Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.33033

Progressively greater biological carbon storage in the deep Atlantic during glacial inception: Implications for seafloor carbonate dissolution and ocean alkalinity

DAVID LUND[1], MONICA GARITY[1], KENNETH A. FARLEY[2] AND FRANK PAVIA[3]

[1]University of Connecticut
[2]California Institute of Technology
[3]University of Washington

Changes in oceanic circulation and carbon storage have been implicated as important drivers of atmospheric CO_2 during the last glacial cycle (0 to 150 ka), though consensus on the mechanisms responsible remains elusive due to sparse marine carbonate chemistry reconstructions. Here we use vertical profiles of carbonate ion concentration ($[CO_3^{2-}]$) from the Southwest Atlantic to investigate oceanic carbon sequestration during intervals of atmospheric CO_2 change. During the first major decline in atmospheric CO_2 (115 to 109 ka), enhanced carbon storage occurred in the abyssal South Atlantic (>3,500 m water depth). During the second decline (72 to 68 ka), enhanced carbon storage occurred throughout the deep Atlantic (>2,000 m water depth). Paired with $\delta^{13}C$ and $\delta^{18}O$ vertical profiles from the same location, the $[CO_3^{2-}]$ results suggest progressively greater sequestration of biological carbon occurred in the deep Atlantic as the volume of Southern Source Water expanded during glacial inception.

The vertical profiles of $[CO_3^{2-}]$ show that only modest (~200 m) shoaling of the carbonate ion saturation horizon occurred during the first drop in atmospheric CO_2. During the second drop, however, the saturation horizon shoaled by 800 m. The resulting dissolution of seafloor calcium carbonate would have enhanced ocean alkalinity, contributing to further draw down of atmospheric CO_2 after 70 ka. In an effort to quantify sedimentary carbonate dissolution, we will present new vertical profiles of $CaCO_3$ flux from key time intervals and discuss how such records can be used to constrain changes in ocean alkalinity on glacial-interglacial timescales.