Paleoclimatic Studies from Sediments in the Bay of Bengal

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The Bay of Bengal receives large volume of sediments discharged through seven major rivers, the largest of them being the Ganga and the Brahmaputra river system (G-B). These sediments preserve records of the sediment discharged from these rivers. Sediment composition of the Bay appears to be mainly governed by three processes viz. detrital, biogenic and diagenetic, with detrital being the dominant in this region. Their input reveals physical and chemical erosion of the terrain over which they flow and is strongly dependent on the monsoon intensity, especially the southwest or summer monsoon (Sarin et al., 1979).

This study reports results from the two gravity cores (4032; ~13.36°N; 88.9°E and 4040; 6.03°N; 89.94°E) collected from the central and southern Bay of Bengal respectively. These cores were dated at the NSF Arizona AMS facility on Planktonic foraminifera separates from select depths and \(^{14}\)C ages calibrated to calendar years using CALIB 4.1 (Stuiver et al., 1998) with a \(\Delta R\) value of 22 years (Dutta et al., 2001). The sedimentation rate for 4032 varied significantly with a faster rate at ~20 Ka consistent to that reported from the southeastern Arabian Sea with enhanced sedimentation rates by a factor of 3-4 high during LGM compared to other periods during the past ~30 ka (Agnihotri et al., 2002). During the last LGM, the Bay of Bengal experienced enhanced sedimentation due to significant detrital flux. The sedimentation rate remained constant at 1.7cm/ka in 4040 at the top of 90°E ridge.
The CaCO₃ content shows large variation from 7 to 53% in core 4032, whereas it is high and fairly constant (60-71%) in 4040. The C орг in core 4032 varied from 0.2-1.5% with C/N (wt. ratio) ranging from ~2-20. The high deposition periods in 4032 corresponds to the high in C орг (1-1.5%) and with a high C/N ratio of >15 indicating enhanced terrestrial input and thereby preservation of C орг. δ¹³C of organic matter also shows lower value (-26‰) indicative of higher contribution of detrital source. CaCO₃ an indicator of productivity, shows a decrease between ~40ka to LGM (~20 ka) in the two cores and subsequently an increase till present. Since 15ka to present it is seen that all the productivity indicators CaCO₃, Ba/Al and Sr/Al show continuous increase indicative of strengthening of southwest monsoon since last LGM.

The strontium, neodymium and osmium isotopic composition of sediments store record of provenance and hence that of environmental change. The Bay of Bengal receives sediments from the Himalaya, Peninsular India and Indo-Burman ranges. These sediments have distinct Sr, Nd and Os isotopic signatures (France-Lanord et al., 1993; Singh and France-Lanord, 2002; Colin et al., 2006). Sr and Nd isotopic composition measured on the silicate fraction of the surface sediments show strong influence of G-B rivers in the northern Bay of Bengal. The samples from the western Bay of Bengal show mixed signature of Sr and Nd isotopes derived mainly from the rivers draining in the western continental margin of India. The samples from the Andaman Sea have least radiogenic Sr and more radiogenic εNd, supposed to be influenced by sediments from the Irrawaddy river. ⁸⁷Sr/⁸⁶Sr in core 4032 varies from 0.711-0.719 with
minimum $^{87}$Sr/$^{86}$Sr at 9kyr. In this core, at 9, 34 and 44kyr depleted Sr isotopic signature are seen, implying weak SW monsoon and thus low G-B discharge and strong NE monsoon leading to enhanced Irrawaddy discharge.

The chemical and isotopic studies of the sediments from two cores in the Bay of Bengal yielded information on changes in the productivity during the past and variation in the provenance of sediments. These results would be discussed in detail.

References