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Antiphased dust deposition and productivity in the Antarctic Zone over 1.5 million years

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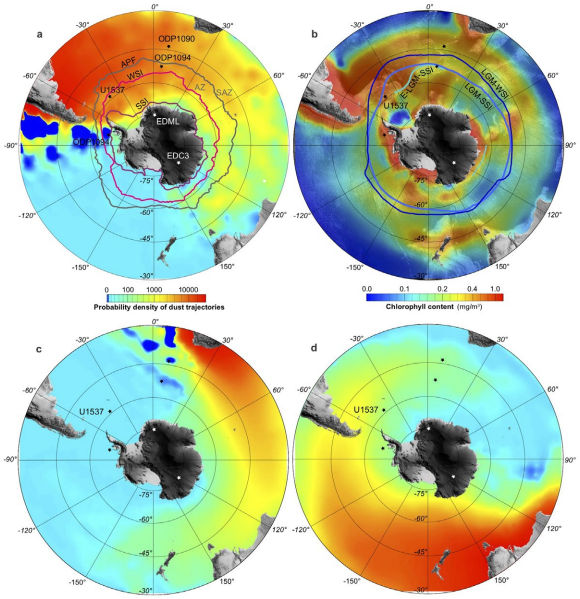

The Southern Ocean paleoceanography provides key insights into how iron fertilization and oceanic productivity developed through Pleistocene ice-ages and their role in influencing the carbon cycle. We report the first high-resolution record of dust deposition and ocean productivity for the Antarctic Zone, close to the main dust source, Patagonia (Fig. 1). Our deep-ocean records cover the last 1.5 Ma, thus doubling that from Antarctic ice-cores. We find a 5 to 15-fold increase in dust deposition during glacials and a 2 to 5-fold increase in biogenic silica deposition, reflecting higher ocean productivity during interglacials. This antiphasing persisted throughout the last 25 glacial cycles. Dust deposition became more pronounced across the Mid-Pleistocene Transition (MPT) in the Southern Hemisphere, with an abrupt shift suggesting more severe glaciations since ~0.9 Ma. Productivity was intermediate pre-MPT, lowest during the MPT and highest since 0.4 Ma. Generally, glacials experienced extended sea-ice cover, reduced bottom-water export and Weddell Gyre dynamics, which helped lower atmospheric CO_2 levels.