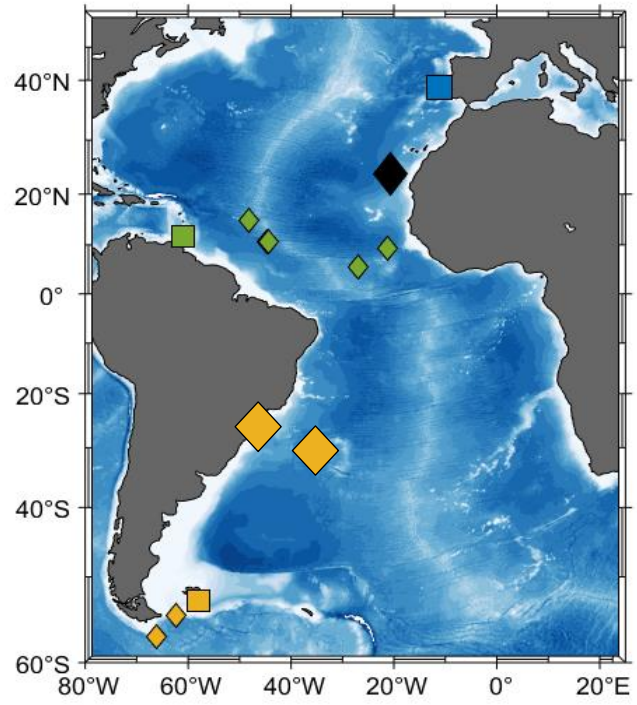

Coming soon…

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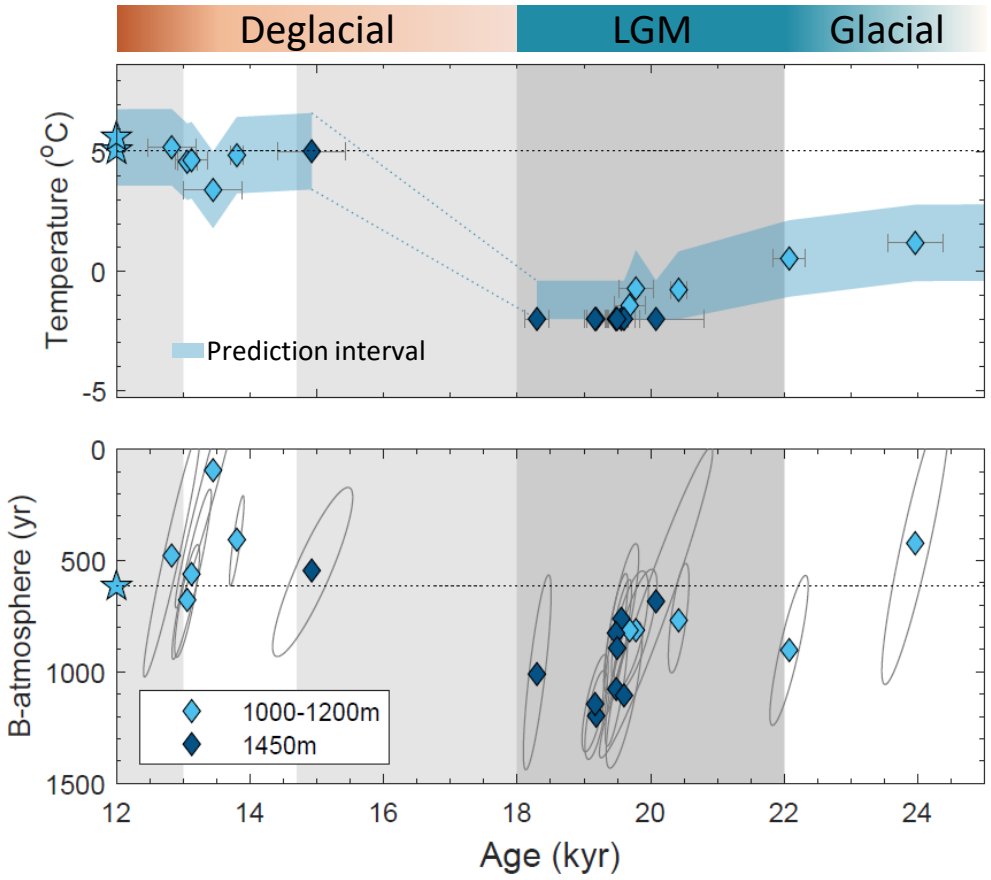
Summary

Thank you!
Obrigada!



- **Last Glacial Maximum (LGM):**
  - Rapid **^{14}C decrease** towards **AAIW signatures**
  - Larger ^{14}C difference of intermediate and deep waters (**stratified ocean**)
  - **Cold** intermediate waters similar to AAIW and NADW
- **Deglaciation:**
  - **^{14}C** increase towards **modern values**
  - Less ^{14}C difference from intermediate and deep waters → **better mixed ocean**
  - **Warming** of tropical intermediate waters:
    - In agreement with **atmospheric warming at Antarctica**
    - **Preceding** atmospheric warming peak of **Northern Hemisphere**

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