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Rare Earth Elements and Radiogenic Isotopes from Mineral Dust in East Antarctica: Sensitive Tracers of the Atmospheric Circulation and Climate Variability Through Time

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Southern Hemisphere (SH) dust depositions recorded major changes in origin and flux intensity during the Last Glacial-Interglacial Transition (LGIT) reflecting modifications in atmospheric circulation. Dust archives from ice cores have shown compelling evidence that Southern South America (SSA) is the major dust supplier to Antarctica. However, there is yet no consensus on contributions from secondary Potential Source Areas (PSAs) such as, Australia, New Zealand, Southern Africa (SAF), and Antarctica itself. Among those, SAF is a vast PSA that has been, so far, largely understudied. With a main focus on the Namibian coast in SAF, this work presents an innovative and multi-proxy approach for the identification and quantification of the SH PSAs for Antarctica and the Southern Ocean during the LGIT. We developed a statistical algorithm (complemented with Monte Carlo simulations) combining Rare Earth Elements from well-known PSAs in SH to provide the best fit to the REE patterns measured in EPICA Dronning Maud Land (EDML) allowing for the provenance identification and quantification. Our results provide the first high-resolution and continuous record of the PSAs contribution in the South Atlantic sector of East Antarctica from 26.5kyr to 7.5kyr BP. A major shift is observed at ~14.5kyr BP where the contribution (and thus flux) from Patagonia, the main dust supplier during the Last Glacial Maximum, fell from ~70% to ~45%. In the Early Holocene, SAF (~25%) and to a lesser extent Australia and New Zealand became more prevalent[1]. In addition, Sr, Nd and Pb isotopic compositions from the SH PSAs were compared with the East Antarctica dust signature[2]. In agreement with our REE results, during the last glacial climatic periods, East Antarctica dust isotopic composition (EDC & Vostok ice cores) is very uniform converging to an unequivocal SSA signature. In contrast, interglacial dust depositions (in agreement with South Atlantic sediments) show more extreme negative ε_{Nd} and radiogenic $^{87}Sr/^{86}Sr$, typical of the SAF isotopic signature, reflecting a larger contribution from SAF as a main dust supplier of Antarctica.

[1]Vanderstraeten *et al.* (accepted), *STOTEN*.

[2]Gili *et al.* (2022), *Nature Communications Earth & Environment* 3, 129, 1-12.