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80 kyr record of palaeoceanographic conditions from southeastern Africa

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A link exists between the Agulhas Current system and climate in southeastern Africa, where rainfall appears to be related to warm Agulhas surface waters. Marine sediment cores collected off river mouths integrate both marine and terrestrial climates, and help to clarify links between Agulhas palaeoceanographic conditions, nutrient inventories and river discharge. We studied a marine sediment core (GIK 16154-4, 280m water depth, generated within the EU Marie Curie GATEWAYS project) located on the continental shelf at the mouth of the Limpopo River, to monitor past changes in both continental and marine environments during the past $\sim$80 kyr cal BP by using a suite of geochemical proxies. Magnetic susceptibility (MS), XRF scanning and total bulk sediment analyses (total carbon, organic carbon, total nitrogen) were used to reconstruct periods of high and low terrestrial input to the core site. Additionally, sea surface temperature (SST) has been reconstructed using the UK'37 index from alkenones, and Ba/Ca was measured on planktic foraminifer (Ba/Ca$_{planktic}$) and benthic foraminifer (Ba/Ca$_{benthic}$) to monitor past changes in surface and subsurface dissolved Ba concentration.

Ba/Ca$_{benthic}$has a positive correlation with Antarctic dust concentration, peaking at times of low SST. Strong westerly winds may have led to the influx of cooler, southern sourced waters, into the Mozambique Channel throughout glacial periods, most likely associated with greater inflow of nutrient-rich Antarctic Intermediate Water into the south western Indian Ocean. The SST record shows quite warm temperatures (24-26˚C) at this latitude during the last glacial maximum, with a warming of 3˚C during the last deglaciation. Log Ti/Ca from XRF and carbonate-corrected MS data suggest that the Limpopo River discharge, influenced by rainfall occurring within the Limpopo River catchment, increased from MIS 4 to the LGM, and then decreased from the LGM to the late Holocene. Organic C/N ratios from bulk sediment shows similar features, indicating that the contribution of terrestrial organic matter content was influenced by the same processes as MS and XRF Log Ti/Ca. Superimposed on the climatic signal is the maximum deposition of terrestrial material during deglacial sea level rise, caused by the inundation of the continental shelf and the reworking of sediment. Ba/Ca$_{planktic}$values show positive correlation with total alkenone concentration, and to a lesser extent with carbonate content; peaks in all three occur during the Holocene, early MIS 3 and MIS 4. Further work is required to determine whether Ba/Ca$_{planktic}$can be used to infer changes in surface water productivity at the mouth of the Limpopo River, or rather if it reflects river discharge from the Limpopo catchment.