The **Atlantic Ocean deep sea** was very **warm** during the late Cenozoic. What does this mean for $\delta^{18}O_{sw}$ and ECS?

Warm late Cenozoic bottom water temperatures until 2.2 Ma, revealed from clumped isotopes of ODP Site 1264

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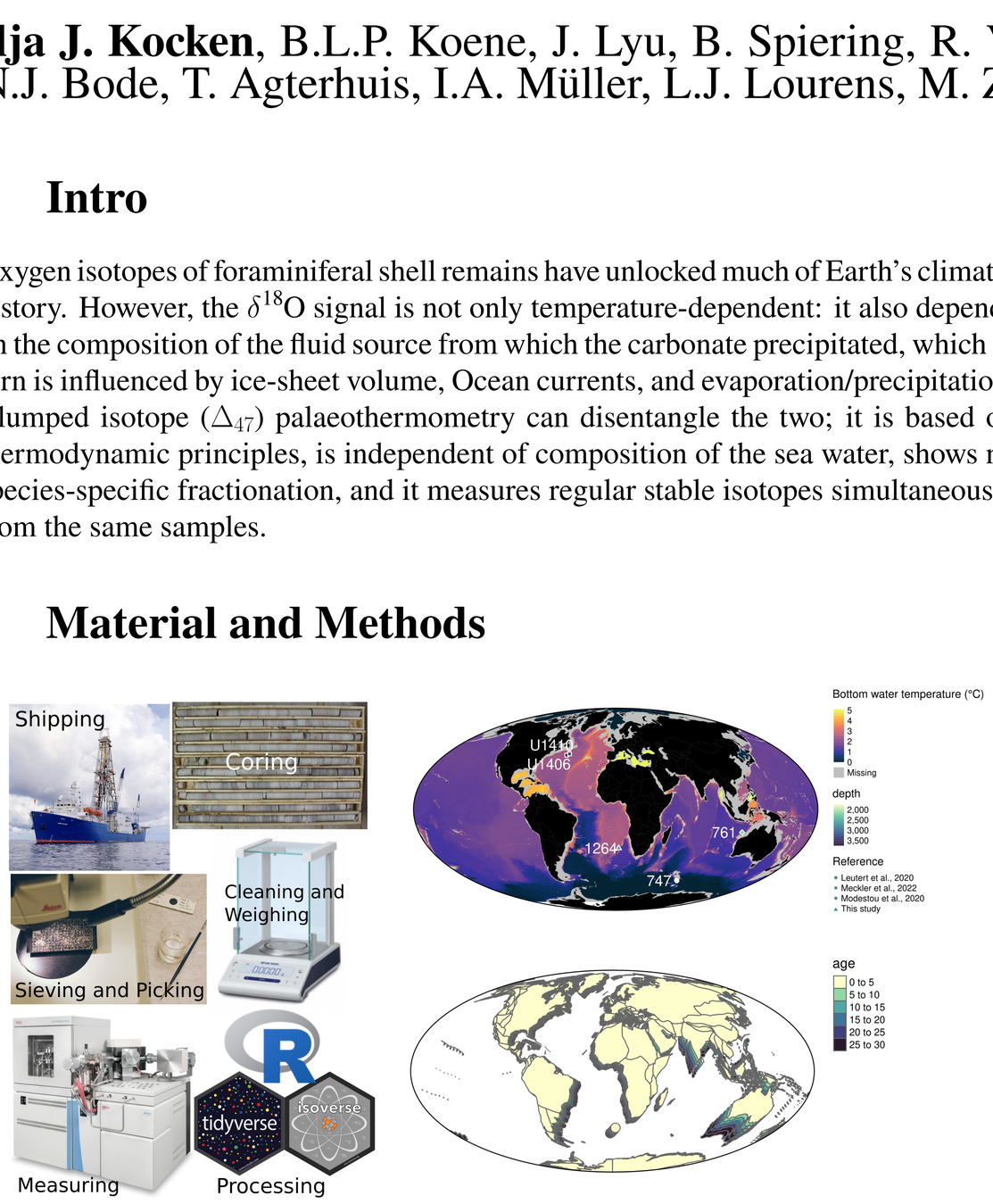
1 Intro

