

Seasonality and strong winter monsoon during high pCO₂ condition of early Eocene based on clumped isotope in mollusc growth bands

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Eocene period marks an event of extreme warmth as recorded in the continental and marine sequences worldwide {1,2}. Position of Indian Plate near to the equator during PE provides a unique opportunity to understand the Eocene climate. Two previous studies {3,4} from a continental sedimentary succession from India addressed appearance or dispersal of terrestrial fauna (mainly mammals) and the nature of extreme climate condition. In the present study equivalent strata, 120 m thickness was investigated, where four negative carbon isotope excursion (CIE) were demarcated at unequal intervals. The maximum negative value was observed in the sample originating below the mammal layer (ML), while the position of other three excursions were above the ML; consistent with earlier work (3,4). Eocene pCO₂ maxima calculated was 800 ppm. following the empirical relationship given elsewhere (5) assuming -6.2‰ as δ¹³C of atmospheric CO₂ (6). An autochthonous shallow water species of mollusk, *Ceostocorbula sp.* was collected close to the layer with CIE. Clumped isotope analyses of growth bands formed during early ontogenetic stage suggest temperature variability of 16°C (Δ₄₇ = 0.69) to 32°C (Δ₄₇= 0.61) whereas later ontogenetic stages recorded a temperature variability from 26.4°C (Δ₄₇= 0.64) to 45°C (Δ₄₇= 0.56). Salinity, deduced applying the modern day Salinity vs δ¹⁸O_{seawater} linear relationship (7) showed evidence of fresh water discharge during the winter time indicating intensification of north easterlies during early Eocene.

[1] Koch *et al* (1992), *Nature* **358** [2] Zachos *et al* (2001), *Science* **308** [3] Clementz *et al* (2011), *Geology* **39** [4] Samanta *et al* (2013) *JESS* **122** [5] Schubert and Jharen(2012), *GCA* **96**, [6] Grein *et al* (2006), *Palaeodiversity* **3** [7] Lee-Grande and Schindt, (2006), *GRL* **33**