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Tracing MPT atmospheric CO_2 Oscillations via Southern Ocean CO_2 system Reconstructions

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The Mid-Pleistocene Transition represents a critical climate transition from 41-kyr to 100-kyr glacial-interglacial cycles, occurring without changes in orbital forcing and likely driven by internal feedbacks involving atmospheric CO_2 and ice-sheet dynamics. With recent work generating high-resolution atmospheric CO_2 records, a focus is now to understand the drivers for CO_2 change at this time. The Southern Ocean is a key driver of glacial-interglacial CO_2 change in the late Pleistocene, due to its unique biogeochemistry and deep-ocean connections, yet while several studies have suggested this region may also be critical to the MPT, the nature of Southern Ocean CO_2 dynamics over the MPT remains a mystery. Here, we present a new $\delta^{11}B$ record from planktic foraminifera *Neogloboquadrina pachyderma* in sediment core PS1506 (68.73°S, 5.85°W) that tracks pH and surface pCO_2 in the Antarctic Zone of the Southern Ocean over the past 1.4 Ma. Our data reveal a close coupling between Southern Ocean CO_2 chemistry and atmospheric CO_2 levels, highlighting its control on CO_2 dynamics during the MPT. Reconstructed declines in glacial surface pCO_2 follow the expansion of the Antarctic Ice Sheet during the build-up to the MPT before MIS 36. Additionally, glacial surface pCO_2 reached minima during MIS 16, coincident with peak global and Northern Hemisphere ice volume. Notably, high-resolution records show no suppressed interglacial pCO_2 in the Southern Ocean in the build up to the so-called “900 ka event”—a key interval of increased carbon storage in the deep ocean associated with MPT evolution. These findings highlight how Southern Ocean processes drove global CO_2 and climate changes and provide essential evidence to evaluate proposed MPT mechanisms.