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Evolution of Carbonate Chemistry over the Last Full Glacial Cycle: 160 kyr of B/Ca-derived $\Delta[CO_3^{2-}]$ from the Pacific Ocean

ALLISON JACOBEL[1,2], KASSANDRA M COSTA[3] AND TOM MARCHITTO[2]

[1]Middlebury College
[2]University of Colorado Boulder
[3]Woods Hole Oceanographic Institution

Quantitative constraints on deep ocean carbonate chemistry are critical for understanding the processes responsible for glacial-interglacial changes in atmospheric pCO_2 and the ocean feedbacks that amplify carbon cycle change. Numerous approaches have been developed to reconstruct deep ocean carbonate chemistry including size normalized foraminifera weights, CT-based foraminifera density estimates, and benthic foraminifera B/Ca. Here, we present a new benthic B/Ca-based record of carbonate ion concentration ($\Delta[CO_3^{2-}]$) [e.g.1] from central equatorial Pacific site ML1208-16BB (0.48°N, 156.27°W; 2926 m) [2] spanning the last 160 kyr. These data extend a recently published deglacial record [3] from the site and allow for analysis of the last full glacial cycle at an average resolution of ~2 kyr.

Our study site, bathed by Pacific Deep Water, reveals increases in deep ocean $[CO_3^{2-}]$ of 33 ± 8 μmol/kg over the last deglaciation (20-10 ka), and 39 ± 8 μmol/kg over the penultimate deglaciation (140-130 ka). The deglacial amplitudes are substantially larger than previously reconstructed in the western equatorial Pacific and Indian Oceans, but significant disagreement in both signal amplitude and trends across the equatorial Pacific make diagnosing large scale carbonate chemistry patterns challenging [3]. Discrepancies between sites may suggest pronounced zonal heterogeneity in deep Pacific carbon storage, local overprinting of the B/Ca proxy (e.g., bioturbation, high organic carbon fluxes), and/or a larger role for regional alkalinity feedbacks than previously appreciated. Understanding regional patterns, especially over multiple climate transitions, is critical for understanding how CO_2 invasion and ocean acidification propagate into the deep ocean with implications for predicting future trends in ocean carbon sequestration and carbonate system responses.

References

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