Moving continent and changing seasonality in high pCO_2 worlds : A tale using clumped isotopes on the mollusc shell growth bands from the Indian plate, Noa's Ark in deep time

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Planet earth has experienced high atmospheric CO_2 concentrations at different time frames during its geological history. The information about the climate variabilities during these time windows can help to better predict this planet's future climate conditions. The unique voyage of the Indian plate as an isolated landmass travelling from the southern to the northern hemisphere covers some of these greenhouse time periods starting from the Cretaceous followed by early Eocene and early-mid Miocene. Thus the incremental carbonate growth bands of fossil mollusc shells of representative time frames can capture the snapshots of seasonality of these critical time periods.

Here in this study, we have carried out carboante clumped isotope analysis across the incremental growth bands of mollusc shells of early Cretaceous, late Cretaceous, early Eocene and early-mid Miocene ages collected from different sedimentary basins of India. India was situated at the 40°S, 30°S, 4°N and 23°N palaeolatitudes during early Cretaceous, late Cretaceous, early Eocene and early-mid Miocene respectively. Our Δ_{47} based temperature reconstructions show variabilities from 14°-32°C, 20°-38°C, 20°-42°C, 14°-35°C for the early Cretaceous, late Cretaceous, early Eocene and early-mid Miocene time periods respectively. The calculated $\delta^{18}O_{water}$ from the obtained temperature and $\delta^{18}O_{carbonate}$ information show variabilities from -1.8‰ to 2‰ for the early Cretaceous , -2‰ to 1‰ for the late Cretaceous, -3‰ to 2‰ early Eocene,-4.8‰ to -0.67‰ for the early to mid Miocene time periods. The gradual depletion in the $\delta^{18}O_{water}$ values with time probably indicate increase in the freshwater influx through glacier fed river runoff and development of monsoon dominated climate system subsequent to the hard collison of the Indian plate with the Eurasian plate.