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Terrigenous discharge of the Ganges-Brahmaputra River and productivity changes in the Gulf of Bengal on millennial to orbital time scales during the past 100 kyr

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High-resolution paleoclimate records from the Indian Monsoon area show remarkable similarity with the abrupt temperature variations found in Greenland ice cores (e.g., Schulz et al., 1998; Kudrass et al., 2001, Altabet et al., 2002). In general a strong monsoon (strong SW winds, high precipitation, high sea surface temperatures) is associated with warm phases in the North Atlantic.

Sediment core SO188-342KL (19˚58'N, 90˚02´E, 1256 m, sedimentation rate of ca. 10 cm kyr^{-1}), recovered from the northern Gulf of Bengal, ∼200 km south of the Ganges-Brahmaputra mouth, is ideally suited to monitor climate fluctuations in the river's catchment area and the Gulf waters on Dansgaard/Oeschger (D/O) time scales. For North Atlantic interstadials high resolution XRF measurements of Ti/Ca ratios indicate increased river suspension load due to strengthened precipitation and continental erosion. Chlorin abundance (a chlorophyll-α degradation product) determined from photospectrometric reflectivity measurements covering the past 100 kyr and siliceous microfossil counts for the past 15 kyr show millennial events superimposed on orbital-scale variations. The close correspondence with the Ti/Ca record suggests that maxima in terrigenous supply and nutrient discharge to the northern Gulf coincide with increased paleoproductivity. The Bengal fan is the largest submarine sediment fan of the world and an important depocenter for organic carbon. Although primary production rates in the northern Gulf of Bengal are relatively low (20-180 g C m^{-2} yr^{-1} at the eastern Indian shelf and 30-80 g C m^{-2} yr^{-1} in the open ocean) organic carbon sediment accumulation rates (0.5 to 2 g C m^2 yr^{-1}) are comparable to those of eastern boundary upwelling areas. The high terrigenous fluxes accelerate the transport of organic carbon to the seafloor and cause high burial rates. The low frequency (orbital) paleoproductivity changes found in core SO188-342KL show an inverse relationship with the atmospheric CO_2 oscillations observed in Antarctic ice cores between 20 and 60 kyr ago. We therefore speculate that variations in marine paleoproductivity and associated carbon burial in the Bengal fan may have contributed to the atmospheric CO_2 changes during the last glacial period.