EGU24-22132, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-22132
EGU General Assembly 2024

Reading dust provenance record in Epica Dome C Ice Core (EDC) of Antarctica reveals a shift from Patagonian to African sources through the last deglaciation (2.9 – 33.7 kyr)

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Epica Dome C (EDC) ice core is invaluable and highly-resolved record of Earth's climate. Within the database of climate proxies in deep ice core, quantifying the contribution of the various sources of dust has been very challenging and, so far, no continuous record of dust provenance has been established. Here, we developed an algorithm that combines the REE patterns from a large database (from 207 sediments/soils in well-known Potential Source Areas - PSA - in the Southern Hemisphere) to fit the REE patterns measure in EDC data[1]. Complemented by Monte Carlo simulations to account for analytical uncertainties and by evaluation of goodness-of-fit, our model quantifies the respective contribution of the dust sources (regrouped by large PSA like Patagonia, Africa, S-E Australia, New Zealand and Puna-Altiplano) deposited in EDC ice core between 2.9 and 33.7 kyr at a centennial resolution.

Our provenance record reveals that a major shift in dust provenance occurred at ~14.5-kyr BP during which the contribution of Patagonia (PAT – the main supplier of dust of the Last Glacial Maximum -LGM) declined from 55% to 35% (% of total dust deposition) while African dust (SAF) became more prevalent from 20% during LGM to 40% after 14.5 kyr BP. As a matter of fact, the main supplier of dust in EDC during the Holocene is Southern Africa. We ascribe this abrupt shift to (i) long-lasting changes in the hydrology and of Patagonian rivers and (ii) to a sudden acceleration of sea-level rise between 14 and 15 kyr BP that submerged vast swathes of Patagonian continental shelf, triggering a decline in PAT dust supply to Antarctica. In turn, this induced a steep increase – in relative term - of SAF dust contribution in EDC.

Importantly,our record for EDC is very much consistent with our previous results for Epica Dronning Maud Land (EDML)[2] ice core showing the exact same shift (PAT for SAF dust) between 14 and 15 kyr BP. Yet, compared to EDML, EDC record shows generally larger contribution for SAF

and lower PAT dust which seems logical considering the respective localization of EDML and EDC. Our results for EDC thus confirms the relationship between dust composition and eustatic sea level and also highlight the importance of African dust deposition in the Southern Indian ocean and in the adjacent sector of the Southern Ocean since 14 kyr. Our tracing method using REE patterns offers a new, high-resolution tool for the reconstruction of atmospheric paleo-circulation and paleoclimate in the Southern Hemisphere.

[1]Gabrielli *et al.,* (2010), *Quaternary Science Review* 29, 1-2.

[2]Vanderstraeten *et al.,* (2023), *Science of the Total Environment* 881, 163450