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CO_2 rise across Mid-Brunhes linked to changes in Antarctic Intermediate Water

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Antarctic Intermediate Water (AAIW) plays a key role in the global carbon cycle, but its contribution to past CO_2 variability in the past is still poorly understood. Using multi-proxy paleoceanographic reconstructions (foraminiferal Mg/Ca, Δ_{47}, $\delta^{18}O$) from the South Pacific sector of the Southern Ocean, we investigate changes in AAIW's physical properties across the Mid-Brunhes Event (MBE), a major atmospheric CO_2 transition. Our results reveal a contrasting evolution within the Subantarctic Pacific: while surface ocean temperatures remained relatively stable over the past 600 ka, the subsurface experienced a marked shift in AAIW properties across the MBE towards warmer and saltier conditions. This change could be related to a reduction in iceberg-derived freshwater input and may have affected the ability of AAIW to sequester atmospheric CO_2. Prior to the MBE, colder and fresher conditions, coinciding with a steep vertical thermal gradient, would have enhanced CO_2 drawdown and minimized outgassing, enabling AAIW to retain its high CO_2 load. The synchronization of the suggested reduction in AAIW's uptake efficiency with the increase in atmospheric CO_2 across the MBE suggests a pivotal role in modulating atmospheric CO_2 during this critical climate transition. This finding challenges the traditional view that this shift is mainly attributed to changes in bottom water formation.