Developing a 3.5-million-year benchmark record of Indian Ocean Dipole variability

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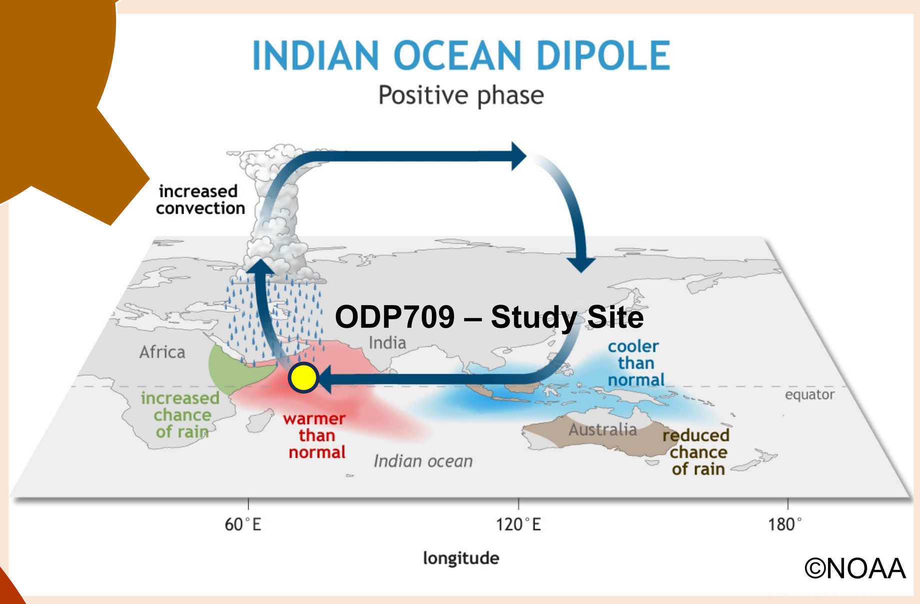
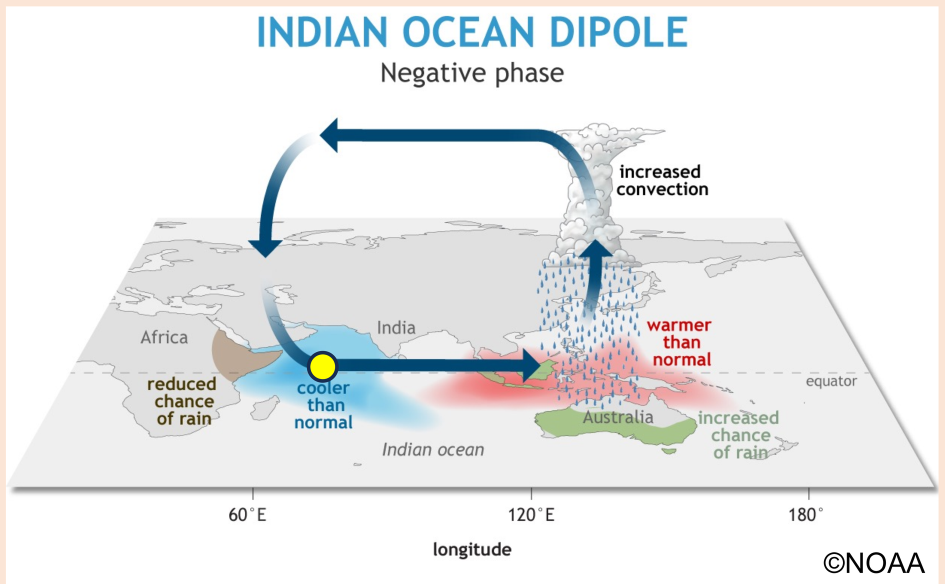
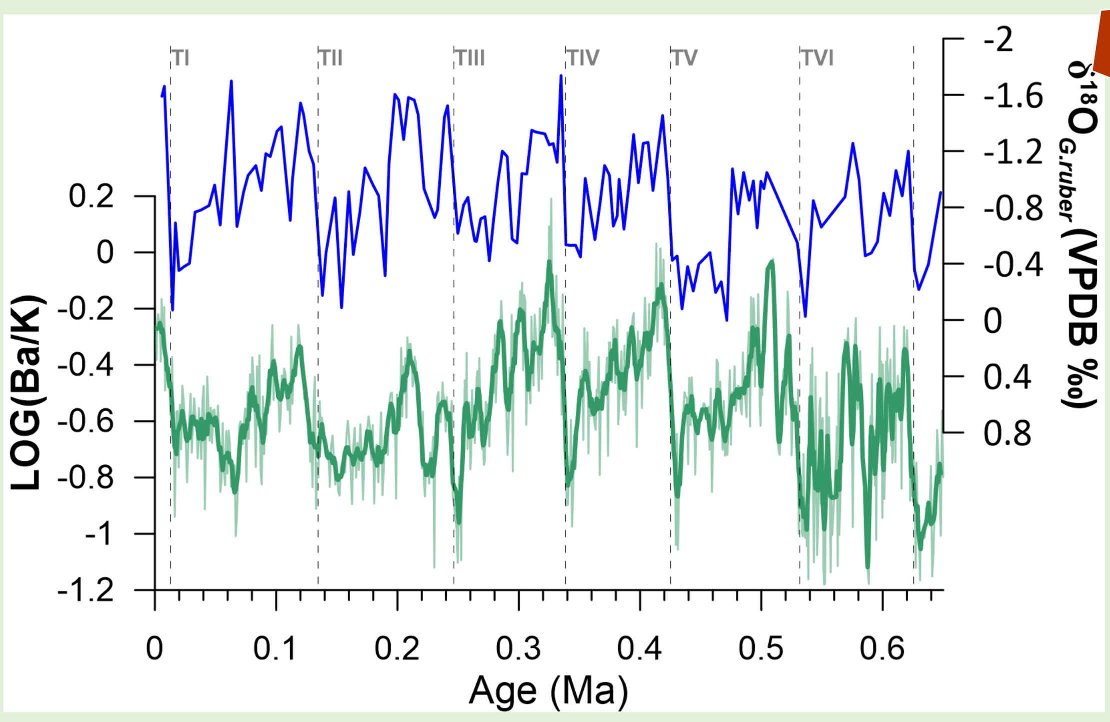
Introduction

