Five geochemical time series support a southward shift of the Earth's thermal equator, causing better ventilation of the deep ocean, as the cause of the rise in atmospheric CO_2 at the end of the last glacial period

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The glacial-interglacial atmospheric CO_2 change has famously resisted explanation for the past three decades, as chronicled by Wally Broecker and numerous colleagues. Here we add mean ocean temperature over the deglaciation as another geochemical clue in the puzzle. The time series of mean ocean temperature, Antarctic air temperature, atmospheric radiocarbon ($^{14}CO_2$), and atmospheric CO_2 mixing ratio all strongly resemble each other. Diatom-related upwelling proxies from the southern ocean also resemble the derivatives of these records. We can think of only one mechanism that accounts for the striking resemblance of these five tracer histories: an increase in the westerly winds over the deep-ocean outcrop around Antarctica, coeval with a southward shift of the Earth's thermal equator during the Mystery Interval (17.7-14.7 ka) and Younger Dryas (12.8- 11.6 ka). These winds markedly improve along-isopycnal mixing of tracers and heat between the surface and the deep ocean, via mesoscale eddies, effectively ventilating and heating the abyssal interior. Recent dysoxia proxies (Anderson et al., 2019) have shown that the deep Pacific was nearly anoxic during the last ice age, confirming that poor ventilation of the deep ocean and its respired biological carbon was the dominant cause of the low glacial atmospheric CO_2. Wally heard this news shortly before his passing and was very happy about it.