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Mid Cretaceous climatic oscillations from southern (40°S) latitude: Evidence from bivalves (Gryphea) and Belemnites using clumped isotopes

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Palaeoclimate archives from the mid Cretaceous time period provides valuable information about Earth's climate system dynamics in a greenhouse world scenario and its relationship with extinction of different taxa in both terrestrial and marine domains. Recent studies using $^{40}Ar/^{39}Ar$ dating method on the autochthonous glauconite from Karai shale formation, Cauvery basin (S.India) reveals that the sedimentation took place between 100±7 to 92.6±6 Ma[1] when the Indian plate was situated at the 40°S paleolatitude. This age range (late Albian-mid Turonian) is consistent with the biostratigraphy age of the formation and covers two ocean anoxic events (OAE) 1d and (OAE) 2 in contemporaneous offshore deposits. This highly fossiliferous formation also marks the extermination of belemnites from the basin much ahead of their global extinction at the K/Pg boundary, also documented in other parts of the world[2]. In this study we have carried out carbonate clumped isotope analysis across the growth bands of Oyster shells (*Gryphea sp*.) from the Karai shale formation to reconstruct seasonality. Similar investigations were carried out on the last growth chambers of the belemnite shells from the same strata for probing the conditions for their extermination. Our study reveals a Δ_{47} based apparent temperature range 20-35°C and $\delta^{18}O_{water}$ compositions 0.5 to 4 ‰ from Gryphea which were mud bottom dwellers of warm and shallow epicontinental seas[3], around 50m depth[4]. Whereas more mobile nektonic belemnites, thriving at the shelf habitat within 0-200 m depth zone[5] captured higher amplitude of temperature (13-35°C) and $\delta^{18}O_{water}$(-0.6 to 4‰). We noted lighter $\delta^{18}O_{water}$ composition corresponds to lower temperature as documented both in Gryphea and Belemnites, indicating about winter time precipitation in a greenhouse world. A warm surface water condition with enriched $\delta^{18}O_{water}$ has been documented in both cases indicating highly evaporating condition in a semi enclosed basin. This is supported by synsedimentary gypsum deposition. We will highlight the probable cause of belemnite extermination at the time of presentation.

Ref: [1] Bansal et al., 2018, Geol Jour; [2] Iba et al., 2011, Geology; [3] Hallam 1982, Palaeobiology; [4] Mettam et al., 2014, PPP; [5] Hoffman and Stevens 2020, Biol Rev;