

Assessing changes in the upper water thermal structure variability in the northern Indian Ocean during the past 24 ka

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The reconstruction of the Indian summer monsoon (ISM) mainly uses paleo-archives from the Arabian Sea and Bay of Bengal, and the Andaman Sea. A few studies used planktonic foraminiferal geochemistry to reconstruct past changes in the surface characteristics of the Bay of Bengal. Here we used a sediment core IND-CJ23-02 (12.8266°N, 86.989°E) from the central Bay of Bengal to reconstruct changes in the upper water characteristics by applying the isoprenoid glycerol dibiphytanyl glycerol tetraethers (isoGDGTs) proxy TEX₈₆ and hydroxylated isoprenoid GDGTs proxy RI-OH with the Mg/Ca in the planktonic foraminifera *Trilobatus sacculifer*. The branched GDGTs indices ($\Sigma IIIa/\Sigma IIa$ and BIT) and isoGDGTs indices (Methane Index, iGDGT0/Crenarchaeol, %iGDGT2, and Crenarchaeol/Crenarchaeol-iso) were used to discriminate the source of GDGTs and applicability of TEX₈₆ and RI-OH. Our data suggest that the principal archaeal origin of GDGTs was *Thaumarchaeota* group I.1a. Moreover, the isoGDGTs and OH-GDGTs indices (iGDGT2/iGDGT3, %Crenarchaeol-iso, and OH0/OH2) were used to evaluate the seasonality or the water column depth of TEX₈₆ and RI-OH. Data suggest that the TEX₈₆ and RI-OH derived temperatures are incongruent with the sea-surface temperature. Modern climatological data suggest that the TEXH 86-T and RI-OH-T most likely record temperature at 50 m and 70 m water depth from April to June, respectively. Our reconstructed TEX₈₆-T varies between 27.6 and 31.3 °C, whereas the RI-OH-T ranges from 25.5 to 30.2 °C higher than the *T. sacculifer* Mg/Ca-SST or modern mean summer SST. An anti-phase relation between TEX₈₆ and RI-OH, Mg/Ca was identified during two dry Heinrich Stadial (HS) 1 and Younger Dryas (YD), whereas in-phase relation prevailed during wet Bolling/Allerod. The pattern and timing of thermal structure variability are consistent with precipitation and GBM runoff; however, the divergence between the organic and inorganic paleo-proxies suggests an inherent dichotomy.