The **Indian Ocean Dipole (IOD)** is the primary mode of interannual variability of sea surface temperature (SST) in the tropical Indian Ocean. The climatic effects of the IOD are diverse and geographically widespread. Extreme flood events in eastern Africa, weakened summer monsoon intensity over India and Southeast Asia as well as severe droughts in Australia are among the most significant societal consequences of IOD variability. These extreme climate events caused by the IOD are predicted to become more common in the future as greenhouse gas emissions increase (Cai et al., 2018). However, despite its significance, **surprisingly little is known about IOD variability during the geological past**, which would allow for a better assessment of its sensitivity to atmospheric CO_2 level changes in the future. In this study, we present the first insights into the spatio-temporal complexity of the IOD over the past 3.5 million years. We utilize geochemical proxy data (**XRF core scanning**, **stable oxygen and carbon isotopes**, as well as Mg/Ca paleothermometry of planktonic foraminifera) derived from **Site ODP 709, situated in the western equatorial Indian Ocean** - a key region for IOD forcing.

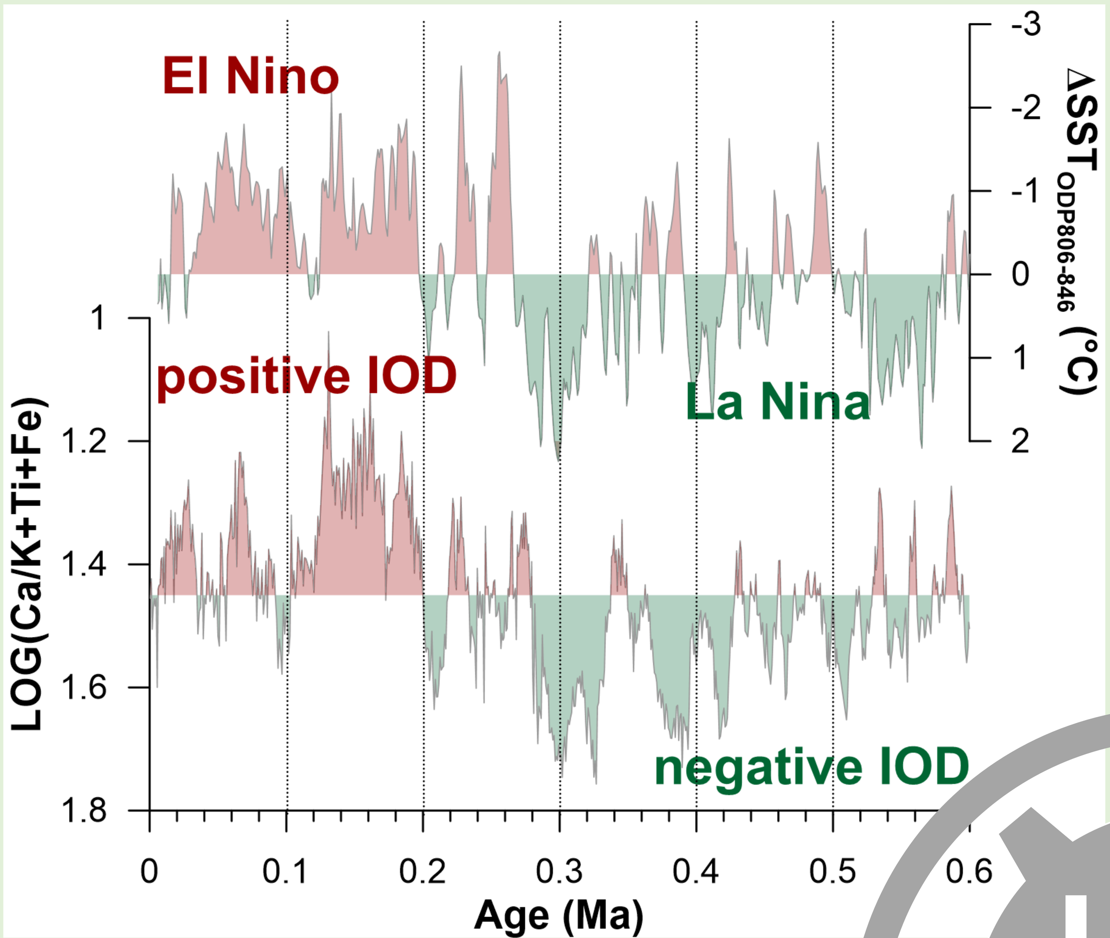




600 kyr Case study

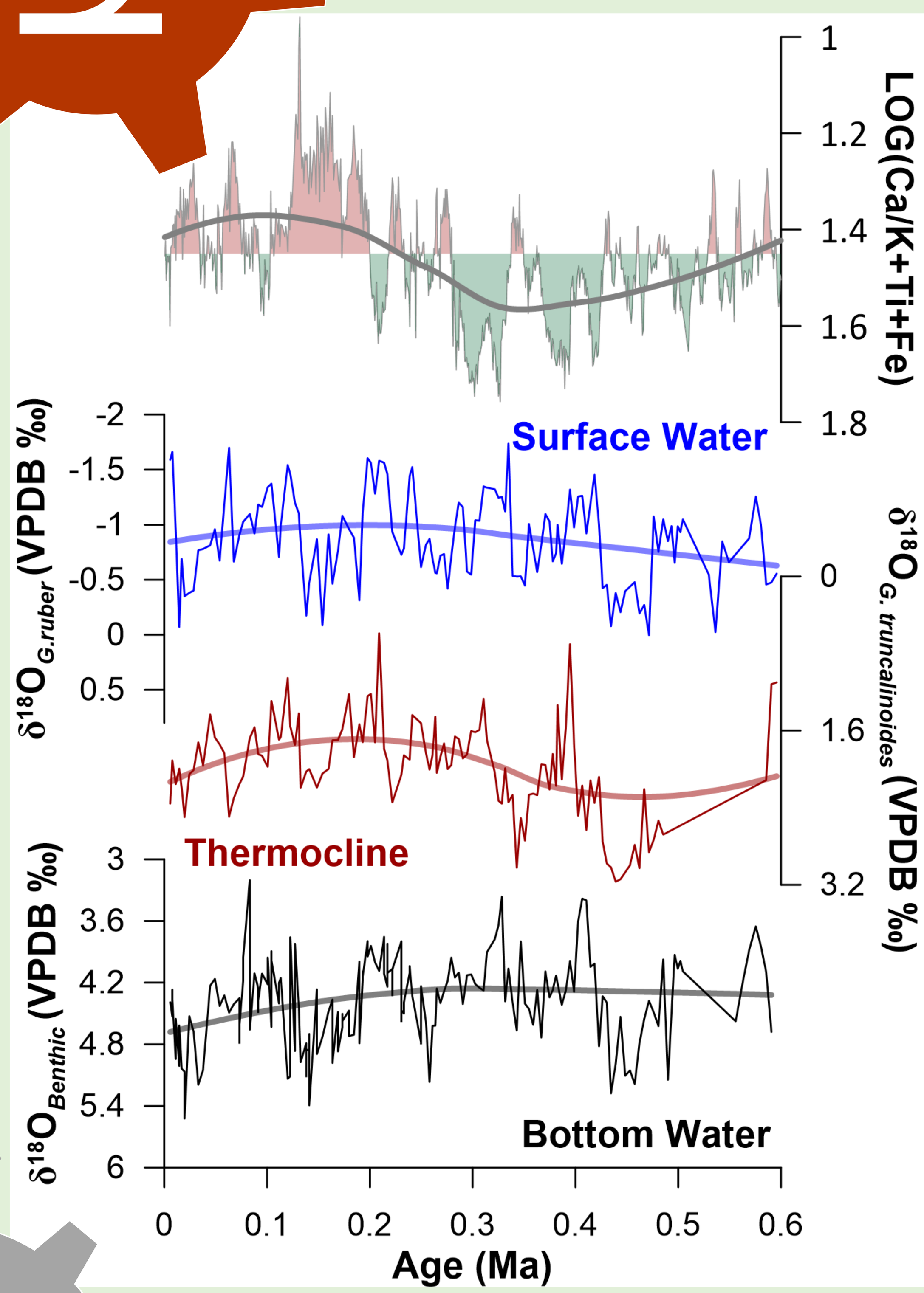


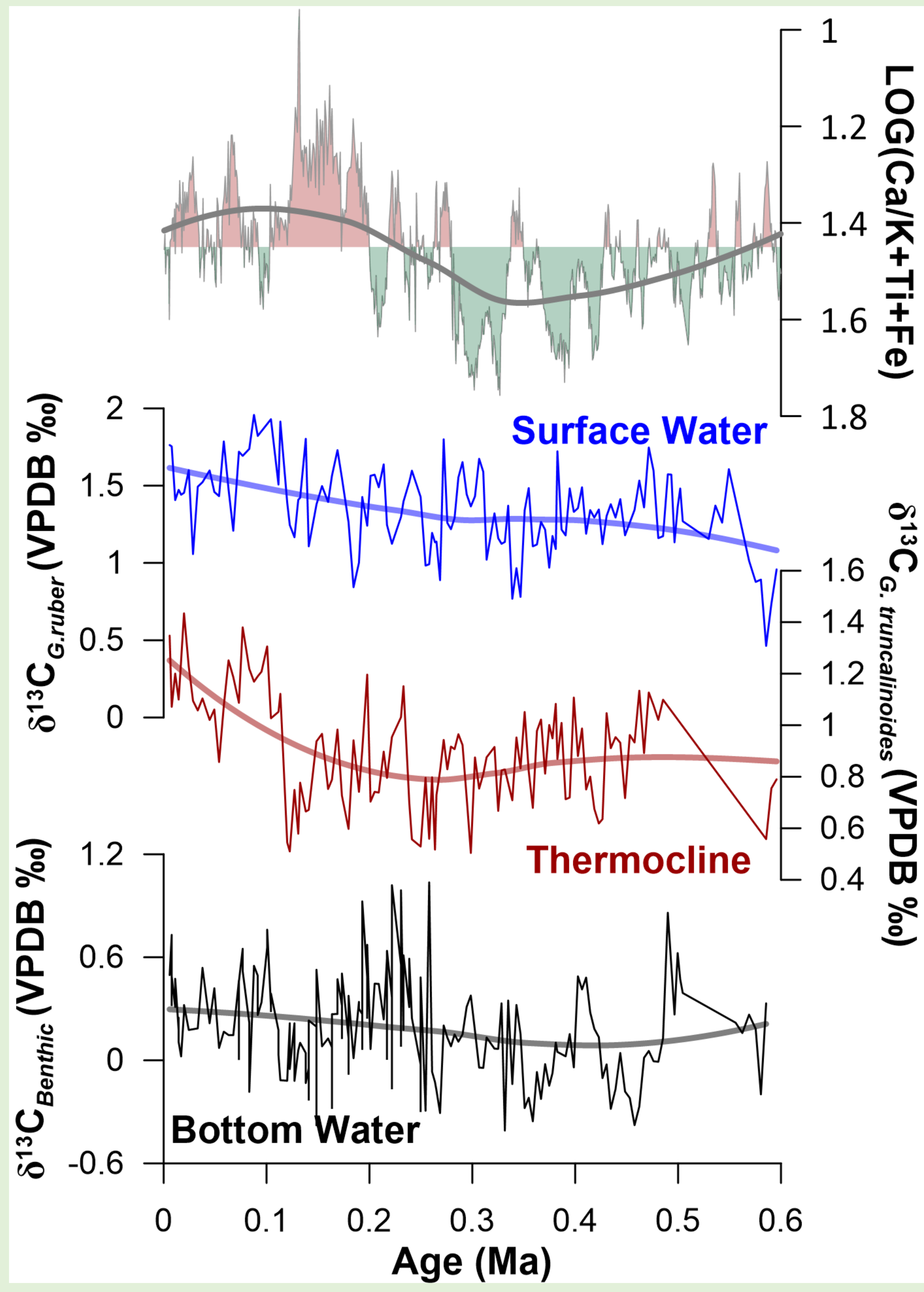
- Age model ODP 709 – Tuning Ba/K and $\delta^{18}O$ *G. ruber* to LR04 (Lisiecki and Raymo, 2005)



