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A record of barite accumulation rate for marine export productivity changes in the tropical Indian Ocean during the Mid-Pliocene–Early-Pleistocene transition

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One of the most interesting features in the marine oxygen isotope records is the gradual shift towards heavier [U+F064]18O from the Mid-Pliocene, which ends with the initiation of Northern Hemisphere glaciation (NHG) around 2.7 Ma. The lack of significant change in sea surface temperature in the tropical Indian Ocean as revealed in the previous studies does not rule out their possible contributions to this dramatic climate change during the Mid-Pliocene transition. Changing circulation systems in the region will control the supply of nutrients for the water masses which in turn determine the marine productivity. In the areas of high productivity, ocean export productivity may potentially provide a mechanism of CO_2 draw-down into the deep ocean, through which contributing to the lowering of the global temperature. In this study, we present a record of barite accumulation rate (BAR) for DSDP Site 214 drilled on the Ninetyeast Ridge. Here we use the marine barite, which is formed during the decay of organism in the twilight zone, as a proxy for ocean export productivity. Our results show that the BAR of Site 214 varies between 0.25 and 1.25 mg/cm2/kyr during the period between 4 Ma and 2 Ma. Five intervals of increased BAR from 3.6 Ma to 2.4 Ma are identified with the most distinct peak centred around 3 Ma. The overall pattern does not follow either the oxygen isotope record for the Site or the sea surface temperature and subsurface temperature reconstructed with the Mg/Ca of foraminifera. This suggests that regional changes in ocean circulation and water masses may have played more important role than temperature in controlling the productivity change in the tropical Indian Ocean. The relative higher productivity around 3 Ma may imply a biogenetic process towards the intensification of NHGs.