A 70-ka stable isotopic and organic carbon record from a deep sea sediment core in the Bay of Bengal

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Abstract

We have reconstructed the sea surface temperature (SST) and salinity (SSS) at 5°N and 90°E in the Bay of Bengal for the last 70-ka using $^{18}O/^{16}O$ and Mg/Ca ratios in planktonic foraminifera. This gravity core (SK-157-14) provides a continuous record of the surface water characteristics for the studied time interval. $^{13}C/^{12}C$ and C_{org} have been used to infer productivity changes at this location. Time framework of this core was developed using ten radiocarbon dates of the bulk sediment samples and oxygen isotope stratigraphy.

The $\delta^{18}O$ record of G. ruber exhibit high glacial-interglacial amplitude ($\Delta\delta^{18}O$ ~2.2 per mil), which is in agreement with other published records from this region. The $\delta^{18}O$ contrast between the Last Glacial Maximum and Holocene, after correcting for global ice volume effect, is relatively high (~ 1.0 per mil). This residual $\delta^{18}O$ could arise either because of ~ 4-5°C decrease in temperature or due to ~ 3 per mil increase in salinity or a combination of both. Mg/Ca ratios determined in mixed dpecies of G. ruber and G. sacculifer of this core and previously published records from the North Indian Ocean suggests a decrease in sea surface temperature (SST) by ~ 2.5°C during LGM. This means that ~ 0.5 per mil change in $\delta^{18}O$ can be attributed to an increase in salinity by ~1.5 - 2 per mil. Hence the surface waters of this site were characterized by decrease in temperature by ~ 2.5°C and increase in salinity by ~ 1.5 - 2 per mil during the LGM. Large fluctuations are observed in $\delta^{13}C$ (0.6 to 1.6 per mil) and C_{org} (0.2 to 2.7%) records, suggesting significant changes in productivity.

METHODOLOGY

⇒Carbon and oxygen isotopic compositions in the foraminiferal shells were determined in ~ 20 µg of cleaned specimens. $^{18}O/^{16}O$ and $^{13}C/^{12}C$ ratios were determined on Delta^{PLUS}XP Mass Spectrometer with GASBENCH device.

⇒ Corg was estimated using TOC Analyzer (model Shimatzu).

⇒ Mg/Ca ratios were measured in thoroughly cleaned specimens of planktonic foraminifera *G. ruber and G. saccullifer* using AAS.

CONCLUSIONS

LGM sediments are characterized by increase in $\delta^{13}C$ and Corg content, suggesting higher glacial productivity.

Paired $\delta^{18}O$ and Mg/Ca ratios in planktonic foraminifera indicate decease in SST during LGM by ~ 2.5°C and increase in salinity by 1.5 - 2 ‰.

The LGM-to-Holocene $\delta^{18}O$ amplitude (~ 2.2‰o is consistent with other published records from this region.