- Carbonate variability at Site ODP 709 can be traced by Ca/K+Ti+Fe

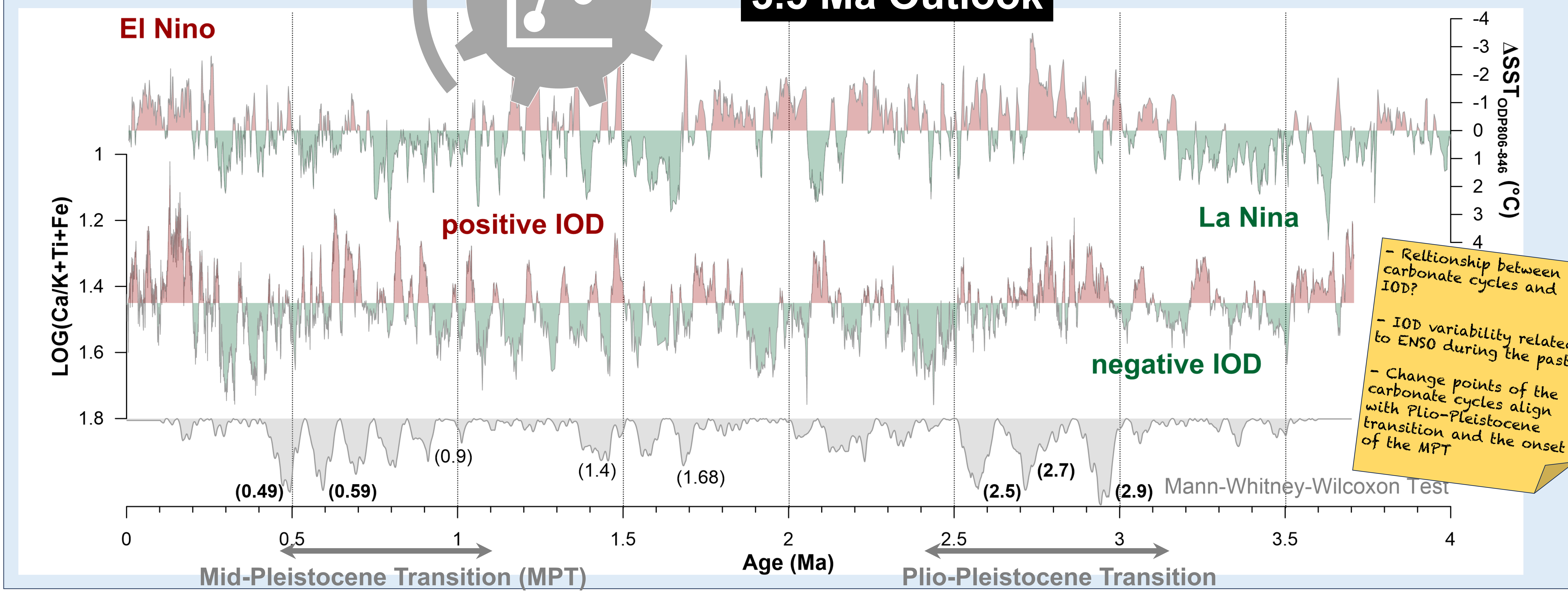
- **Carbonate cyclicity at Site ODP 709 a tracer of IOD variability through the geological past?**





- Water colum strcuture reconstrcuted using stable oxygen/carbon iisotopes of benthic and planktic foraminifera

3.5 Ma Outlook



- Reltionship between carbonate cycles and IOD?
- IOD variability related to ENSO during the past?
- Change points of the carbonate cycles align with Plio-Pleistocene transition and the onset of the MPT