Bearing of Last Glacial Maxima (LGM) on Sediment Accumulation in Parts of Arabian Sea –

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The west coast of India witnesses a wide range of monsoonal precipitation from the north to the south. While, the annual precipitation in the Kachchh, Gujarat area is around 300 mm, it is nearly 2500 mm in the coastal areas of Kerala. Along with the spatial variation of monsoonal precipitation, there was change in the southwest monsoonal intensity through the Late Quaternary (Sarkar et al. 2000), which must have resulted in a change in sediment accumulation rate along the west coast of India. Continental margins including shelf and slope are very active oceanic regions. In addition to the varying monsoonal precipitation along the west coast of India as mentioned above, seasonally changing monsoon driven-coastal circulation, upwelling, river discharges make the 'system' interesting (Somayajulu et al. 1999). Attempts were made to look at the sediment accumulation rate in off the west coast of India.

In order to understand the climate induced changes in sediment accumulation rate, quite a few offshore cores were raised from the locations with different water depths and from different latitude as well along the western coast of India. Ten ~150 cm long offshore sediment cores from water depths ranging from ~280 m to ~2800 m (between 08°00.7' N and 21°51.9' N) in the Eastern Arabian Sea have been retrieved for the present study. The grain size of the terrestrial input in the basin is < 63 µm. The sediment is rich in planktonic foraminifera.

In order to determine the sediment accumulation rates, commonly employed radionuclides viz. naturally occurring ^{210}Pb (half-life = 22.3 years) and ^{14}C (= 5730 years), and man-made ^{137}Cs (= 30 years) have been used for dating the sediments in the cores. While ^{210}Pb and ^{137}Cs isotopes could be used to date and hence to determine the sediment accumulation rate during last ~100 years only, ^{14}C dates could go back to the entire core length equivalent to ~45 ka. In an attempt to establish the ^{14}C based chronology in the cores, handpicked foraminiferal separates (250-400 µm) belonging to only "upper water plankton" in the sediment core at an interval of 10-20 cm have been dated using accelerator mass spectrometry (AMS). ^{14}C ages thus obtained have been corrected for reservoir age and calibrated to calendar ages. These age data in the cores when plotted against the depth below sea floor, it was observed that sediment accumulation rates in between all the sampling intervals are not same resulting in non-linear sedimentation rate. In the northern core (3104G - 12°49.9'N, 71°45.6'E), barring LGM period, the sediment accumulation rate varies between ~2 cm and ~6 cm/ka. Sedimentation rate during LGM in this core increased to ~13 cm/ka. Similar phenomenon has also been observed in the southern core (3101G - 08°00.7'N, 74°01.3'E), where the sediment accumulation rate barring the LGM period varies between ~3 cm to ~8 cm/ka, and the same during LGM has been ~13 cm/ka.

The point to be noted here is that in both the locations sediment accumulation rates increased by a few fold during the last glacial maxima. Normally the sedimentation rate should increase during enhanced monsoon induced increase in precipitation. In contrary to this, LGM being the period of enhanced aridity, the sediment accumulation rate should have decreased. In reality, in spite of enhanced aridity the sediment accumulation rate in the eastern Arabian Sea increased by few folds. It has been reported that during LGM the southwest (SW) monsoon in the areas of Indian west coast decreased to about two-third of its present strength, which means, with the depletion in precipitation there was an increase in sediment accumulation rate. In spite of absence of any 'systematic' trend in the ratios of Ti/Al, Fe/Al, and Mg/Al in cores 3101G and 3104G Agnihotri et al. (2003) proposed a model in order to address this increment in sediment accumulation in the eastern Arabian Sea. According to their model, 'wind induced erosion of exposed shelf sediments and its lateral transport during low sea-level stands' at the time of LGM led to the enhancement of sediment supply in the marine environment. If this model holds good then the sediment accumulated in the marine realm during the low-stand are reworked from the exposed shelf and hence should give rise to older dates. In reality, the sediment deposited during LGM does not show such inversion of dates.

Through an alternative model this enhancement in sediment accumulation

during LGM can be explained by the strengthening of the northeast (NE) monsoon blowing seaward, which is corroborated by the southern extension of the Thar Desert reaching close to the Orsang Basin (22°5' N, 73°35' E), a tributary of the Narmada River (Juyal et al. 2003, 2006). In addition, enhanced aridity induced reduced binding capacity of the soil would have increased the erosion and resulting enhancement of the quantity of the wind borne sediment supply from the 'Thars' to the eastern Arabian Sea effecting a two to three fold increase in sediment accumulation rate during LGM.

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