Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18884

Millennial atmospheric CO_2 changes linked to multiple modes of ocean ventilation

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Measurements of Antarctic ice cores reveal millennial-scale variations in atmospheric CO_2 during the last 800,000 years. For its large carbon inventory, the deep ocean can impose critical impacts on these variations. However, it remains elusive regarding how carbon interacted between the deep ocean and the atmospheric reservoirs due, in part, to paucity of deep-sea carbonate chemistry reconstructions. Here, we present a high-resolution deep ocean carbonate ion record over the last entire glacial cycle, based on measurements of B/Ca in benthic foraminifera from core MD95-2039 (40.6°N, 10.3°W, 3381 m) located at the Iberian Margin. The chronology of the core is constructed using planktonic foraminifera *G. bulloides* $d^{18}O$ from the same core, following the established method (Shackleton et al., 2000). Our high-resolution record, combined with a robust age model, allows us to confidently define different types of relationships between deep-sea carbonate ion and atmospheric CO_2 changes on millennial timescales. Causes for these different relationships will be discussed in terms of various ocean ventilation modes involving both Southern Ocean and North Atlantic processes, with implications for millennial-scale atmospheric CO_2 changes.

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