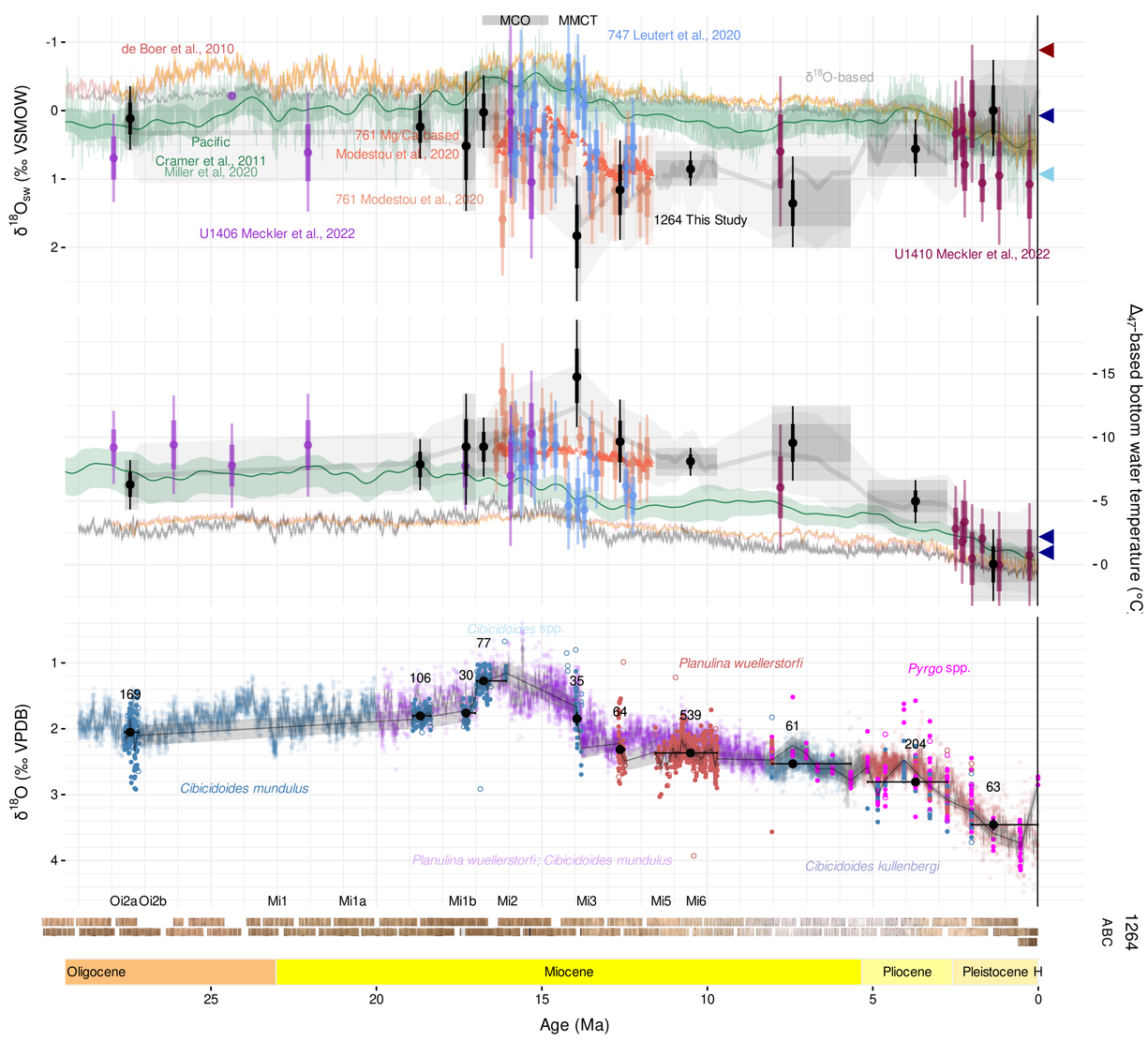
Oxygen isotopes of foraminiferal shell remains have unlocked much of Earth's climatic history. However, the $\delta^{18}O$ signal is not only temperature-dependent: it also depends on the composition of the fluid source from which the carbonate precipitated, which in turn is influenced by ice-sheet volume, Ocean currents, and evaporation/precipitation. Clumped isotope (Δ_{47}) palaeothermometry can disentangle the two; it is based on thermodynamic principles, is independent of composition of the sea water, shows no species-specific fractionation, and it measures regular stable isotopes simultaneously from the same samples.

2 Material and Methods



- Create ≥25 aliquots of 10–15 (80 to 100 µg) washed foram shells.
- Dissolve in phosphoric acid at 70 °C in a Kiel IV carbonate device and purify released CO_2 with cold traps and a porapak trap at –40 °C to get rid of organic compounds.
- Measure isotopes on a Thermo Fischer Scientific 253 Plus.
- Pressure sensitive Base Line correction [1].
- Empirical Transfer Function (ETF) using 3 carbonate standards, ETH-1–3.
- Temperature calibration[2, 3].
- Calculate $\delta^{18}O_{sw}$ from $\delta^{18}O_{cc}$ and T [4, 5]
- Get high-res $\delta^{13}C$, $\delta^{18}O$, and a low-res Δ_{47}, T, $\delta^{18}O_{cc}$ record.
- Profit.

3 Results



4 Conclusions

- Our South East Atlantic clumped isotope (Δ_{47}) record from benthic foraminifera corroborates global warm bottom water temperatures during the Miocene and Pliocene.
- We reconstruct high $\delta^{18}O_{sw}$ values, which would indicate the presence of a larger-than modern Antarctic ice sheet.
- This is highly unlikely, there are probably other influences on $\delta^{18}O_{sw}$
- Bottom water temperatures ultimately cooled to modern temperatures at around ∼2.5, when CO_2 values dropped.

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