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Sedimentary evolution and climate history of SE Africa (Zambezi River region) since Marine Isotope Stage 3

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The continental climate history of SE Africa is of much interest since this region falls under the dual influence of the Inter-tropical Convergence Zone and Congo Air Boundary and likely experienced considerably different hydrological conditions when glacial conditions prevailed. Likewise, the Mozambique Channel is an important corridor for warm and saline Indian Ocean waters into the Atlantic influencing the buoyancy of Atlantic thermocline waters, deep-water formation, and Atlantic Meridional Overturning Circulation. Additionally, sea surface temperatures (SSTs) of the southern Indian Ocean are important for modulating precipitation in SE Africa.

Here, we utilize surface sediments from the shelf area off the Zambezi River to identify the sediments supplied by the modern Zambezi River and smaller coastal rivers based on the bulk inorganic sediment composition. The distribution of bulk inorganic compositions are compared with calibrated XRF core-scanning data of 4 sediment cores along the Zambezi margin situated between ∼400 m and ∼1300 m water depth. The bulk inorganic sediment composition of these sediment cores accurately documents decreasing lithogenic contribution after ∼ 16 kyr BP and a northward migration of the suspended-sediments of the Zambezi River. These changes are partly related with the landward retreat of the Zambezi River mouth system and the initiation of the northward shelf currents as a result of the progressive flooding of the Zambezi margin and shelf area during deglacial sea-level rise.

The bulk inorganic sediment composition is compared with organic geochemical proxies for the deepest sediment core PE304-80 (1329 m water depth; -18.24 °S, 37.87° E) to simultaneously examine SE African continental conditions and the SST history in the Mozambique Channel over the last ∼50 kyr. Both organic and inorganic geochemical proxies indicate pronounced millennial-scale lithogenic fluctuations occurring within Marine Isotope Stage 3, possessing a similar structure to Dansgaard-Oeschger (DO) events. However, SSTs proxies indicate early warming following the Last Glacial Maximum at ∼19 kyr, whereas decreasing lithogenic contributions start only after ∼16 kyr BP. This suggests a decoupling of the mechanisms controlling SSTs in the Mozambique Channel and SE African continental conditions.