# Miocene evolution of the Asian Monsoon from climate and productivity proxies in the Bay of Bengal and South China Sea

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Export particle flux from primary production and terrigenous input in combination with planktic and benthic foraminiferal isotope records were used to monitor monsoon-related paleoceanographic changes in the Bay of Bengal (Indian Monsoon) and South China Sea (East Asian Monsoon) through the middle to late Miocene. Proxy indicators of carbon export flux to the seafloor and carbonate accumulation rates at International Ocean Discovery Program (IODP) Site U1443 located in 2925 m water depth at the northern end of the Ninetyeast Ridge closely track changes in the carbonate budget of the deep Indian Ocean. Prolonged intervals of low carbonate concentrations and accumulation rates from ~17 to 15 Ma and from ~13.2 to 8.7 Ma indicate episodes of reduced carbonate deposition, which correlate with the globally recognized early to middle Miocene “Carbonate Drought” and the middle to late Miocene “Carbonate Crash”. The global occurrence of these events implies that changes in chemical weathering and in the riverine input of calcium and alkalinity into the ocean reservoir (rather than changes in circulation or inter-ocean carbonate fractionation) drove carbonate accumulation in the deep Indian Ocean. Higher XRF-scanner derived Log(Ba/Ti) together with a change in the redox state of deep sea sediments at ~11.2 Ma indicate a rise in biological production and export flux to the sea floor. A contemporaneous stepwise steepening of the gradient between mixed layer and deep ocean $\delta^{13}C$ starting from a minimum at ~11 Ma also indicates intensification of the biological pump at Ocean Drilling Program (ODP) Site 1146 (2091 m water depth) in the South China Sea. We suggest that the attendant increase in carbonate accumulation in the Indian Ocean was linked to increased nutrient flux and intensification of upper ocean mixing, associated with changes in the seasonality and intensity of the Asian monsoon.

Keywords: Asian Monsoon, Miocene, International Ocean Discovery Program , Foraminiferal stable isotopes, Foraminiferal Mg/Ca, X-ray fluorescence scanning elemental data

 