

Changes in dust provenance modulated export production in the South Pacific across the Mid- Pleistocene Transition

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The Mid-Pleistocene Transition (MPT) marks a shift in periodicity from 41 to ~100 ka glacial cycles. Due to a lack of changes in external forcing explaining this transition, internal forcing and feedback mechanisms have been invoked. Changes in atmospheric CO₂ via Southern Ocean dust-driven iron (Fe) fertilization and export production have been considered a possible explanation. However, currently available records are limited to the South Atlantic and do not include constraints on the partial solubility of the dust particles, a key property for dust-driven Fe fertilization in the Southern Ocean. Here we present mineral dust property reconstructions from IODP Expedition 383 Sites U1540 and U1541 in the Subantarctic Zone (SAZ) of the central South Pacific. Quantitative provenance constraints based on neodymium, strontium and lead isotope data and the isotope mixing model MixSIAR show a marked change in dust provenance preceding the MPT. We find two characteristic features of this change between 1.5 and 1.2 Ma BP: (i) relative increase of dust input from South American sources (from ~25 % to ~60 %) and (ii) higher amplitudes between the different sources thereafter. At the same time, complementary major and trace element data show a change towards a chemically more pristine (more soluble) dust fraction that corresponds with indicators of primary production. Our findings suggest that the shift in Southern Hemisphere dust provenance enhanced the supply of more soluble dust particles, thus amplifying the export production in the Fe-deficient Southern Ocean SAZ during glacials across the MPT.